EFFECTS OF NUTRITION EDUCATION PROGRAMS ON NUTRITION KNOWLEDGE, DIETARY INTAKE, BELIEFS AND SELECTED HEALTH PARAMETERS OF PREGNANT ADOLESCENTS

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PARAMETERS OF PREGNANT

ADOLESCENTS

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CHAPTER I

INTRODUCTION

Adolescent pregnancy is a major public health problem in the United States compared to other industrialized countries (Alan Guttmacher Institute, 1994). Of all babies born, approximately 13% are to adolescent mothers (Mulchahey, 1990). Adolescent pregnancy occurs in all ethnic groups and in individuals from all socioeconomic levels (Rees, Endres & Worthington-Roberts, 1989). The national teen birth rate increased by one-fourth among 15 to 19 year olds between 1986 and 1991. In 1992 the teen birth rate declined slightly in most states among Black and White 15 to 19 year olds while the number of births to teens 14 years or less increased (Child Trends Inc., 1995). In Oklahoma, the teen birth rate for 15 to 19 year olds increased from 17th in the nation in 1991 to 13th in 1992 (AHD/CHGS, 1995). Native Americans account for almost 21% of adolescent births in Oklahoma (MCH/OSDH, 1992).

Nutrient needs and requirements are significantly increased during adolescence to meet the demands of rapid physical growth. The additional nutrient requirements of pregnancy place adolescents at high nutritional risk (Institute of Medicine, 1990; Story, 1990c; Story & Alton, 1995). In addition to poor nutrition, several risk factors have been identified for poor pregnancy outcome during adolescence. These include low prepregnancy weight, poor weight gain, preexisting anemia, lack of social support, rapid repeat pregnancies, lack of appropriate prenatal care and delayed health care (Mulchahey, 1990). Particular concerns related to nutrition include pica, anemia, pregnancy-induced hypertension, gestational diabetes and substance abuse (Alton, 1990; Alton & Mulchahey, 1990). Prematurity and increased neonatal mortality are health risks for infants born to adolescent mothers (Mulchahey, 1990; Story & Alton, 1995). In Oklahoma, Native American is the largest minority group (U.S. Bureau of the Census, 1994). Native American adolescents are at high risk for nutrition problems, as well as substance abuse (Blum, Harmon, Harris, Bergeisen & Resnick, 1992; Story, Tompkins, Bass & Wakefield, 1986). Anemia, overweight, and too rapid weight gain have been reported among Native American prenatal patients. Much more information is needed on nutritional status, dietary intakes and nutrition education knowledge of Native Americans (Jackson, 1986). Nutrition education through schools and/or comprehensive clinic programs can help improve the nutritional status and pregnancy outcome of pregnant adolescents (Rees & Worthington-Roberts, 1994).

The Expanded Food and Nutrition Education Program (EFNEP) began in 1968 to help low-income homemakers with young children acquire the knowledge, attitudes, and skills to implement a nutritionally adequate diet. The result, then, would be improved self-esteem and improvement of the entire family's diet. The effectiveness of EFNEP is dependent upon the indigenous paraprofessionals who teach EFNEP participants (Chipman & Kendall, 1989). Today, EFNEP participants include pregnant adolescents and adolescent mothers. The paraprofessional may have a greater impact on some hard to reach adolescents (Struempler, Tate, Blount & Goebel, 1989;

Strychar, Achterberg & Sullivan, 1991). There is a need to develop program materials on pregnancy specifically for the adolescent and to train paraprofessionals to effectively teach appropriate information (Strychar, Achterberg & Sullivan, 1991).

Significance of the Study

A need for nutrition education materials to use with pregnant adolescents has been identified among paraprofessionals in the southern region working with pregnant adolescents (Hunt, Williams, Claypool & Stoecker, 1994). Results of this study will evaluate the effectiveness of specific materials for the pregnant adolescent to relay nutrition and health information to pregnant adolescents, a high risk population which includes a large percentage of Native Americans (Blum, Harmon, Harris, Bergeisen & Resnick, 1992).

If the importance of implementing an effective nutrition education program for EFNEP pregnant adolescents is established, then the need for further research regarding nutrient requirements, anthropometric and weight gain standards during adolescent pregnancy would be supported (Institute of Medicine, 1990; Rees, Endres & Worthington-Roberts, 1989; Story & Alton, 1995).

The effectiveness of a nutrition education program for EFNEP pregnant adolescents has implications for policymakers in that the results of positive pregnancy outcome and reduced financial costs to the community can be used to document the need and support for future programs (Rees & Worthington-Roberts, 1994).

Statement of the Problem

The purpose of the present investigation is to evaluate the effects of two different nutrition education programs on nutrition knowledge, maternal dietary intake, beliefs and selected health parameters of EFNEP pregnant adolescents. The selected health parameters include anthropometric measurements of height and weight to determine body mass index (BMI), mid-arm circumference and triceps fatfold thickness to calculate upper mid-arm muscle area and upper arm fat area, prepregnancy weight, prenatal weight gain, and blood pressure. Biochemical measurements include hematocrit, hemoglobin, serum transferrin, total iron-binding capacity (TIBC), serum iron, transferrin saturation, serum glucose, glycosylated hemoglobin, serum fructosamine, and serum insulin. Birth outcomes documented include live births, evidence of birth complications, birth weight, length, and infant feeding patterns.

The independent variable is the type of nutrition education program (the regular EFNEP nutrition education program for adults versus a nutrition education program specifically designed for the pregnant adolescent). Nutrition knowledge, dietary intake, beliefs, and selected health parameters are the dependent variables.

Research Objectives

Based on research reported by Alton & Mulchahey (1990); the Institute of Medicine (1990); Jackson (1986); Mulchahey (1990); Rees & Worthington-Roberts (1994); Rees, Endres & Worthington-Roberts (1989); Story (1990c); Story & Alton

(1995); and Strychar, Achterberg & Sullivan (1991) the following research objectives were formulated:

1. To determine the effects of socioeconomic factors (age, ethnic group, educational level, size of community, type of social and financial support, or type of medical care) on the pretest of nutrition knowledge and beliefs, on dietary intake, and on eating behaviors of pregnant adolescents.
2. To determine the effects of socioeconomic factors (age, ethnic group, educational level, size of community, type of social or financial support, or type of medical care) on initial iron and glucose parameters of pregnant adolescents.
3. To determine the relationship between initial BMI, prenatal weight gain, iron and glucose parameters, and the pretest of nutrition knowledge and beliefs, dietary intake, and eating behaviors of pregnant adolescents.
4. To determine the effects of socioeconomic factors (age, ethnic group, educational level, size of community, type of social or financial support, or type of medical care) or type of nutrition education program on the pregnant adolescents' change in knowledge score.
5. To determine the difference in nutrition knowledge, anthropometric parameters, prenatal weight gain, dietary intake, or iron and glucose parameters due to type of nutrition education program.
6. To determine the difference in nutrition knowledge or dietary intake before and after each nutrition education program.

7. To determine the effect of nutrition education on change in anthropometric, iron and glucose parameters, and blood pressure among pregnant adolescents in either program.

Hypotheses

The following hypotheses were developed for this study:

1. There will be no significant effects of socioeconomic factors (age, ethnic group, educational level, size of community, type of social and financial support, or type of medical care) on the pretest of nutrition knowledge and beliefs, on dietary intake, and on eating behaviors of pregnant adolescents.
2. There will be no significant effects of socioeconomic factors (age, ethnic group, educational level, size of community, type of social or financial support, or type of medical care) on initial iron and glucose parameters of pregnant adolescents.
3. There will be no significant relationship between initial BMI, prenatal weight gain, iron and glucose parameters, and the pretest of nutrition knowledge and beliefs, dietary intake, and eating behaviors of pregnant adolescents.
4. There will be no significant effects of socioeconomic factors (age, ethnic group, educational level, size of community, type of social or financial support, or type of medical care) or type of nutrition education program on the pregnant adolescents' change in knowledge score.

5. There will be no significant difference in nutrition knowledge, anthropometric parameters, prenatal weight gain, dietary intake, or iron and glucose parameters due to type of nutrition education program.
6. There will be no significant difference in nutrition knowledge or dietary intake before and after each nutrition education program.
7. There will be no significant effect of nutrition education on change in anthropometric, iron and glucose parameters, and blood pressure among pregnant adolescents in either program.

Definition of Terms

The following terms were defined for this study.

Adolescent Pregnancy - Gestation which occurs between the ages of 11 and 19 years.

Paraprofessional - Referred to as Nutrition Education Assistants (NEAs) in the Oklahoma EFNEP program and Chickasaw Nation Native American Women, Infants and Children (WIC) program.

EFNEP Counties - in this study include subjects from Bryan, Choctaw, Pushmataha and Tulsa counties in Oklahoma.

Extension Service (ES)/WIC Counties - in this study include subjects enrolled in the Chickasaw Nation Native American WIC program located in Ada, Oklahoma and serving Carter, Johnston, Marshall, Murray and Pontotoc counties.

Eating Right Is Basic (ERIB) - the regular EFNEP adult nutrition education curriculum used with one of the participant groups.

Have A Healthy Baby (HAHB) - the nutrition education curriculum developed for pregnant adolescents 11 to 19 years of age used with one of the participant groups.

Beliefs Score - a beliefs score was determined based on the initial factor analysis results of both education programs. Factors include food cravings-likes and dislikes, folklore, prenatal weight gain, nutrition and cravings, and health. Based on the Likert-scale of 1 (strongly agree) to 5 (strongly disagree), and the number of belief statements in each factor (4 to 5), scores ranged from 4 (strongly agree) to 25 (strongly disagree).

Nutrition Score - dietary intakes at least 67% of the Recommended Dietary Allowances (RDAs) for calories, protein, vitamin B_6, folate, vitamin A, vitamin C, iron, zinc and calcium were each assigned two points. Intakes below 67% of the RDA were assigned one point. The highest possible score for the nine nutrients was eighteen and the lowest possible score was nine.

Assumptions

The following were assumptions of this study:

1. The information obtained by interviewing the subjects was accurate and complete.
2. The anthropometric, blood sample, and blood pressure measurements were consistent, accurate and complete.
3. Directions to fast before blood sampling were followed by each subject.

4. The knowledge, beliefs and dietary assessment forms for subjects were reliable and valid.
5. The training of the paraprofessionals to implement the nutrition education program was consistent, accurate and complete.

Limitations

The findings of this research are limited to the pregnant adolescents who participated in the educational program for pregnant adolescents and may not be generalized to other populations. A further limitation of this study is that all subjects were not beginning and ending the educational program at the same time in their pregnancy. The age of the subjects ranged from 11 to 19 years, a peak growth period of the life cycle. An assessment of individual maturation was not included in this study. Other limitations include that all subjects agreed to be fasting for the blood data collection days and the analyses of the dietary recall may not have included all foods exactly as recorded due to limitations of the dietary analysis system. Limitations to the Nutrition Score include the assumption that 67% of the RDA is adequate based on work reported in the literature. Separate training sessions for paraprofessionals were conducted for each of the curriculums and paraprofessionals conducting the adult EFNEP nutrition education program groups were trained on use of the curriculum for pregnant adolescents after the study. However, paraprofessionals conducting the adult EFNEP groups could have had prior exposure to other materials on adolescent pregnancy. Limitations of comparing two programs in a controlled study are recognized including confounding factors such as age, ethnic group, as well as education and economic levels, which could influence program effects.

Organization of the Study

Chapter I includes the introduction identifying the problem, the significance of the study, the purpose of the study, the research objectives and hypotheses, a definition of operational terms, and the assumptions and limitations of the study. Chapter II contains a literature review relevant to the study. Chapter III describes the research and the methods used to collect and assess the research data. Chapter IV is written in manuscript form using the guide for authors for the Journal of Nutrition Education. Chapters V and VI are written in manuscript form using the guide for authors for the Journal of the American Dietetic Association. Chapter VII includes a summary of the findings, conclusions, and recommendations of this investigation.

CHAPTER II

REVIEW OF THE LITERATURE

The prevalence, health and psychosocial risks of adolescent pregnancy are reviewed in this chapter. Also, the nutrient requirements including trace mineral status, nutrition and lifestyle, nutritional assessment, weight gain and nutrition-related concerns during adolescent pregnancy are discussed. The significance of nutrition education programs conducted by paraprofessionals for pregnant adolescents and relevant research studies are included. Relevant research studies pertaining to the Native American are included in each section. A summary is included to emphasize the most important points discussed that support the purpose, research objectives and hypotheses of this study.

Adolescent Pregnancy-Prevalence, Health and Psychosocial Risks

National Trends, The Southern Region and Oklahoma

Adolescent pregnancy has received much more attention in recent years compared to the 1960's and 1970's (Committee on Adolescence, 1980). In fact, adolescent pregnancy is considered a public health problem in the United States today (Mulchahey, 1990; Rees & Worthington-Roberts, 1994; Rees, Endres & Worthington-

Roberts, 1989). Pregnancy appears to be increasing among adolescents less than 16 years of age. Younger adolescents are at a greater risk for physical and psychosocial problems associated with adolescent pregnancy, while the older adolescent is more likely to encounter social and economic problems (Hollingsworth & Kreutner, 1980; Mulchahey, 1990). Expenditures for public assistance to pregnant adolescents are significant. In 1989 national figures estimated the expense for Aid To Families With Dependent Children (AFDC), food stamps and Medicaid to teenage mothers was $21 billion while in Oklahoma the cost was $164 million (MCH/OSDH, 1992).

Adolescent pregnancy occurs among all ethnic groups and socioeconomic levels throughout the United States (Rees, Endres & Worthington-Roberts, 1989). Among individual states, births to adolescent mothers are generally in the range of 5 to 20%. The southern regional states were ranked more than five points above the national average in estimated births to adolescents per 1,000 women ages 15 to 19 in 1985 (Mulchahey, 1990). Data from 1991 indicate that the percent of births to adolescents in selected southern regional states was as follows: Arkansas-19.9%, Louisiana-17.6%, North Carolina-16.2%, South Carolina-17.0%, Tennessee-17.7%, Texas-16.0%, and Virginia-11.5% (U.S. Bureau of the Census, 1994). In 1990, almost 17% (7,718) of live births in Oklahoma were to adolescents (<20 years old), 113 of these were to mothers less than 15 years of age (MCH/OSDH, 1992; Oklahoma Institute For Child Advocacy, 1992). The Oklahoma teen birth rate for teenagers 15 to 19 years from 1991 to 1993 was 68 per 1,000 girls compared to the national rate of 61 per 1,000 girls in 1992 (AHD/CHGS, 1995). Oklahoma's teen birth rate for adolescents

15 to 19 years ranked 13th in the nation in 1992 (AHD/CHGS, 1995). Native Americans account for almost 21% of teen births in Oklahoma (MCH/OSDH, 1992). According to Indian Health Service records, among 15 to 19 year olds in Oklahoma, the birth rate per 100,000 in 1990 was 10,605 for Native Americans, 12,371 for Blacks and 5,654 for Whites (IHS, 1991). The total number of births among 10 to 19 year olds by race in Oklahoma in 1993 was 5,403 for Whites, 776 for Blacks, 1,066 for Native Americans, 51 for other races and 11 for unknown race reported (AHD/CHGS, 1995).

Recidivism of teenage pregnancy is an additional concern (Rees, Endres & Worthington-Roberts, 1989). In Oklahoma, it is estimated that more than 20% of adolescents who deliver babies will give birth to another child before they are 20 years old (MCH/OSDH, 1992).

Risks Of Adolescent Pregnancy

The medical, economic and psychosocial risks are particularly high for the pregnant adolescent compared to a pregnant woman (McAnarney, 1987; Mulchahey, 1990; Rees & Worthington-Roberts, 1994; Scholl, Hediger & Belsky, 1994; Story & Alton, 1995). Poor pregnancy outcome for the pregnant adolescent is the result of the interaction of these risk factors rather than the impact of a single factor (McAnarney, 1987).

The risk factors for poor outcome in the pregnant adolescent are as follows (McAnarney, 1987; Mulchahey, 1990, p. 4): "maternal age, especially 15 years or younger; pregnancy less than two years after menarche; poor nutrition/low prepregnancy weight; poor weight gain; sexually transmitted diseases; preexisting anemia; substance abuse; poverty; lack of social support; lack of education; rapid repeat pregnancies; lack of access to age-appropriate prenatal care; late entry into the health care system; and unmarried status".

There are additional risks to the adolescent mother and her infant. Maternal health risks associated with adolescent pregnancy include the following: "pregnancy induced hypertension; premature labor; intrauterine growth retardation; anemia; maternal mortality; and the increased incidence of cephalopelvic disproportion" (Mulchahey, 1990, p. 5). Data from the Indian Health Service in Oklahoma indicate that among teen pregnancies in 1991, out of 694 total deliveries, 600 (86.5%) reported complications in delivery (ectopic pregnancy, spontaneous abortion, and other complications of pregnancy) (IHS, 1991).

Neonatal risks associated with adolescent pregnancy include the following: "increased perinatal mortality; increased neonatal mortality; prematurity; intrauterine growth retardation; lack of access to pediatric health care services; and poor parenting skills" (Mulchahey, 1990, p. 5). In Oklahoma (1988 to 1990) the rate of births to adolescent mothers before 37 weeks was 16.1% compared to 9.6% for non-adolescent mothers. Also, the incidence of low birth weight (<2,500 g) infants born to adolescent mothers was significantly greater (7.9%) compared to non-adolescent mothers (5.2%) (MCH/OSDH, 1992).

Psychosocial risks for mother and child associated with adolescent pregnancy include "failure to complete education, unemployment, poverty, dependence upon public assistance, poor job satisfaction, marital instability, and greater number of children per mother" (Mulchahey, 1990, p. 5). Socioeconomic deprivation is associated with poor pregnancy outcome worldwide. Undernutrition, infectious diseases and lack of medical care all contribute to poor pregnancy outcome particularly among low-income populations (Dwyer, 1987). Approximately 55% of pregnant teenagers do not seek prenatal care during the first trimester compared to 26% of adult women (MCH/OSDH, 1992). A survey of Oklahoma mothers found that teenagers accounted for one-in-six rural births and one-in-eight urban births. Compared to urban women, rural women are 1.6 times more likely to have transportation problems and 1.4 times more likely to have financial limitations to early prenatal care (MCH/OSDH, 1993). Early and adequate prenatal care can help to prevent many of the risks associated with teenage pregnancy. Babies with life threatening difficulties are cared for in neonatal intensive care units, costing over $1,000 per day. It is projected that each dollar spent on providing more adequate care saves $3.38 in neonatal medical expenses during the first year of life (MCH/OSDH, 1993). Every dollar spent on pregnant women in the Special Supplemental Food Program for Women, Infants, and Children (WIC) can save up to $4.21 in medicaid costs (U.S. General Accounting Office, 1992). A goal stated in the Healthy People 2000 report is for 90% of pregnant women of all ages to receive prenatal care during their first trimester (U.S. Department of Health & Human Services, PHS, 1990).

Recommendations

Recommendations from the American College of Obstetricians and Gynecologists for prenatal care for adolescents include the following (Mulchahey, 1990, p. 6):

"Health: general medical care, contraceptive counseling, easy access to pregnancy testing, availability of abortion services, maternal/infant nutrition services, age appropriate obstetrical and pediatric care, screening/ treatment for sexually transmitted diseases, and outreach.

Educational: access to continued school services during pregnancy, vocational training/placement, parenthood preparation/education, and health education.

Social: individual and family counseling, transportation, legal assistance, assistance with childcare/finances/housing, and assistance with health care funding".

Factors Influencing Nutrient Requirements During Adolescence and Pregnancy

Poor nutrition is a risk factor for both the adolescent mother and her infant which can be modified with appropriate prenatal intervention (McAnarney, 1987; Rees & Worthington-Roberts, 1994; Story & Alton, 1995). Nutrient requirements increase sharply and parallel changes in body composition (Dwyer, 1981). Pubescence is defined as follows: "the period of sexual development which ends with the emergence of the capacity for sexual reproduction and usually encompasses the years up to age 13 in females and 15 in males" (Dwyer, 1981, p. 56). Growth spurt and sexual maturation vary considerably among individuals during adolescence (Gutierrez & King, 1993; Rees, Endres & Worthington-Roberts, 1989). Physiological growth is generally completed for the adolescent female within four years following menarche or approximately 17 years of age (Tanner, 1981).

Gynecologic Age (GA) is defined as "the difference between chronologic age and age at menarche. It may be used as an indirect measure of physiologic immaturity and growth potential" (Story, 1990c, p. 21). A GA of two years or less is considered high nutritional risk. An individual's own growth needs must be met in addition to the nutrient requirements of pregnancy (Rees, Endres & Worthington-Roberts, 1989). Nutritional needs are greatest for those pregnant adolescents who have not completed their own growth (Heald & Jacobson, 1980). Females with a GA of four years are considered physiologically mature so that nutritional requirements are similar to adult pregnant women (Garn, LaVelle, Pesnick & Ridella, 1984).

Research reported by Frisancho, Matos & Flegel (1983) supports the hypothesis that there is competition for nutrient requirements between the younger pregnant adolescent still in rapid growth and the fetus. Compared to older women, fetuses of 10 to 16 year old females have been observed to grow much slower (Naeye, 1981). Physiologically immature pregnant adolescents tend to deliver low birth weight babies which could be due to a decreased net availability of nutrients (Frisancho, Matos & Bollettino, 1984).

Prior nutritional status is a major influence for the pregnant adolescent (Gutierrez & King, 1993; Story & Alton, 1995). Individuals with inadequate diets or who were underweight before pregnancy may have increased nutrient requirements. Other factors which may influence nutrient needs for the non-pregnant adolescent include "body composition and size; menstruation; physical activity and participation in sports; oral contraceptive use; as well as chronic illness and infection" (Story, 1990c, p. 21).

Nutritional Requirements During Adolescence and Pregnancy

Nutrient Requirements and Intakes

The research base for nutrient requirements for the pregnant adolescent and non-pregnant adolescent is limited (Gong & Spear, 1988; Rees, Endres & Worthington-Roberts, 1989; Story & Alton, 1995). The Committee on Nutritional Status During Pregnancy 1990 recommends further research on the nutritional status of pregnant adolescents in terms of age, income and ethnic background (Institute of Medicine, 1990, p. 21).

The Recommended Dietary Allowances (RDAs) for adult pregnant women have traditionally been used to estimate nutrient needs for the pregnant adolescent (Food and Nutrition Board, 1989). These estimates are added to the RDA for non-pregnant adolescents 11 to 14 years and 15 to 18 years (Rees, Endres & Worthington-Roberts, 1989). A margin of safety is included in the recommendations for protein, minerals and vitamins but not energy. The RDAs for pregnancy may not be adequate to meet the growth needs of the younger pregnant adolescent (Gutierrez & King, 1993; Story, 1990c). Estimates for individual nutrient needs should consider peak growth and growth rate, body build and level of activity (Rees, Endres & Worthington-Roberts, 1989).

National dietary surveys assessing 24-hour dietary intakes of female adolescents have reported diets to be deficient in energy, vitamin A, vitamin B_6, vitamin D, vitamin E, folic acid, riboflavin, iron, calcium, magnesium, phosphorus, and zinc (Abraham, Carroll, Dresser & Johnson, 1977; Johnson, Johnson, Wang, Smiciklas-Wright & Guthrie, 1994; Story, 1990c; Story & Alton, 1992). Among teenage girls iron and calcium were the most neglected nutrients reported (Hampton, Huenemann, Shapiro & Mitchell, 1967). Nutrients most frequently below 67% of the RDAs for female adolescents from eight southern states were folacin, iodine, vitamin D, iron, calcium, vitamin B_6, zinc, magnesium, and vitamin A (McCoy et al., 1984). Most Native American female adolescents did not meet the RDAs for calcium and iron (Story, Tompkins, Bass & Wakefield, 1986). The percent of calories from total fat and saturated fat as well as mean sodium intakes were above recommended amounts for the majority of 933 adolescents aged 11 to 18 years among the sample reported in the 1987-88 USDA Nationwide Food Consumption Survey (Johnson, Johnson, Wang, Smiciklas-Wright & Guthrie, 1994).

Similar findings of suboptimal dietary patterns have been reported among pregnant adolescents (Story, 1990c; Story & Alton, 1995). Diets of low-income pregnant adolescents were low in calories, iron, calcium, and vitamin A (King, Cohenour, Calloway & Jacobson, 1972). Calcium and iron were most lacking in a study of 861 pregnant teenagers (McGanity et al., 1968). Loris, Dewey and Poirier-Brode (1985) reported that the average intake for 11 nutrients except iron was above the RDAs among pregnant teenagers attending either a teen obstetric clinic or a school program for teens. Skinner, Carruth, Pope, Goldberg and Varner (1990) assessed the dietary adequacy of 97 pregnant adolescents by obtaining two 24-hour recalls and found mean intakes less than the RDA for iron, zinc, vitamin B_6 and folate. Total lipids provided 36% of kilocalories with 19% of kilocalories from saturated fat. Morse, Clarke, Merrow and Thibault (1975) reported pregnant teenagers had higher intakes of calories, protein, calcium, phosphorus and iron compared to adult pregnant women. Nutrient density (mean nutrient per 1,000 kcal) of the diets for pregnant adolescents was significantly lower than nutrient values for older pregnant women for protein, phosphorus, calcium and magnesium (Endres, Dunning, Poon, Welch & Duncan, 1987). A study of Navajo women ages 16 to 35 years indicated the following nutrients were less than 60% of the RDA during pregnancy: calcium, magnesium, zinc, copper, vitamin D, vitamin E, vitamin B_6, biotin and folacin (Butte, Calloway & Van Duzen, 1981).

Energy

Total energy needs during pregnancy are influenced by the following factors: growth status, physical activity, body composition, pregravid weight and stage of pregnancy. Without first meeting energy requirements, protein will not be available for necessary metabolic functions (Story, 1990c; Story & Alton, 1995). Additional energy requirements during pregnancy are estimated at 300 kcal/day. This recommendation is for the second and third trimesters (Food and Nutrition Board, 1989). An adolescent may require additional calories during the first trimester to meet her own growth needs (Story, 1990c). The prevalence of dieting reported in adolescent females may compromise nutrient requirements for growth and during pregnancy (Dwyer, Feldman & Mayer, 1967; Endres, Dunning, Poon, Welch & Duncan, 1987; Rees & Worthington-Roberts, 1994). Blackburn and Calloway (1974) studied the activity patterns of pregnant adolescents 14 to 19 years residing in a metabolic ward. Energy expenditures varied from 38 to 50 kcal/kg/day. A metabolic study of pregnant women 20 to 35 years indicated that body weight was directly correlated with resting energy expenditure and self-paced walking (Nagy & King, 1983). Studies are needed to assess energy expenditures of very young pregnant adolescents (Gutierrez & King, 1993). Weight gain is the best indicator of adequate energy intake during pregnancy (Rees, Endres & Worthington-Roberts, 1989).

Protein

The daily protein recommendation for pregnant adolescents less than 15 years old is 1.7 g protein/kg pregnant weight and for pregnant adolescents 15 to 18 years old is 1.5 g protein/kg pregnant weight (Story, 1990c, p. 23). The RDAs recommend an additional daily 10 g of protein (Food and Nutrition Board, 1989). This is in addition to 1.0 g/kg non-pregnant weight (11 to 14 years) and 0.8 g/kg non-pregnant weight (15 to 18 years) (Story, 1990c, p. 23). Pregnant adolescents of low socioeconomic status and/or with low energy intakes are at risk for not meeting the recommendations for protein. Adequate energy is recommended to spare protein for tissue synthesis and optimal growth (Rees, Endres & Worthington-Roberts, 1989; Story, 1990c). King, Calloway and Margen (1973) used a balance technique to measure nitrogen (N) retention in teenage pregnant girls 15 to 19 years of age during their third trimester of pregnancy. Nitrogen retention averaged 2.4 g per day. Increasing the total N intake from 9.3 to 20.0 g per day resulted in a low efficiency for N utilization of 30%. Investigators proposed that nitrogen is retained by the mother which cannot be accounted for by the nitrogen retention retained by the fetus and maternal tissue (King, Bronstein, Fitch & Weininger, 1987).

Calcium

The RDA for calcium during pregnancy is 1,200 mg per day (Food and Nutrition Board, 1989). Adequate calcium is essential for fetal skeletal development and to prevent maternal tissue depletion (Gutierrez & King, 1993; Worthington-Roberts & Rees, 1989). Younger adolescents may need up to 1,600 mg of calcium per day to meet their own growth requirements in addition to the requirements of pregnancy (Story, 1990c). Matkovic and Heaney (1992) reported a threshold intake of 1,480 mg of calcium per day for the 9 to 17 year old age group (males and nonpregnant females). A study of calcium metabolism reported that adolescent females compared to adult females had a significantly higher calcium balance indicating that net absorption and retention of calcium are more efficient to meet the demands of growth (Weaver et al., 1995). It is particularly important to meet the RDA for calcium during adolescence to attain optimal bone mass and reduce the risk of developing osteoporosis (Peacock, 1991). Bone demineralization may be a risk for lactating adolescent mothers when dietary intakes are low in calcium or phosphorus (Chan, Ronald, Slater, Hollis & Thomas, 1982). Lactose intolerance may need special attention when recommending dietary sources of calcium to American Black, Native American, or Hispanic individuals (Story, 1990c). If the pregnant adolescent who is lactose intolerant cannot meet calcium needs through dietary sources, then calcium supplements may be recommended (Institute of Medicine, 1990; Story & Alton, 1995).

Iron

A common nutritional problem for female adolescents is iron deficiency anemia (Bailey, Mahon & Dimperio, 1980; Bailey, Wagner, Christakis & Davis, 1982). During adolescence the need for iron increases due to the onset of menstruation. Furthermore, adolescent pregnancy markedly increases the need for iron. Thus, the pregnant adolescent requires iron to support her own growth needs as well as the development of the fetus and expansion of maternal blood volume. Low iron stores are a particular concern for nonpregnant adolescents because there is increased risk for developing iron deficiency anemia during pregnancy (Story & Alton, 1995; Worthington-Roberts & Rees, 1989). Iron deficiency anemia was reported in 15 to 20% of a sample of Navajo women ages 16 to 23 years at term (Butte, Calloway & Van Duzen, 1981). Iron deficiency may contribute to comprised growth for the adolescent mother including cephalopelvic disproportion (Brabin & Brabin, 1992). Anemia and impaired immune response have been reported in younger adolescents in India (Srikantia, Prasad, Bhaskarametal & Krishnamachari, 1976). Average iron intakes of adolescent females 13 to 15 years old were 14.9 mg per day with a significant positive correlation between iron and energy intakes ($p < 0.001$) (Elsborg, Rosenquist & Helms, 1979). The 1987-88 USDA Nationwide Food Consumption Survey identified low iron and zinc intakes of female adolescents aged 11 to 18 years

(Johnson, Johnson, Wang, Smiciklas-Wright & Guthrie, 1994). The mean caloric intake reported in the National Health and Examination Nutrition Survey II for females 15 to 17 years was 1,731 kcal/day. It is estimated that 6 mg/1,000 kcal of iron is provided by the average American diet (Story, 1990c). The RDA for iron during pregnancy is 30 mg per day (Food and Nutrition Board, 1989). During the second and third trimesters, an iron supplement of 30 mg per day is recommended by the Institute of Medicine in order to prevent anemia and maintain iron stores (Institute of Medicine, 1990).

Copper

Copper is an essential nutrient widely distributed in the food supply. In 1980, a safe and adequate range of 1.5 to 3 mg per day was established (Food and Nutrition Board, 1989). Pennington, Young and Wilson (1989) estimated copper intakes of teenage girls to be less than optimal. Dietary intakes were 60% below the RDA among a sample of Navajo women ages 16 to 23 years of age at term (Butte, Calloway & Van Duzen, 1981). Copper is a component of several key enzymes important in metabolism known as cuproenzymes. Superoxide dismutase protects erythrocytes from oxidation and ferroxidases function in iron oxidation (Prohaska, 1990; Turnlund, 1988). Manifestations of copper deficiency include microcytic hypochromic anemia, electrocardiographic abnormalities, glucose intolerance, hypercholesterolemia and impaired immune competence (O'Dell, 1990). High zinc intakes can interfere with copper absorption (Greger, Zaikis, Abernathy, Bennett & Huffman, 1978). Plasma copper levels were slightly higher for Black compared to White adolescent females

(Sloane, Gibbons & Hegsted, 1985). Significant correlations between hair copper and neonatal weight and serum copper and head circumference were found during the third trimester of pregnancy in women more than 18 years of age (Vir, Love & Thompson, 1981). In one study, plasma copper and plasma ceruloplasmin activity significantly increased after a glucose challenge during the course of pregnancy (Smith, Moser-Veillon, Nagey, Douglas & Smith, 1991).

Zinc

Zinc is essential for protein synthesis and normal development and growth (Gutierrez & King, 1993; King, Bronstein, Fitch & Weininger, 1987). During pregnancy the RDA for zinc is 15 mg per day (Food and Nutrition Board, 1989). Fetal zinc requirements are highest during the third trimester of pregnancy (King, Bronstein, Fitch & Weininger, 1987). After menarche was attained among 12, 14, and 16 year old females, erythrocyte zinc concentration increased while dietary intakes of zinc decreased (Kenney et al., 1984). Among 23 Navajo women 16 to 23 years of age, 68% had serum zinc levels below 50 ug/dL at term and medium dietary intakes less than 60% of the RDA (Butte, Calloway & Van Duzen, 1981). Greger et al. (1978) reported average intakes of zinc among adolescent females to be 75% of the RDA. Low-income pregnant teenagers (ages 13.5 to 19.6 years) received 30 mg zinc (Z) or placebo (P) in a double-blind study. Normal-weight mothers and underweight multiparas in the Z group had a reduction in premature births and neonatal morbidity (Cherry et al., 1989). Plasma zinc levels were lower ($p < 0.05$) among pregnant adolescents with hypertension/toxemia (Cherry et al., 1981). Interactions among specific trace minerals is another issue. Zinc supplementation presents a risk for iron and copper status (Yadrick, Kenney & Winterfeldt, 1989). Serum zinc concentrations decreased significantly in a study of pregnant adolescents taking a multivitamin with 18 mg of iron (Dawson, Albers & McGanity, 1989).

Manganese

The estimated safe and adequate (ESADDI) range for manganese is 2 to 5 mg per day (Food and Nutrition Board, 1989). Results of the Total Diet Study (1982-1986) indicate that teenage girls had intakes of manganese 72% of the lower limit of the ESADDI range (Pennington, Young & Wilson, 1989). Manganese is an essential element that functions as an enzyme cofactor to activate the formation of metal enzyme complexes and is an important part of two known manganese metalloenzymes localized in mitochondria, pyruvate carboxylase and superoxide dismutase. Manganese is also important in biogenic amine and carbohydrate metabolism. Deficiency signs include impaired glucose tolerance; poor growth and reproductive performance; as well as abnormal bone and cartilage formation (Committee on Diet & Health, 1989; Kies, 1987). Congenital, irreversible ataxia is exhibited by offspring of manganese-deficient pregnant animals. Interactions between iron and manganese have been demonstrated. Enhanced manganese absorption occurred in iron deficiency, while increased dietary iron contributes to manganese deficiency (Keen & Zidenberg-Cherr, 1990).
Manganese inhibited iron absorption in human adult subjects (Rossander-Hulten, Brune, Sandstrom, Lonnerdal & Hallberg, 1991). Lymphocyte manganese-dependent

superoxide dismutase (MnSOD) activity has been used to evaluate manganese status in young women (Davis & Greger, 1992).

Chromium

Chromium is an essential trace element that acts as an insulin potentiator and is important for normal carbohydrate metabolism (Stoecker, 1990). A safe and adequate level of 50 to 200 ug per day is recommended by the Food and Nutrition Board (1989). Self selected U.S. dietary intakes of chromium have been reported to be less than optimal (Food and Nutrition Board, 1989). Maternal hair chromium concentration is affected by parity and chromium nutritional status (Saner, 1981). Most recently the hair chromium content of pregnant women with gestational diabetes was compared to nondiabetics. The hair chromium concentration was higher ($p < 0.005$) for the women with gestational diabetes (Aharoni et al., 1992).

Folacin

Folacin is important for increased cell replication and growth due to its role in DNA synthesis (Clark, Mossholder & Gates, 1987). The RDA for folacin during pregnancy is 400 ug per day (Food and Nutrition Board, 1989). Folate deficiency among pregnant women is a common worldwide problem (King, Bronstein, Fitch & Weininger, 1987). Among 23 Navajo women 16 to 23 years of age, 9% had low serum folacin at term while dietary folacin was 40% below the RDA (Butte, Calloway & Van Duzen, 1981). A number of studies have reported less than adequate folacin status in various non-pregnant adolescent female populations (Liebman, 1985; Reiter, Boylan, Driskell & Moak, 1987; Tsui & Nordstrom, 1990). In a low-income pregnant adolescent population, folacin deficiency was a more common finding than iron deficiency (Bailey, Mahan & Dimperio, 1980). Folacin deficiency was prevalent among Native American adolescent substance users (Story & Van Zyl York, 1987). Sources of dietary folate include fortified breakfast cereals, orange juice, dried beans and spinach. Substance abuse, use of anticonvulsants or oral contraceptives prior to pregnancy may contribute to risk of folate deficiency (Story & Alton, 1995). Recent research suggests that higher folic acid intakes may be associated with a decreased incidence of neural tube defects (Rush, 1994; Zimmermann & Shane, 1993). The Centers for Disease Control and Prevention recommend that 400 ug per day of supplemental folate be taken by all women of childbearing age (Gutierrez & King, 1993; Story & Alton, 1995).

Vitamin A

Vitamin A is important for sexual maturation during puberty (Brabin & Brabin, 1992). During pregnancy vitamin A is essential for growth, cellular differentiation and normal fetal development. The Food and Nutrition Board recommends 800 ug RE per day during pregnancy (Food and Nutrition Board, 1989). Poor vitamin A status during pregnancy has resulted in congenital xerophthalmia, neural tube defects, prematurity and intrauterine growth retardation (King, Bronstein, Fitch & Weininger, 1987). Among 23 Navajo women ages 16 to 23 years of age, 24% had low serum retinol levels at term and during lactation mean intakes averaged 60% below the RDA (Butte, Calloway & Van Duzen, 1981). Dietary intakes of vitamin A tend to be low due to limited fruits and vegetables. On the other hand, excessive doses of vitamin A are a concern for the pregnant adolescent (Story, 1990c). Vitamin A analogues sometimes are used to treat acne. Women taking isotretinoin (13-cis-retinoic acid) during pregnancy to treat cystic acne resulted in a high incidence of fetal malformations (abnormal craniofacial features, central nervous system abnormalities, and congenital heart defects) as well as elective and spontaneous abortions (Lammer et al., 1985).

Vitamin B_6

Kirskey, Keaton, Abernathy and Greger (1978) reported that approximately one-half of females between 12 and 14 years of age consumed less than two-thirds of the RDA for vitamin B_6. In southern adolescent girls, approximately 50% had marginal or deficient vitamin B_6 status based on using the coenzyme stimulation of erythrocyte alanine aminotransferase activity (Driskell, Clark & Mock, 1987). Alteration in Vitamin B_6 metabolism has been reported in pregnant women (King, Bronstein, Fitch & Weininger, 1987). No relationship between morning sickness during pregnancy and vitamin B_6 status was found (Schuster, Bailey, Dimperio & Mahan, 1985).

Vitamin C

During pregnancy the RDA for vitamin C is 70 mg per day (Food and Nutrition Board, 1989). Cigarette smokers may have increased vitamin C requirements during pregnancy due to increased catabolism of the vitamin. Pregnant adolescents who smoke should increase their vitamin C dietary intakes to 100 mg of vitamin C per day (Gutierrez & King, 1993; Story, 1990c).

Prenatal Supplements

The nutrient requirements of pregnancy can be met through a nutritionally adequate diet with the exception of iron (Story & Alton, 1992; Story & Alton, 1995). The Institute of Medicine (1990) recommends a low-dose vitamin-mineral supplement for pregnant adolescents who may not eat a balanced diet to meet the nutrient requirements for pregnancy (Story & Alton, 1995). However, supplements should not take the place of a balanced diet (Story, 1990c). In cases of tobacco, alcohol or drug use, multiple pregnancy or strict vegetarianism, a supplement is recommended (Story & Alton, 1992; Story & Alton, 1995).

Guidelines For Prenatal Diet

Story (1990c) identifies the following criteria for a healthy prenatal diet which incorporates the current Dietary Guidelines (p. 26):

- "Provides enough food energy for adequate weight gain
- Is well-balanced and follows the daily food plan
- Provides a variety of foods within each food group
- Spaces eating in intervals throughout the day
- Provides adequate amounts of high fiber foods
- Includes 10 cups of fluid daily
- Limits beverages that contain caffeine (150 mg caffeine/day)
- Excludes alcohol

- Is moderate in fat, saturated fat, cholesterol, sugar and sodium
- Tastes good and is enjoyable to eat."

The recommended number of daily servings for the pregnant adolescent from the Food Guide Pyramid and U.S. Dietary Guidelines includes two to four servings of fruit and/or juice including a vitamin C source; three to five vegetable servings including a vitamin A source; four to five servings of low-fat dairy or milk products; three servings of meat or protein foods; and six to eleven servings of grains (Story & Alton, 1992; Story & Alton, 1995).

Nutrition and Lifestyle During Adolescence and Pregnancy

Nutrition and Lifestyle

During adolescence, an individual's eating habits are strongly influenced by growing independence, peer pressure, an active social life and busy schedules (Story & Alton, 1995; Story & Resnick, 1986). More meals and snacks are eaten in a hurry and outside the home. Teenagers rely heavily on vending machines, convenience stores and fast food outlets to obtain food (Nutrition Committee-Canadian Pediatric Society, 1983; Story & Resnick, 1986). The mass media also has a tremendous influence on the eating habits of today's teenagers (Society for Adolescent Medicine, 1983). These influences are not any different for the pregnant adolescent (Story & Alton, 1992). Story (1990a) points out the implications for the pregnant adolescent, "every pregnant adolescent needs to hear the message that the single most important things they can do to have a healthy baby is to eat well, gain an appropriate amount of weight, and avoid alcohol and drugs" (p. 35).

Patterns of irregular meals and increased snacking contribute to the possibility of inadequate dietary intakes (Martin & Valente, 1987; Rees, Endres & Worthington-Roberts, 1989; Story & Alton, 1995). Dietary intake records of pregnant adolescents showed that they consumed more breads, cereals, sweets, desserts, carbonated beverages and salty snack foods compared to older pregnant women (Endres, Dunning, Poon, Welch & Duncan, 1987). Twenty-four hour recall questionnaires of prenatal clients (ages 14 through 35 years) seen at the Wewoka Indian Health Center in Oklahoma indicated the diets were high in fat, sugar and sodium (Keshishian & Hembekides, 1988-1989). Compared to before pregnancy, the nutrient density was higher for calcium, riboflavin, vitamin A, and ascorbic acid among a sample of 34 pregnant adolescents (Skinner & Carruth, 1991).

The incidence of snacking was 80% among adolescents 11 to 18 years of age (Bigler-Doughten & Jenkins, 1987). Afternoon snacks at home are common (McCoy et al., 1986). Ezell, Skinner and Penfield (1985) reported that the nutrient densities of snacks were low among adolescents. Candies, carbonated beverages and salty snacks obtained from school vending machines were the most popular morning snacks. The bioavailability of iron was low in adolescents' snacks (Vigletti & Skinner, 1987). Among 1,224 southern adolescent females, snacks provided particularly important amounts of riboflavin, vitamin C and thiamin which contributed 52%, 43%, and 39%

of each RDA respectively (McCoy et al., 1986). Thus, snacks can make an important contribution to meeting the increased nutrient needs of the adolescent (Bigler-Doughten & Jenkins, 1987; McCoy et al., 1986).

The diets of female adolescents who skipped meals for the purpose of weight reduction were rated poor (Macdonald, Wearring & Moase, 1983). On a typical school day, among Tennessee female teenagers, 39% skipped breakfast and among the 15% of the total sample who skipped lunch, 75% were females. The evening meal was consumed by 94% of the sample, while 89% consumed at least one snack. Approximately two-thirds of the energy requirement was supplied by the evening meal and snacks (Skinner, Salvetti, Ezell, Penfield & Costello, 1985). Popular food choices, fast service, and casual atmosphere are some of the reasons why adolescents prefer fast food restaurants (Story, 1984). Although typical fast foods tend to be high in fat and sodium, more nutritional choices are possible (Story, 1990a).

More and more investigators are reporting the prevalence of dieting and preoccupation with body shape among adolescent girls (Rees & Worthington-Roberts, 1994). Fear of obesity is in part due to the societal pressure to be thin (Dwyer, Feldman & Mayer, 1967; Story, 1990a). The binge purge syndrome to lose weight was reported among 13% of a sample of tenth grade students (Killen et al., 1986). The pregnant adolescent who diets frequently may be at nutritional risk due to low nutrient reserves (Story, 1990a). Young primigravidae 18 to 37 years who had been dieters before pregnancy responded to excessive weight gain during pregnancy with episodes of bulimia (Fairburn & Welch, 1990). Obesity is a particular problem for Cherokee

Native American youth and is a risk factor for adult-onset diabetes (Story, Tompkins, Bass & Wakefield, 1986).

Cultural sensitivity and awareness of differences in cultural values, health beliefs and food habits are important for health professionals when working with various cultural groups. Story (1990a) points out differences in dietary patterns among Blacks, Mexican Americans (including Hispanics), Chinese, Southeast Asian and Native Americans.

Each Native American tribe has distinct cultural differences. Traditional foods among Native Americans of Oklahoma include fry bread, crackling corn bread, bean bread, Pawnee foots (meat turnovers), fried squirrel, Indian squash, sofky (hominy), wild onions with scrambled eggs, fried huckleberries and Indian pudding. Older women in the family are more likely to prepare traditional foods than younger women (Keshishian & Hembekides, 1988-1989). A sample of Cherokee Native American WIC participants in North Carolina found the WIC foods to be acceptable and used by other household members as well as the participants (Slonim, Kolasa & Bass, 1981).

A limited food budget may be a factor contributing to poor dietary intake, particularly if the adolescent is supporting herself (Rees, Endres & Worthington-Roberts, 1989). Emmons (1986) reported that low-income families relying on food stamps, and WIC clients purchase food during the first part of the month. However, the nutrition problems identified were continuous.

Substance Use and Risks During Pregnancy

Substance use among adolescents is a public health problem particularly for Native American youth (Blum, Harmon, Harris, Bergeisen & Resnick, 1992; Martin & Valente, 1987; Story & Van Zyl York, 1987). Alton (1990) reported the results of a survey to determine chemical use among pregnant adolescents less than 18 years of age. At the first prenatal visit, use of cigarettes, alcohol, marijuana and other drugs (amphetamines, cocaine, LSD, barbiturates) was 62%, 18%, 9% and 5% respectively. Increased perinatal mortality and morbidity may be associated with chemical use during adolescent pregnancy (Alton, 1990, p. 97).

Pletsch (1988) reported a case-controlled study of substance use and health activities of inner-city pregnant adolescents. Subjects included 119 pregnant and 313 non-pregnant adolescents ages 14 to 19 years most of whom were Black. Alcohol, cigarettes and marijuana were widely used by both groups. Among the pregnant adolescents, cigarette use was increased ($p < 0.05$). Martin and Valente (1987) report that over the last decade adolescent females are the only group for whom there has been an increased trend in smoking. However, the pregnant group also reported more favorable activities related to health in terms of nutrition and exercise.

The prevalence of alcohol use at younger ages parallels the increased incidence of adolescent pregnancy. Infants born with Fetal Alcohol Syndrome (FAS) are the devastating result of heavy alcohol use during pregnancy which is characterized by growth and mental retardation, neurological as well as behavioral defects and abnormal craniofacial features. Although less severe compared to FAS, the incidence of Fetal Alcohol Effects (FAE) is more common (Martin & Valente, 1987).

Nutritional Assessment of Pregnant Adolescents

Identifying Nutritional Risk

The pregnant adolescent is at nutritional risk particularly if she is less than 15 years of age (American College of Obstetrics & Gynecology Task Force on Nutrition, 1978). A formal initial assessment of nutritional status should ideally be completed at the beginning of pregnancy. Surveillance should continue throughout the pregnancy (Rees, Endres & Worthington-Roberts, 1989; Story, 1990b; Story & Alton, 1995). The team of health professionals (physicians, nurses, nutritionists, psychologists) need to take advantage of the "high motivation" period of pregnancy when a woman is more likely to improve health habits for herself and her infant (American College of Obstetrics and Gynecology Task Force on Nutrition, 1978). It is imperative that health professionals be familiar with the physiological, psychological, emotional, social, and cognitive changes unique to adolescence (Carruth, 1988).

Story (1990b) reviews the purpose of nutrition assessment for the pregnant adolescent as follows (p. 41):

(a) "To evaluate the nutritional status of the pregnant adolescent,

(b) to identify those pregnant adolescents who are at nutritional risk, and

(c) to formalize an individualized care plan with follow-up and referral, when appropriate."

Accurate nutritional assessment involves evaluating several components as follows: relevant history (medical, obstetric, lifestyle, and psychosocial); dietary assessment; anthropometric evaluation; laboratory testing; and clinical evaluation (Story, 1990b). During adolescence, growth and development also need to be assessed (Carruth, 1988).

Basic data is obtained from the medical history component of the nutritional assessment. Relevant medical, obstetric and psychosocioeconomic history provides information to identify nutritional risk factors. According to the American College of Obstetrics and Gynecology Task Force On Nutrition (1978) the following criteria are used to identify nutritional risk factors at the onset of pregnancy (pp. 5-8): adolescence (especially those who are within three years of their GA) because the adolescent has not completed her own growth; three or more pregnancies within two years; poor reproductive performance (e.g., low birth weight infants); economically deprived in which case the client may be referred to participate in the Special Supplemental Food Program for Women, Infants and Children (WIC); food faddist or the client who practices pica; heavy smoker, drug addict, alcoholic; chronic systemic diseases (anemia or diabetes); and prepregnant weight (less than 85% or greater than 120% of standard weight). Nutrition risk factors during pregnancy include anemia, inadequate weight gain, excessive weight gain and the demands of lactation. A past or present eating disorder is a risk for inadequate diet and/or fear of weight gain (Story, 1990b).

A psychosocial history is used to identify the emotional, social and economic factors that may affect diet (Story, 1990b, p. 43). Such factors include income level, cultural and ethnic background, family function and living situation, peer relation, relationship with infant's father, emotional health, feelings about pregnancy, school enrollment or employment, as well as participation in food assistance programs. Furthermore, assessment of educational and cognitive level are necessary to coordinate nutrition education and counseling strategies.

Dietary Assessment

The dietary assessment consists of the nutrition history, dietary intake and nutrient analysis (Story, 1990b). The most appropriate dietary assessment method for adolescents is not known (Carruth, 1988). The nutrition history can provide information on food intake as well as food management and resources (food availability and budget, food assistance programs, cooking facilities); dietary practices and patterns (usual meal and snack patterns, food allergies and intolerances, cultural/ethnic or religious practices, previous dietary practices, unusual food patterns, vitamin and mineral supplements, attitudes about eating during pregnancy as well as dietary concerns during pregnancy such as nausea, vomiting or constipation (Story, 1990b, pp. 43-44).

Carruth and Skinner (1991) surveyed health professionals including dietitians about their clients' beliefs about nutrition during pregnancy. There were strong regional differences in beliefs about cravings and folklore particularly in the southeastern states. Most beliefs were scientifically unsound such as restricting salt, dieting during pregnancy and eating for two. Even today "old wives' tales" are practiced. For example, "beets build red blood" was heard by 11.7% of the dietitians surveyed nationwide. A survey among 115 pregnant adolescents in Tennessee indicated erroneous beliefs about nutrition during pregnancy including salt restriction, maternal versus fetal needs as well as the use of prenatal supplements (Carruth & Skinner, 1992).

The nutrition history may be self administered in a clinic setting. However, Story (1990b) cautions that reading level and language skills be considered in tailoring the nutrition history for low income and low education groups.

There are a number of methods to assess the nutritional quality of the diet. These include the 24-hour food recall, usual food intake, food frequency list, and food records. Each method has limitations and advantages (Carruth, 1988; Story, 1990b).

A 24-hour recall is a record of the dietary intake of the previous 24 hours. Although this may not be representative of a usual day, this method can be quantitatively analyzed. Story (1990b) recommends using the 24-hour recall along with a food frequency list. The 24-hour recall can be compared to the recommended Food Guide Pyramid. Greger and Etnyre (1978) used a single 24-hour recall to assess the validity to estimate the nutrient intake of adolescent females 12.5 to 14.5 years participating in a 30 day metabolic study. Most of the subjects estimated their energy, protein, calcium and zinc intakes within two-thirds to four-thirds of the actual intake. Intakes of vitamins A and C, thiamin, niacin, and iron tended to be overestimated rather than underestimated. Accuracy could be improved by conducting more than one dietary recall on individual subjects.

The food frequency list is a qualitative method used to assess how often particular foods or food categories are consumed. The limitations of this method are that all foods consumed may not be listed and respondent burden is greater with more food items (Story, 1990b). Underestimation of nutrients by a one-week food frequency questionnaire compared to a three-day food diary has been reported (Krall & Dwyer, 1987). Frank et al. (1992) compared a self-administered food frequency questionnaire (FFQ) for adolescents to seven consecutive 24-hour dietary recalls as part of the Bogalusa Heart Study. Reliability and validity of the FFQ were quantitated in order to associate specific eating patterns with risk for cardiovascular disease.

Suitor, Gardner and Willett (1989) compared food frequency and diet recall methods. Included were three 24-hour recalls on nonconsecutive days to assess dietary intakes of low-income pregnant women ages 14 to 43 years. Energy, protein, calcium, iron, zinc and vitamins A, B_6 and C were evaluated. The method of dietary data collection needs to be culturally sensitive and suitable for the low level reader. The pregnancy food frequency questionnaire (PFFQ) developed and tested resulted in high correlations when administered two consecutive times within two weeks for all nutrients except vitamin A. This tool is appropriate to use with most English-speaking, low income pregnant women except up to 20% of the population who may overestimate food intake. More recently, Suitor and Gardner (1992) developed an interactive, self-administered computerized food frequency questionnaire for low-income women. Fifty-eight percent of the 64 participants stated they preferred the computerized program over the written food frequency instrument.

Unlike the 24-hour dietary recall, the usual food intake method involves information on foods eaten typically. Adolescents do best with this method when asked questions related to food intake in terms of daily activities. This method provides qualitative dietary information (Story, 1990b).

Food records require the adolescent to record food and beverages consumed within a three to seven day period of time. Respondent burden is higher and literacy is required so that adolescents may not be as compliant with this method (Story, 1990b). Food records may be more appropriate in counseling clients about specific nutritional problems such as too much or too little weight gain during pregnancy (Story, 1990b). Mullenbach et al. (1992) evaluated dietary intakes of adolescents by comparing a three-day food record and a 24-hour recall by telephone. Mean nutrient intakes demonstrated that the 24-hour recall by telephone is a valid method to assess dietary intakes of adolescents. Less cost, less respondent burden and fewer coding errors are added advantages. Karvetti and Knuts (1992) compared a two-day diet record and observed food and nutrient intakes of subjects 15 to 65 years of age. The estimated food diary is more valid in working with groups rather than individuals.

Once collected, the dietary information needs to be evaluated. Nutritional adequacy can be assessed qualitatively and quantitatively. The Food Guide Pyramid for the pregnant adolescent is used to evaluate the diet qualitatively (Story & Alton, 1992; Story & Alton, 1995). Quantitative nutrient analysis is accomplished through use of a computer program (Story, 1990b). Results are compared to the Recommended

Dietary Allowance for pregnancy and the appropriate age group (11 to 14 years and 15 to 18 years) (Food and Nutrition Board, 1989).

Anthropometric Evaluation

Prenatal anthropometric assessment needs to include measurements of stature and weight as well as weight gain monitoring (Story & Alton, 1995). The prenatal weight history should be completed early in prenatal care. Information needs to include prepregnancy weight as well as current weight, weight gain in previous pregnancies, attitude towards weight gain, and exercise patterns (Story, 1990b, p. 46).

Prepregnancy weight is usually obtained from the client retrospectively (Gong, 1990). Hediger, Scholl, Ances, Belsky and Salmon (1990) found self-reported weights tend to be reliable ($r > 0.90$) during adolescent pregnancy with the exception of overweight teenagers who tend to underreport their weight. Fortenberry (1992) found that both male and female adolescents in the heaviest weight quartiles significantly underreported weight compared to adolescents in the lighter quartiles. Self-reported weight of 69 Native American teenagers 12 to 19 years of age was lower ($p < 0.05$) compared to higher measured weight (Himes & Story, 1992). It has been reported that adolescent prenatal clients estimate fairly accurate prepregnancy weights which can be used to determine prenatal weight gain (Stevens-Simons, McAnarney & Coulter, 1986).

Monitoring of skinfold and arm circumference measurements may be useful in assessment of protein-energy reserves, as well as over or under nutrition particularly in high-risk pregnancy situations. Reference data for prenatal body fat patterns during adolescence are not currently available (Story, 1990b).

A study of Cherokee Native American teenagers in North Carolina assessed anthropometric measurements to evaluate growth, height, and weight as well as the incidence of obesity. Mean body weights and triceps skinfolds were significantly greater compared to Ten-State Nutrition Survey reference data (Story, Tompkins, Bass & Wakefield, 1986).

Weight Gain During Adolescent Pregnancy

Weight Gain and Pregnancy Outcome

Maternal weight gain is an important predictor of pregnancy outcome. The amount of weight gained during pregnancy influences the birth weight of the infant (Gong, 1990). The results of a study of 44 low income pregnant teenagers between 13 and 17 years indicated a difference in birth weights ($p < 0.01$) between those who gained adequate weight and those who did not. Mean birth weights in the adequate weight gain group were 3,323 g and 2,726 g in the inadequate weight gain group, a difference of 597 g (Ravindra, 1989).

Frisancho, Matos and Flegel (1983) compared pregnant adolescents to adult women. Significant differences in birth weight of infants born to 13 to 16 year olds were noted after controlling for height. Smaller infants were born to younger mothers after adjusting for weight, sum of skinfolds and muscle area.

Prepregnancy weight and weight gain during pregnancy have been associated with perinatal mortality (Brown, 1988; Dwyer, 1987). The Collaborative Perinatal

Project data from the National Institutes of Health indicate a U-shaped relationship between perinatal mortality of underweight, normal weight and overweight women and prenatal weight gain (Naeye, 1979). Studies have indicated that underweight women need to gain more than 20.5 kg during pregnancy in order for mean birth weights to be more than 3,500 g which is the recommended standard for a healthy infant (range is between 3,500 and 4,000 g). Normal weight women need to gain 15.5 kg and overweight women need to gain 9.5 kg. Neither smoking, ethnicity nor diseases or disorders that affect weight gain were accounted for in these population statistics (Brown, 1988).

Low prepregnancy weight is associated with increased risk of low birth weight infants particularly among younger adolescents (Gong, 1990). In a group of 99 low income adolescents ages 13 to 19 years enrolled in the Teen Pregnancy Service (TPS), a significant number of low birth weight full term infants were born to mothers who gained 10.9 kg or less during pregnancy (mean = 3,094 g) compared to those who gained at least 11.4 kg (mean = 3,356 g; $p < 0.008$). There was a weak correlation ($r = .15$, $p < 0.07$) between prepregnancy body mass index (BMI) and weight gain. Comparing the prepregnancy weights of overweight and underweight teenagers, birth weights of infants born to overweight teenagers were significantly higher ($p < 0.02$) (Schneck, Sideras, Fox & Dupuis, 1990).

Haiek and Lederman (1988) compared the relationship between maternal weight for height and term birth weight in teens and adult women. Both low prepregnancy weight and low gestational weight gain were evaluated from records of 90 primiparous teens less than 16 years old and 90 primiparous adults 19 to 30 years of age. Increased birth weight was associated with increased prepregnancy weight, weight gain and percent of standard weight for height in teens and adults. A weight gain of 14 kg in the underweight teen group was associated with low birth weights. As teens approached 140% or more of standard weight for height there was a decreased incidence of low birth weight babies. Otherwise mean birth weight was 264 g lower ($p < 0.001$) among the teenagers compared to the adult women even with appropriate maternal weight for height.

Weight gain for the pregnant adolescent is a controversial area in the literature. Hediger, Scholl, Ances, Belsky and Salmon (1990) reported the rate and amount of weight gain associated with maternal weight-for-height and birth weight in a cohort of 1,419 low-income pregnant adolescents in Camden, New Jersey. The median weight gain at term was 14.2 to 15.5 kg which is significantly greater than gains reported for pregnant adults. Except in overweight adolescents, increased birth weights of infants born to White adolescents were associated with increased prenatal weight gains. Improved birth weights were not significantly related to weight gain greater than the 75th percentile in underweight or overweight Puerto Rican or Black adolescents. Scholl, Hediger, Salmon, Belsky and Ances (1989) reported the influence of prepregnant body mass and weight gain for gestation on spontaneous preterm delivery and duration of gestation during adolescent pregnancy. There was a significant association between low prenatal weight gain and prepregnant body mass with low birth weight and small-for-gestational-age infants. A study of teenage participants in the National Collaborative Perinatal Project (NCPP) indicated higher prenatal weight gains were associated with decreasing age (13 years) and lower birth weights. Thus, failure to associate increased prenatal weight gains with increased birth weights could be due to increased fluid retention in younger adolescents (Garn & Petzold, 1983). Hediger, Scholl, Belsky, Ances and Salmon (1989) found the risk of delivering a small-for-gestational-age infant was increased with weight gains less than 4.3 kg at 24 weeks gestation among pregnant adolescents. They also found a significant association between preterm delivery and inadequate gains of less than 400 g/week late in pregnancy. At 16 weeks, there was an increased risk of low birth weight among those with maternal weight gains less than the 25th percentile and an increased risk of macrosomia with maternal weight gains above the 75th percentile (Scholl, Hediger, Ances, Belsky & Salmon, 1990). These studies stress the importance of early weight gain monitoring for the pregnant adolescent.

Factors Affecting Pregnancy Outcome

Although one of the strongest predictors of infant birth weight is weight gain during pregnancy, other factors influencing pregnancy outcome include gestational age; gynecologic age/growth potential; total maternal weight gain; prepregnancy weight status; pattern of weight gain; substance use including cigarettes, drugs and alcohol; sexually transmitted diseases; and stress (Gong, 1990, p. 55). Pregnant adolescents with a GA age of less than two years are at nutritional risk because of the compromises imposed by pregnancy on their own growth and developmental needs (Gong, 1990).

Frisancho, Matos and Bolletino (1984) evaluated the relationship of nutritional factors of growing adolescents ages 13 to 15 years to birth weight of their infants in Lima, Peru. Adolescent mothers who had not reached their potential in height gave birth to infants smaller ($p < 0.05$) than infants whose mothers did reach their potential height. Mothers who completed their own growth demonstrated a greater effect of weight gain and placenta weight gain on infant birth weight. Data indicates that still-growing adolescent mothers who give birth to low birth weight infants may have a decreased availability of nutrients due to competition with the fetus. Placental function is also impaired resulting in fetal growth retardation.

Larger weight gains during pregnancy have been noted among younger adolescents. Garn, LaVelle, Pesick and Ridella (1984) reported a longitudinal study of 1,601 adolescents in the NCPP throughout two or three successive pregnancies. Fluid retention and increased fluid volume but not rapid growth (assessed by changes in stature and weight) were associated with the larger weight gains.

Adolescent primigravidas (12 to 15 years) and multiparas (15 to 18 years) were compared to mature pregnant control subjects (18 to 29 years) (both primigravidas and multiparas). A significant decrease (-282 g, $p < 0.05$) in infant birth weight was associated with multiparas. This finding supports the hypothesis that there is competition between the nutrient needs of the pregnant adolescent and the fetus (Scholl, Hediger & Ances, 1990).

A positive correlation between total maternal weight gain and infant birth weight has been demonstrated by several studies (Brown, 1988; Gong, 1990). A prospective study of 696 pregnant adolescents who delivered by 37 weeks gestation evaluated factors associated with maternal weight gain and infant birth weight. Prenatal weight gain was associated with ethnicity (both Hispanics and Blacks gained less weight compared to Whites), parity and pregnancy-related hypertension. Increased birth weight was associated with maternal weight gain (23 g/kg) for the total sample. There was no significant association ($p > 0.15$) between prepregnancy weight and prenatal weight gain. The odds of delivering a low birth weight infant were reduced for maternal weight gains of 20 kg or more and were associated with odds of 13.1 times higher for delivering a macrosomic infant. However, increased maternal weight gain was not significant for Caesarean section, neonatal death or the infant needing intensive care (Scholl et al., 1988).

A cohort of more than 2,000 low-income pregnant teenagers (12 to 19 years) participated in a Camden, New Jersey study. The objectives were to examine the relationship between dietary intake at the initial prenatal visit, weight gain for gestation and infant birth weight. Inadequate total weight gain for gestation was associated with significant deficits in kilocalorie, protein and carbohydrate intake in a 15% random sample of the cohort. Birth weight, low birth weight or preterm delivery were not directly related to dietary intake. The authors concluded that there may be an indirect relationship between dietary intake and infant birth weight. Furthermore, this relationship may be moderated by maternal weight gain (Scholl, Hediger, Khoo, Healey & Rawson, 1991).

Pregnant adolescents (14 to 17 years) were compared to pregnant young adults (18 to 25 years) in a retrospective examination of maternal characteristics and monthly weight gains. All cases were low-risk pregnancies. Mean total weight gain and infant birth weight were not significantly different between groups. The authors concluded that other predictors of infant birth weight (e. g., cigarette smoking) may be more important than the recommendation of more generous weight gain for the pregnant adolescent (Johnston, Christopher & Kandell, 1991). Birth weights were significantly lower in infants born to adolescent mothers who smoked compared to mothers who did not (mean = 2,882 g compared to 3,162 g; $p < .05$) (Schneck, Sideras, Fox & Dupuis, 1990). When pregnant teenagers were compared to adult mothers to test the hypothesis that both smoking and stress may cause inadequate prenatal weight gain by reducing nutrient utilization, there were significant associations between smoking and inadequate weight gain (1.3 to 3.7 kg), and smoking and infant birth weight (275 to 380 g) among the teenagers ($p \leq 0.01$) (Muscati, Mackey & Newsom, 1988). Carruth (1981) reported a significant relationship between low pregravid weight ($p \leq 0.05$) and smoking in pregnant adolescents. However, in this study, maternal weight gain or infant birth weight were not statistically related to smoking.

Since the optimal weight gain for the pregnant adolescent is unknown, Stevens-Simon and McAnarney (1988) present a multifactorial model that associates adolescent maternal weight gain and low birth weight as follows (p. 949):

> "The six most important physiologic mechanisms underlying the relationship among adolescent maternal age, weight gain and infant outcome include incomplete maternal growth, reproductive immaturity, diminished maternal body size, nutritional deficiencies, socioeconomic and behavioral factors, and maternal emotional stress."

All factors and their interactions need to be considered before making weight gain recommendations for adolescent pregnancy (Stevens-Simon & McAnarney, 1988).

More recently Susser (1991) challenged the causal sequences of maternal weight gain, infant birth weight and diet. More emphasis may need to be given to maternal diet instead of prenatal weight gain to achieve adequate birth weight.

Weight Gain Recommendations

Traditionally, references for adult women have been used as a basis to recommend prenatal weight gain for adolescents. However, recommendations need to be specific for adolescents (Gong, 1990; Worthington-Roberts, 1987). Rosso (1985) recommends providing ranges for normal weight gain during pregnancy. The weight-gain curve to monitor prenatal weight gain includes the assessment of prepregnancy weights ranging from underweight women to overweight women. The reference sample was from a low-income racially-mixed population aged 20 to 25 years. The chart may not be appropriate for younger pregnant adolescents especially for individuals who become pregnant within four years of menarche. Initial weight deficits and estimated growth should also be accounted (Rosso & Lederman, 1982). A method to individualize appropriate weight gain for pregnant adolescents is presented in the position paper of the American Dietetic Association on adolescent pregnancy (Rees, Endres & Worthington-Roberts, 1989).

A summary report of a prenatal nutrition questionnaire and 24-hour recall administered to fifty prenatal patients (14 to 35 years) at the Wewoka Indian Health Center in Wewoka, Oklahoma indicated that 82% of the patients did not know how much weight they should gain during pregnancy. Eleven patients were ages 14 through 17 years and 21 patients were ages 18 through 25 years (Keshishian & Hembekides, 1988-1989).

A normal weight gain pattern for adolescents 17 years and younger during a term pregnancy has been demonstrated to be approximately 35 lb (15.9 kg) (Worthington-Roberts, 1987). The average term weight gain for 80 adolescents (13 to 17 years) was 37 lb (16.8 kg) with younger girls gaining less weight 31.9 lb (14.5 kg) compared to the older girls 39.4 lb (17.9 kg) (Meserole, Worthington-Roberts, Rees & Wright, 1984). Loris, Dewey and Poirier-Brode (1985) reported a mean weight gain of 37 ± 16 lb (16.8 ± 7.3 kg) and mean birth weight of 3,377 ± 480 g of infants born to 145 adolescents ages 13 to 19 years.

The National Academy of Sciences Subcommittee On Nutrition and Pregnancy (Institute of Medicine, 1990) recently reported a recommendation for all pregnant women to receive guidance in maintaining a healthy diet in order to achieve adequate weight gain during pregnancy. A maternal weight gain of 25 to 35 lb (11.4 to 15.9 kg) is recommended for a normal pregnancy in order to reduce the risk of low birth weight infants and adverse maternal health affects. A normal weight-for-height is a BMI of 19.8 to 26.0. Ranges for optimal weight gains are recommended according to prepregnancy weight. A range of 28 to 40 lb (12.7 to 18.2 kg) is recommended for underweight women (BMI < 19.8), while 15 to 25 lb (6.8 to 11.4 kg) is recommended for overweight women (BMI > 26.0 to 29.0). At least a 15 lb (6.8 kg) weight gain is recommended for obese women (BMI > 29). It was further recommended that young adolescents and Blacks gain the higher recommendation of each range (Institute of Medicine, 1990, p. 10). Rees, Engelbert-Fenton, Gong and Bach (1992) assessed weight gain in 459 pregnant adolescents in relation to birth-weight outcome and reported that mothers of infants weighing 3,000 to 4,000 g gained the higher end of the recommendations made by the Institute of Medicine (1990).

Both the amount and pattern of prenatal weight gain are important factors associated with infant birth weight (Dwyer, 1987). The pattern of weight gain averages 0.40 kg per week during the first trimester decreasing to 0.35 kg per week throughout the remainder of pregnancy. Weight gain is attributed to maternal tissues (uterus, breast, blood, placenta, amniotic fluid, and fat) during the second trimester and to the fetus during the third trimester (Dwyer, 1987, p. 209). The prenatal weight gain grid is used to monitor the pattern and amount of weight gained during adolescent pregnancy (Gong, 1990).

Impact Of Nutrition Intervention On Neonatal Outcome

The impact of effective nutrition intervention to promote adequate maternal weight gain can result in the decreased incidence of both low birth weight babies and perinatal death rate (Hughes, 1982; Jacobson, 1982). Statistically significant improvements in birth weights and/or the incidence of low birth weight infants as a result of nutrition intervention during pregnancy have been demonstrated by several studies (Rush, Alvir, Kenny, Johnson & Horvitz, 1988; Rush, et al., 1988; Rush, Alvir, Kenny, Johnson & Horvitz, 1988).

The Higgins Nutrition Intervention Program at the Montreal Diet Dispensary in Canada was developed in 1963 to improve pregnancy outcome. Implementation of the program includes assessment of risk profile; individualized nutrition program; teaching of food consumption patterns based on individual calorie and protein needs; and regular follow-up and supervision by a dietitian (Higgins, Moxley, Pencharz, Mikolainis &

Dubois, 1989). In addition, low income women receive supplemental foods including milk, eggs and oranges. Pregnancy outcome was evaluated for 552 sibling pairs in which each mother participated in the Higgins Program during a second pregnancy but not during their first pregnancy. The average age of the sample was 28.3 $\pm$ 6 years and 65% received food supplements. With nutrition intervention during pregnancy, average infant birth weights were 107 g greater ($p < 0.01$) than infant birth weights of their matched siblings after adjustments for parity and sex. There was also a decrease ($p < 0.01$) in the rate of low birth weight infants as a result of nutrition intervention. The incidences of intrauterine growth retardation (IUGR) and perinatal mortality were also lower among intervention infants (Higgins, Moxley, Pencharz, Mikolainis & Dubois, 1989).

The Special Supplemental Food Program for Women, Infants and Children (WIC) was established in 1972 to provide food supplements to low-income prenatal and lactating women, infants and young children up to five years of age. Participants are at medical and/or nutritional risk. Program components include the assessment of nutritional and medical risk, nutrition education, a supplemental food package and referral to health care services (Kennedy, Gershoff, Reed & Austin, 1982).

Kennedy, Gershoff, Reed and Austin (1982) reviewed WIC and non-WIC participant nutrition records in a retrospective study of 1,328 pregnant women (910 WIC and 418 non-WIC) with a mean age of 22 years from over a five year period. There were significant associations between maternal characteristics (pregravid weight, prenatal weight gain, and previous low birth weight infants) and birth weight among

WIC participants ($p < 0.001$). There were significant ($p < 0.05$) associations between gestational age and maternal weight gain with birth weight. WIC participation was positively associated with improved birth weight.

Several studies have reported the effects of the WIC program on nutrition intervention or pregnancy outcome comparing adolescents and older women participants. Weight gains per trimester were within the recommended ranges for pregnant adolescents participating in the WIC program (Endres, Poell-Odenwald, Sawicki & Welch, 1985). Pregnancy outcome was assessed in a comparative study which included 32 adolescents and matched mature controls participating in WIC. When controlled for confounding factors, no significant differences in infant birth weights were found between groups. The trimester of WIC enrollment was significantly associated with prenatal weight gain. There were significantly shorter gestations, earlier menarche and inadequate prenatal weight gain among young adolescents compared to mature women (Scholl, Decker, Karp, Greene & DeSales, 1984).

A comprehensive prenatal care program compared pregnancy outcome among adolescents and older women. There was increased risk among adolescents (13 to 19 years) of delivering a low-birth-weight infant (< 2,500 g) or a preterm infant (< 38 weeks gestation) regardless of prenatal care. The amount of prenatal care may have more impact on pregnancy outcome than maternal age (Leppert, Namerow & Barker, 1986).

Nutrition-Related Concerns During Adolescent Pregnancy

Iron Deficiency Anemia

Iron deficiency anemia is common in adolescent pregnancy. Major physiologic changes occur during pregnancy that contribute to iron deficiency anemia. These include physiologic changes in blood volume, increased iron demands (a single pregnancy requires 1,200 mg of iron), and low or absent iron stores (Alton & Mulchahey, 1990; Scholl, Hediger & Belsky, 1994). Blood volume expansion begins during the first trimester peaking at 32 to 34 weeks gestation. At this time the hemoglobin, hematocrit and red blood cells will be lowest with increases of 6 to 8% at 40 weeks. This phenomenon occurs with or without iron supplements during pregnancy (McGanity, 1987).

Iron deficiency anemia results in decreased hemoglobin production and a reduction in the amount of oxygen carried to body cells and tissues. Iron containing enzymes may be reduced as well. Perinatal morbidity may increase with iron deficiency anemia causing prematurity, low birth weight, postpartum hemorrhage, decreased maternal well-being, maternal transfusion and compromised fetal iron status (Alton & Mulchahey, 1990; Scholl & Hediger, 1994; Scholl, Hediger & Belsky, 1994).

Participation in the Special Supplemental Food Program for Women, Infants, and Children (WIC) indicated a positive and significant increase in hemoglobin and hematocrit values (Kennedy & Gershoff, 1982). Higgins, Pencharz, Strawbridge, Maughan and Moxley (1982) studied changes in maternal hemoglobin values in terms of their relationship to infant birth weight. Mothers were participants of the Montreal Diet Dispensary Nutrition Program. High protein intakes during pregnancy were associated with decreased hemoglobin due to the expansion in blood volume. There was an inverse relationship between birth weight and late antepartum hemoglobin ($p < 0.01$) and hemoglobin changes ($p < 0.025$). The relationship between initial hemoglobin and infant birth weight was not significant. Mitchell and Lerner (1992) found maternal hemoglobin levels below 110 and above 130 g/L were associated with lower infant birth weight. The interaction between maternal cigarette smoking and hemoglobin values was not significant. Increased rate of premature births among Black women was associated with several risk factors including increased incidence of anemia, underweight, and urinary tract infections as well as socioeconomic factors (less than 20 years of age, single, less than a high school education and receiving welfare support) (Lieberman, Ryan, Monson & Schoenbaums, 1987). Scholl, Hediger, Fischer and Shearer (1992) studied more than 800 inner city gravidas 12 to 29 years and found an association between low birth weight and iron deficiency. Lower mean energy and iron intakes early in pregnancy as well as lower mean corpuscular volume were significantly associated with iron deficiency.

Multiple laboratory parameters to measure iron status need to be compared according to weeks of gestation rather than by trimester (Beard, 1994; McGanity, 1987). It is recommended to assess serum ferritin between 16 and 20 weeks of pregnancy in order to identify any hematologic risk. Seventy-two medically indigent White and Black women with a mean age of 16 years participated in a study to evaluate the use of a multivitamin/multimineral supplement with iron that would maintain adequate hematologic values as well as maternal iron stores during pregnancy and through 12 weeks postpartum. Both the treatment and control groups showed the lowest mean serum iron at 32 weeks. The group taking the iron supplement decreased by 6% and the non-iron treated group decreased by 26%. Serum ferritin levels of the treated group were statistically higher throughout pregnancy. By 12 weeks postpartum both groups returned to baseline levels (McGanity, 1987). Stroble, Vaughn, Manore and Spicher (1989) assessed pregnant adolescents during the second trimester and found that erythrocyte counts ($p < 0.001$), hemoglobin ($p < 0.001$), hematocrit ($p < 0.001$) and serum B_{12} levels ($p < 0.05$) were significantly lower compared to non-pregnant control subjects. Then, during the post-partum period, there was a significant increase compared to the third trimester (all = $p < 0.05$).

Routine prenatal monitoring of hematocrit and hemoglobin values is a preventive measure to detect iron deficiency anemia. Although a daily supplement of 30 mg of ferrous iron is recommended during the second and third trimesters, the recommended dose is increased to 60 to 120 mg per day if iron deficiency anemia is diagnosed during pregnancy (Institute of Medicine, 1990). The supplement should not be taken with milk, tea, or coffee and preferably it should be taken between meals. Excess iron can interfere with zinc absorption (Solomons, 1986).

For the pregnant adolescent during the first trimester recommended hemoglobin values are greater than 12.0 g/dL and hematocrit values are greater than 36%. Throughout the rest of pregnancy desirable hemoglobin values are greater than 11.0 g/dL and hematocrit values are greater than 33% (Alton & Mulchahey, 1990, p. 70).

In Blacks, normal hemoglobin levels may be 1.0 g/dL less than the recommended values (Alton & Mulchahey, 1990, p. 70).

The intracellular iron storage protein indicating iron reserves is ferritin which is a sensitive and specific indicator of iron deficiency anemia. A ferritin value of less than 12 ng/ml is accepted as the criterion for iron deficiency anemia. Other laboratory indices include percent saturation of transferrin (the ratio of serum iron and total iron binding capacity (TIBC)), mean corpuscular volume (MCV) (the average volume of red blood cells) and the mean corpuscular hemoglobin concentration (MCHC) (the concentration of hemoglobin in red blood cells) (Alton & Mulchahey, 1990).

Groner, Holtzman, Charney and Mellits (1986) used a double blind randomized clinical trial to assess the effects of iron-deficiency on short term memory and attention span. They also determined the correlation between iron status and psychometric test scores. Subjects 14 to 24 years of age had hematocrits greater than 30% and received prenatal care before 16 weeks of gestation. The experimental group received 90 mg ferrous fumarate twice daily for one month. Short-term memory significantly improved in the experimental group. Psychometric test score performance also improved as a result of the iron therapy.

Pica

Pica refers to abnormal regular cravings and ingestion of inappropriate substances which may or may not be foods. Pica substances include clay, dirt, moth balls and coffee grounds (Alton & Mulchahey, 1990; Moore & Sears, 1994). Frequent ice consumption has been reported among low income pregnant adolescents. Estimates given for practicing pica among 99 subjects were 5 to 10% which included the consumption of clay, dirt, matches, hair spray, cigarette butts and ashes (Schneck, Sideras, Fox & Dupuis, 1990).

The etiology of pica is unknown. It has been known to occur during pregnancy among women of various age, racial, cultural, geographic and socioeconomic groups. It has been hypothesized that iron deficiency anemia and preeclampsia may be related to pica. However, a clear relationship has not been identified. Potential adverse effects of pica during pregnancy include alkalosis from ingestion of baking soda, and lead toxicity from paint ingestion (Alton & Mulchahey, 1990; Moore & Sears, 1994).

Food cravings and aversions have also been frequently reported among pregnant women (Tierson, Olsen & Hook, 1985). In the postpartum period these tend to drop markedly (Worthington-Roberts, Little, Lambert & Wu, 1989).

Gestational Diabetes Mellitus

Gestational Diabetes Mellitus (GDM) is a possible complication of adolescent pregnancy. The diabetes may be pre-existing (Type I or Type II Diabetes Mellitus) or it may be diagnosed during pregnancy resulting in GDM (Alton & Mulchahey, 1990). The National Diabetes Data Group defines GDM as "carbohydrate intolerance of variable severity with onset of first recognition during pregnancy" (Metzger & The Organizing Committee, 1991, p. 198).

A variety of perinatal complications are associated with GDM. The perinatal risks associated with GDM include preeclampsia, polyhydramnios, Caesarian delivery, prematurity, macrosomia, birth trauma, shoulder dystocia, neonatal metabolic abnormalities (hypoglycemia, hypocalcemia, hyperbilirubinemia, polycythemia) and respiratory distress syndrome. During infancy and/or childhood there is the possibility of impaired carbohydrate tolerance or obesity later in life. Maternal blood glucose levels may determine how much risk is associated with GDM (Alton & Mulchahey, 1990, p. 75).

DeHertogh (1991) presents risk factors associated with the severity of GDM at the time of diagnosis. These include age of patient, previous history of GDM, early onset of GDM in index pregnancy, high fasting blood glucose level, degree of oral glucose tolerance test (OGTT) abnormality, insulin response to OGTT (uncertain), high amniotic fluid insulin level, high HbA1c and/or fructosamine level (DeHertogh, 1991, p. 158). This report does not support the use of glycosylated proteins in monitoring GDM, yet elevated levels of HbAlc may indicate a more severe form of GDM and be associated with more neonatal risks (DeHertogh, 1991). Other reports indicate the usefulness of glycohemoglobin monitoring as an indication of long-term blood glucose control. Glycohemoglobin levels greater than 7% are an indication of abnormal control. Normal glycohemoglobin values during pregnancy should be in the range of 5 to 7% (O'Shaughnessy, 1985). The advantage of monitoring fructosamine levels is that glucose status can be determined over a shorter period of time (Reece et al., 1991). Insulin resistance is associated with a number of changes in renal and endocrine functions during adolescent pregnancy (Molitch, 1993). Excess weight gain decreases carbohydrate tolerance further and should be avoided (Alton & Mulchahey, 1990).

A retrospective study of 150 women with GDM grouped according to body mass index reported that hypertension without proteinuria ($p = 0.05$) and preeclampsia ($p = 0.07$) occurred in the GDM group compared to control subjects matched for age, parity, and ethnicity. Being overweight made no significant difference in the incidence of hypertensive complications in the GDM group. Increased Caesarean delivery rates ($p < 0.01$) were more common in the GDM group (Goldman, Kitzmiller, Abrams, Cowan & Laros, 1991). A study of 878 women with GDM controlled by diet or diet plus insulin to maintain euglycemia resulted in a significantly high incidence of neonatal complications ($p < 0.05$). Macrosomia, hypoglycemia, hyperbilirubinemia, hypocalcemia, polycythemia as well as major congenital anomalies were reported (Hod, Merlob, Friedman, Schoenfeld & Ovadia, 1991). A strict euglycemic diet followed by women with GDM can prevent macrosomia (Peterson & Jovanovic-Peterson, 1991).

All pregnant women should be screened for GDM including pregnant teenagers. Early treatment may help to prevent perinatal complications. At a multiethnic (Mexican-American, White, Black and Indochinese) pregnancy clinic, the incidence of GDM was 1.4% out of 137 teenagers 12 to 18 years of age who were screened between 24 and 34 weeks of gestation. Abnormal screening tests were reported in 5.8% of the teenagers. More than half of the teenagers with GDM were obese and 54% had excessive prenatal weight gains. The incidence of macrosomia was 8.7% for the total sample (Truscello, Hollingsworth, Felice & Shragg, 1988.)

There is a high incidence of non-insulin-dependent diabetes mellitus among the Pima Indians of Arizona. A glucose tolerance test is a routine part of prenatal care for the Pima Indian women. The prevalence of abnormal glucose tolerance in the offspring of 15 to 24 year olds was significantly associated with maternal glucose values when diabetes was previously diagnosed (Pettitt et al., 1991).

The Diabetes Care and Education Practice Group of the American Dietetic Association recommends an individualized approach to medical nutrition therapy during pregnancy (Tinker, Heins & Holler, 1994). Nutrition intervention is of prime importance in the treatment of GDM (Fagen, King & Erick, 1995; Franz et al., 1994). There is a need for effective educational materials to enhance the nutrition education and diet counseling process (Brech, Ebro & Kopel, 1994).

Hypertension

Perinatal mortality and morbidity in adolescent pregnancy may be due to hypertensive disorders. Classification of hypertensive disorders in pregnancy include pregnancy-induced hypertension (PIH) (preeclampsia; eclampsia), chronic hypertension preceding pregnancy, chronic hypertension with superimposed pregnancy-induced hypertension (preeclampsia; eclampsia) and late or transient hypertension (Alton & Mulchahey, 1990; Lindheimer & Katz, 1985). The most common hypertensive disorder is PIH (Savitz & Zhang, 1989). After 20 weeks of gestation there is an elevation of blood pressure. Hypertensive disorders are associated with several risks for the adolescent as well as the infant. Maternal risks include cerebral hemorrhage; renal, hepatic or cardiac failure; disseminated intravascular coagulation; and generalized bleeding. Infant risks include abruption placentae, spontaneous abortion (first and second trimester), intrauterine growth retardation, fetal death in utero and prematurity (Alton & Mulchahey, 1990, pp. 72-73; Silver, 1989). An epidemiologic study of birth records in North Carolina from 1988 through 1989 indicated that increased risks of PIH were associated with multiple pregnancies, nulliparity and advanced maternal age (Savitz & Zhang, 1989).

The etiology and pathophysiology of PIH are poorly understood (Lindheimer & Katz, 1985). Genetic, hormonal, immunologic and nutritional factors are among the theories to explain the etiology of PIH (Alton & Mulchahey, 1990). Reports of exposure to the Dutch famine (1944 to 1945) during pregnancy indicate a significant reduction in systolic blood pressure related to decreased food intake (Ribeiro, Stein, Susser, Cohen & Neugut, 1982). Cherry et al. (1981) reported that among 272 pregnant adolescents significantly lower plasma zinc was associated with prenatal hypertension/toxemia. Thirty normotensive and hypertensive pregnant women ages 18 to 28 years participated in a study to evaluate the effects of calcium supplementation (1,000 mg Ca/day) on blood pressure for 20 weeks. In the hypertensive group, calcium supplementation significantly lowered diastolic blood pressure. Results indicated a significant inverse relationship ($p < 0.05$) between dietary calcium and both systolic and diastolic blood pressure (Knight & Keith, 1992). Comprehensive prenatal care has been associated with diminished risk of PIH among teenagers (Scholl, Hediger & Belsky, 1994).

During the course of pregnancy it is normal for blood pressure levels to decrease 15 to 20 mm Hg particularly during the initial 16 to 20 weeks. This change is due to a drop in peripheral vascular resistance due to increased cardiac output. Then, during the third trimester blood pressure increases due to the increased blood volume and increased peripheral vascular resistance (Alton & Mulchahey, 1990; Silver, 1989).

The American College of Obstetricians and Gynecologists presents the following criteria to diagnose PIH:

Increase in systolic blood pressure $\geq$ 30 mm Hg

Increase in diastolic blood pressure $\geq$ 15 mm Hg

Systolic blood pressure $\geq$ 140 mm Hg

Diastolic blood pressure $\geq$ 90 mm Hg

The first two criteria are particularly important for the pregnant adolescent. PIH is diagnosed according to these criteria from blood pressure readings on at least two occasions with at least six hours difference (Alton & Mulchahey, 1990, p. 74). Use of sodium restricted diets and/or diuretics are not recommended during pregnancy (Alton & Mulchahey, 1990; Lindheimer & Katz, 1985; Silver, 1989).

Nutrition Education For The Pregnant Adolescent

The Expanded Food and Nutrition Education Program

The Expanded Food and Nutrition Education Program (EFNEP) is the largest federally funded nutrition education program in the United States. The United States Department of Agriculture (USDA) administers the program in cooperation with the land grant universities and the Cooperative Extension Service (Anderson, 1988). Since EFNEP began in 1968, 2.5 million families have enrolled in the program (Leidenfrost, 1987, p. 11). The purpose of EFNEP is to help low-income families and youth increase their knowledge and skills in order to implement appropriate behaviors which would in effect improve nutrition and health as well as build self-esteem. EFNEP families tend to have annual incomes below the poverty level, receive food stamps, be enrolled in WIC (Women, Infant and Children Program), and have children under five years of age. Sixty percent of EFNEP families are minorities (Leidenfrost, 1987, p. 12).

EFNEP paraprofessionals are trained and supervised by county extension home economists to teach basic nutrition (Bremner, Campbell & Sobal, 1994). Most paraprofessionals are indigenous to the EFNEP population and are considered the "change agents" who facilitate the learning process by bringing education to the community in a nonthreatening manner (Randall, Brink & Joy, 1989). Each paraprofessional is responsible for recruiting their own clients. Interested participants are enrolled through door-to-door canvassing or they may be referred from other agencies. The recommended enrollment period for clients is one year. A nutrition curriculum is used by the paraprofessionals to teach clients about planning, shopping, and preparing economical and nutritious meals. Furthermore, emphasis is stressed on the relationship between food and good health. Teaching may occur in small groups or on an individual basis. State coordinators and extension nutritionists plan, develop and revise the educational curriculum (Chipman & Kendall, 1989; Leidenfrost, 1987).

Proulx and Jackson (1989) reported the assessment of competency-based workshops on food production for paraprofessionals conducted by the Indian Health Service. The reading levels of participants and instructional materials were assessed as well as teaching methods used to conduct the workshops. Among the participants, there were various social-cultural backgrounds, as well as levels of education and experience. Proulx and Jackson (1989) stress the importance of determining the reading level when working with cross-cultural, bilingual paraprofessionals. Teaching techniques and materials were revised to meet the needs of the participants. Active participation and a variety of teaching strategies were recommended (Proulx & Jackson, 1989).

Knowledge, attitudes and perceptions regarding breast-feeding were evaluated in a group of EFNEP paraprofessionals using a breast-feeding intervention program (Cadwallader & Olson, 1986). Positive scores in attitudes, knowledge and perceptions were related to implementation of the breast-feeding program. However, ongoing training and support of the paraprofessionals are recommended to maximize intervention of the program with clients (Cadwallader & Olson, 1986).

Many EFNEP participants have not completed a high school education. Illiteracy is a problem with this target population and educational materials need to be designed for the low level reader. Chipman and Kendall (1989) report that a national curriculum has been developed for EFNEP at the sixth grade level. However, there continues to be a lack of materials for specific audiences (e.g., pregnant teenagers and specific cultural groups).

Using print materials has several advantages in providing information, education and communication in health programs (Zimmerman, Newton, Frumin & Wittet, 1989, p. 8). Print materials include booklets, posters, fliers, comic books and flip charts. They can be used as reference material and are useful in reinforcing verbal messages. Clients are more likely to share the information with family and friends. Materials can be geared to specific audiences and may help to improve reading, writing and problem solving skills as opposed to verbal communication alone. This type of education may serve as a motivator for those who wish to improve their literacy skills. It is important to pilot test the materials and include paraprofessionals in the development process. This will give them a sense of "ownership" of the materials and increase the possibility of using the materials and sharing them with others (Zimmerman, Newton, Frumin & Wittet, 1989, p. 8). Support materials (e.g., print materials) facilitate the interaction between the client and the paraprofessional. Information needs to be accurate, well understood and meet the needs of the target audience. Audiences need to be defined in terms of demographic, geographic, cultural and psychological characteristics. Accurately defined audiences reflect accurate representation in research to assess knowledge, attitudes and practices (Zimmerman, Newton, Frumin & Wittet, 1989, p. 7).

The California EFNEP has implemented an "interactive nutrition learning center" which includes a computer program for EFNEP participants enrolled in the WIC program. A formal evaluation of the program was not reported (Greathouse & Fujii, 1987).

The EFNEP evaluation study conducted in California evaluated 24-hour food recalls of 355 EFNEP participants and 328 participants in a control group. Significant food recall scores were evident in the group receiving EFNEP instruction after six months compared to the control group who received no instruction. This study documents the need for further evaluation of EFNEP throughout the nation (Tredici, Joy, Omelich & Laughlin, 1988). In a study of Virginia EFNEP homemakers, dietary scores improved significantly. Furthermore, family factors were related to dietary improvements (Torisky et al., 1989). The Colorado EFNEP implemented a simplified progression form to assess EFNEP participants at the end of an 18 month program. Results indicated significant improvements in knowledge and dietary practices including selection of nutritious snacks and food budgeting, as well as food safety and sanitation (Anderson, 1988). Twenty nutrition education lessons, the "Cost Cutter Lesson Series" in the Wyoming EFNEP were evaluated for knowledge, food behavior and consumption with 35 homemakers. Improvements were significant for nutrition knowledge, dietary practices and food management (Romero, Medeiros & Melcher, 1988).

Nutrition practices of former EFNEP clients have been evaluated in a one year follow-up study. Nutrition practices were maintained (Leidenfrost, 1987). Furthermore, some former clients applied their nutritional skills to obtain employment and to manage other resources (Keefe, 1988). In Michigan, improved dietary behaviors were noted in a five year follow-up study upon completion of a nine month EFNEP program (Chipman & Kendall, 1989, p. 267). The long-term effect of EFNEP was assessed in Oklahoma. Participants completing the program indicated significant improvements in dietary intakes compared to baseline data that were sustained over the three year period (Jordan, 1985).

Competency-based curriculum is currently being developed for EFNEP. Specific standards will be needed to measure subject mastery (Chipman & Kendall, 1989, p. 267). An evaluation of a nutrition education program needs to specify outcomes that are realistic (St. Pierre, 1982).

Nutrition Education For Pregnant Adolescents

Nutrition education through schools and/or comprehensive clinic programs can help improve the nutritional status and pregnancy outcome of pregnant adolescents (Rees & Worthington-Roberts, 1994; Story & Alton, 1995; Yu & Jackson, 1995). Secretary Madigan's 1993 nutrition education budget initiative supported USDA's goal of implementing education to improve nutrition. The 1993 budget requested $320.8 million for nutrition education which included $12.5 million to allow EFNEP to work cooperatively with WIC. This was to provide nutrition education to 50,000 additional WIC mothers (Madigan, 1993). A need for nutrition education for Native Americans and assessment of diet, health and nutrition education knowledge was expressed in the priority objectives reported by the Indian Health Service (Jackson, 1986). Native American adolescents need culturally sensitive nutrition and health information (Blum, Harmon, Harris, Bergeisen & Resnick, 1992).

EFNEP has begun to work with pregnant adolescents. In Alabama, "Today's Mom" has been implemented with over 1,500 limited-income pregnant teenagers participating. The curriculum which includes video tapes is taught by paraprofessionals. A unique feature of this program is the use of a volunteer Godparent who serves as a support system and role model (Struempler, Tate, Blount & Goebel, 1989).

In Kentucky, EFNEP has been conducting nutrition education programs for pregnant adolescents. Follow-up evaluations indicate a reduced incidence of low birth weight babies being born to EFNEP participants compared to the state average (Forester, Arnold & Gantz, 1991).

A manual for EFNEP paraprofessionals and pregnant teens was developed and evaluated by the Penn State Nutrition Center entitled "Eating For A Better Start". The evaluation was based on the theory of reasoned action which includes both quantitative and qualitative data collection. The manual was used by paraprofessionals with groups of pregnant teens in various settings including high schools, homes for unwed mothers and health clinics. Results indicated improved attitudes of "very confident" in working with pregnant teens among the paraprofessionals after using the manual (Strychar, Achterberg & Sullivan, 1991).

Other nutrition education programs for pregnant adolescents have been reported. Cognitive pre and posttest scores and analysis of dietary records were used to evaluate a one month nutrition education program for 19 pregnant adolescents ages 13 to 18 years in a high school setting. Cognitive test scores significantly improved for the 11 subjects who completed both the pre and posttest. No significant differences were reported for the pre and post dietary records (Perkin, 1983). White and Skinner (1988) evaluated a behavior change strategy using both male and female adolescents participating in high school health classes. Significant ($p < .01$) behavior change was related to those who set their goal to increase calcium, vitamin A, or vitamin C intakes or decrease sodium. Significant increases were reported for knowledge scores as well. A label reading module for teen shoppers has been developed (Lesan, 1995).

Schneck, Sideras, Fox and Dupuis (1990) recommended that a lower educational level be reflected for all activities, handouts and information presented by an educational program for low-income pregnant adolescents. In the Teen Pregnancy Service (TPS) sample of 99 pregnant teens, many had limited reading skills.

Furthermore, active rather than passive learning needs to include short activity oriented sessions on nutrition. The educational atmosphere needs to be positive and supportive for the pregnant adolescent.

Summary

Both nationally and among the southern regional states, Oklahoma ranks high in the incidence of infants born to adolescent mothers. The birth rate is particularly high for Native American and Black youth. The numerous medical, economic and psychosocial risks for the adolescent and her infant impact on both these individuals and society.

Recent attention has been directed toward nutrition as a significant influence on pregnancy outcome. The purpose of this study was to investigate the possible effects of nutrition education programs for EFNEP pregnant adolescents on knowledge, dietary intake, beliefs and selected health parameters. Studies on nutrient requirements and lifestyle influences during adolescence, as well as nutritional assessment, weight gain, nutrition-related concerns and nutrition education for the pregnant adolescent were reviewed.

Studies support that younger pregnant adolescents are at greater nutritional risk than older pregnant adolescents. The recent recommendation from the Committee on Nutritional Status During Pregnancy for further research on adolescent pregnancy documents the limited number of nutritional research studies reported (Institute of Medicine, 1990). The need for further research is supported by the fact that there are no RDAs for pregnancy during adolescence (Food and Nutrition Board, 1989). And, the number of research studies on nutritional status of Native American pregnant adolescents is particularly limited. Of the studies on selected nutrients reviewed, manganese, copper, chromium and vitamin A included the least number of studies with pregnant adolescents. Suboptimal nutrient intakes due to lifestyle factors have been reported among female adolescents. Few studies have been directed toward the cultural dietary differences of Native Americans.

Identifying nutritional risk during adolescent pregnancy is imperative. Several studies have been reported on dietary assessment using various methods. Anthropometric evaluation studies to assess body fat patterns during adolescent pregnancy are needed.

Appropriate weight gain and positive pregnancy outcome have been well documented in the literature. However, some controversy exists over the optimal weight gain recommendation during adolescent pregnancy.

Gestational diabetes mellitus, iron deficiency anemia, pica and hypertension are documented nutrition related problems which could affect the adolescent during pregnancy. Among Native Americans, gestational diabetes may be a particular concern.

The effects of the EFNEP program utilizing paraprofessionals have been evaluated in terms of knowledge, dietary intakes and practices. However, few studies have incorporated biological or anthropometric parameters to collect baseline and serial measurements to assess the effects of a nutrition education program on nutritional status during adolescent pregnancy. Furthermore, few studies have evaluated educational materials specific for pregnant adolescents.

The need to evaluate nutritional status of pregnant adolescents including Native Americans directed this study to investigate the effect of nutrition education programs for pregnant adolescents assessing baseline and serial measurements. Surveying the literature to date, no studies had reported the effects of nutrition education programs for EFNEP pregnant adolescents on knowledge, dietary intake, beliefs and selected health parameters including trace mineral status.

CHAPTER III

METHODOLOGY

This research was designed to study the effects of two nutrition education programs on nutrition knowledge, dietary intake, beliefs and selected health parameters for pregnant adolescents. This section presents a description of the selection of subjects, experimental design, pilot study, study instruments and procedures, as well as the statistical analyses used.

Subjects

Subjects were pregnant adolescents ages 11 to 19 years who were recruited from the Oklahoma EFNEP program (urban and rural areas) and one Native American tribe to participate in the educational program for pregnant adolescents. Flyers were distributed through the EFNEP home economists and paraprofessionals as well as the local health department and tribal nutritionists working with pregnant adolescents. Initially, solicitation form #1 was used. A more detailed solicitation form (#2) was used once interest in participating in the study was established. Both forms are provided in Appendix A.

Four EFNEP paraprofessionals working with pregnant adolescents were selected to implement the special nutrition education program over an eight-week period conducting a single one-hour lesson per week. Two EFNEP paraprofessionals working with pregnant adolescents participating in the Chickasaw Nation Native American WIC program were also selected to implement the same nutrition education program. Six paraprofessionals were selected to conduct the regular adult EFNEP program. A total of 34 pregnant adolescents were taught by the six specifically trained paraprofessionals and 30 pregnant adolescents participated in the regular adult EFNEP program conducted by the remaining six paraprofessionals. Training of the paraprofessionals was conducted by the EFNEP nutritionist, a registered and licensed dietitian. A total of 64 pregnant adolescents initially began the study. Eighteen pregnant adolescents in the special nutrition education program completed all three days of data collection. Fourteen pregnant adolescents in the regular EFNEP program completed all three days of data collection.

An application for review of human subjects research was approved for both the paraprofessionals (Expedited Review) and the pregnant adolescents (Full Board Review) by the Institutional Review Board for the Protection of Human Subjects at Oklahoma State University (Appendix B). The consent forms used with both the pregnant adolescent and the paraprofessional are included in Appendix A.

Inducements were offered to all pregnant adolescents participating in this study. These included the educational program materials developed for the pregnant adolescent and breakfast on the three days of data collection. In addition, each subject received $10.00 for each data collection day or a total of $30.00 for all three days of data collection.

Design

The method selected for this particular study was experimental. The independent variable (type of educational program) was manipulated to observe the effect on the dependent variables (nutrition knowledge, dietary intake, beliefs, and selected health parameters). A pretest-posttest design was selected (Gay, 1987). Subjects were assigned to one of two educational groups. Both groups were administered the pre and post tests. One group received the "Have A Healthy Baby" (HAHB) program especially designed for pregnant adolescents; the other group received the "Eating Right Is /Basic" (ERIB) adult program. Table 1 illustrates the two educational programs and the number of pregnant adolescents who completed each of the three data collection days.

Table 1

Data Collection Days Completed By Pregnant Adolescents In Each Educational Program

Educational Program	Data Collection Days		
	1[a]	2	3
"Have A Healthy Baby" (HAHB)[b]	34	20	23
"Eating Right Is Basic" (ERIB)	30	25	14
Total	64	45	37

[a]Four adolescents missed the second data collection day but completed the first and third.
[b]One participant was dropped from the final data analysis because she was 20 years of age at delivery.

A total of 32 adolescents completed all three data collection days, 18 in the HAHB group and 14 in the ERIB group.

Pilot Studies

Beliefs and Knowledge Instrument

A scale instrument about health and nutrition during pregnancy was developed. This instrument was adapted with permission (Appendix C) from a published belief's inventory (Carruth & Skinner, 1991) and revised according to a panel of experts review and review of the literature. The revised instrument consisted of 43 belief statements (food and folklore, nutritional practices, cravings and health-medical), and 22 knowledge statements (food and nutrition, substance use, complications and weight). It was administered to a total of 51 nutrition or sociology students as a pretest. The knowledge score resulted in a mean of 14.8 ± 2.0. Factor analysis results of the belief statements identified three major factors: cravings, nutritional practices, and food and folklore. Alpha coefficients and Pearson product-moment correlations were analyzed for each factor to determine the reliability and validity of the scale items. This instrument was adapted for the study of pregnant adolescents (Appendix D).

Study Instruments

A pilot test was used to assess the validity, comprehension and reading level of the following instruments: "Have A Healthy Baby"-Project Data Form (Appendix E), Beliefs and Knowledge Survey form for pregnant adolescents (Appendix D) and Dietary Intake forms for pregnant adolescents (Appendix F). The nutrition education program for pregnant adolescents, "Have A Healthy Baby" and the training materials for the paraprofessionals were evaluated and revised after the pilot study.

Instruments were pilot tested with the Creek County EFNEP program. Paraprofessionals and participants involved in the pilot testing were not participants in the actual study.

Study Instruments and Procedures

Data Collection Days For Pregnant Adolescents

There were three days of data collection scheduled for pregnant adolescent participants: (1) one prior to the eight-week nutrition education program, (2) one following the eight-week nutrition education program, and (3) another at one month following birth of the infant. Data collection days were planned separately within each of the study groups through the local health clinics, county extension offices and high schools. Local physicians were notified of the study.

Project Data Form

A questionnaire for collecting general demographic data and health history pertinent to pregnancy was completed by interview on the initial data collection day. Follow-up data on the mother and infant were obtained after birth of the infant. The questionnaire was pretested in the pilot study. This questionnaire was adapted with permission (Appendix C) from the "Have A Healthy Baby" program from the Expanded Food and Nutrition Education Program, Purdue University Cooperative Extension Service (Konzelmann, Vandergraff, Wood, Barkman, & Roepke, 1991) (Appendix E).

Anthropometric Measures

Height and weight were measured on all three days of data collection. Usual weight before pregnancy was obtained through interview on the initial data collection day. Weight gain during pregnancy was obtained also by interview on the final data collection day after birth of the infant.

Accurate measurements of stature require a stadiometer or a nonstretch tape or measuring stick affixed to a vertical board and a moveable horizontal headboard (Grant & DeHoog, 1991, p. 10). In this study height was measured without shoes using a steel tape fixed to the wall with a right angle headboard. See Appendix G for Procedure To Measure Height.

An upright single beam scale was used to weigh subjects in light clothing without shoes. The scales were reset to zero and calibrated each day weights were taken. Measurements were recorded at a similar time each day. See Appendix G for Procedure To Measure Weight.

Body mass index expresses a relationship between body weight and height. In this study the Quetelet's index, weight (kg)/(height (m))^2, was used to calculate body mass index (BMI) (Gibson, 1990, pp. 178-179). Using the height and weight measurements for each day of data collection, the body mass index (BMI) was determined according to the Procedure To Calculate BMI in Appendix G.

Prepregnancy weight status indirectly reflects maternal energy stores and is important in assessing weight status and weight gain during pregnancy. Appropriate reference data to assess prepregnancy weight status for pregnant adolescents are not available. Recommendations adapted from the Metropolitan Life Insurance Company 1959 tables for height and weight may be used to assess prepregnancy weight status for the adolescent (Gong, 1990, p. 57). In addition, weight needs to be monitored during pregnancy to assess the pattern and amount of weight gain. A weight gain chart recommended for adolescents includes standards for assessing underweight, normal, overweight and obese females (Gong, 1990, p. 59). Usual weight before pregnancy was reported by the pregnant adolescent on the initial data collection day and used to calculate the prepregnancy BMI which was assessed according to recommended standards (Institute of Medicine, 1990, p. 82). Prepregnancy weight status was categorized as underweight, normal, overweight or obese according to the weight gain chart for adolescents (Gong, 1990). Total prenatal weight gain and follow-up weight were obtained at the one month follow-up data collection day and recorded on the Project Data Form in Appendix E.

Mid-arm circumference to assess lean body mass and triceps skinfold to assess energy stores were measured as additional indicators of nutritional status and weight management in this study on all three days of data collection. The combination of these two measurements was used to calculate the mid-arm muscle area. Arm circumference was measured using an Ensure Inser-Tape from Ross Laboratory designed to minimize measurement errors (Zerfas, 1975). The reliability of circumference measurements has been reported to be 0.1 to 0.4 mm for intrameasurer technical errors and 0.3 mm for intermeasurer technical error (Callaway et al., 1988, p. 52). See Appendix G for Procedure To Measure Mid-Arm Circumference. The recommended single skinfold thickness to measure with female adolescents is the triceps skinfold site (Cronk & Roche, 1982). Standard procedures using calibrated Lange calipers (Cambridge Scientific Industries, Cambridge, MD) need to be followed for reliable skinfold measurements (Story, 1990b). Increased error is associated with higher levels of fatness. The reliability of triceps skinfold has been reported to be 0.4 to 0.8 mm for intrameasurer technical errors and 0.8 to 1.9 mm for intermeasurer technical errors (Harrison et al., 1988, p. 68). Reference data for adolescent female triceps skinfold thickness measurements is based on the U.S. Health and Nutrition Examination Survey I (1971-1974) (Frisancho, 1981). Triplicate triceps skinfold measurements using Lange calipers (Cambridge Scientific Industries, Cambridge, MD) were taken by the same trained individual. The calipers were calibrated for accuracy using a metal calibration block on each data collection day. See Appendix G for Procedure to Measure Triceps Skinfold Thickness.

Mid-arm muscle area is calculated on the basis that the arm muscle is circular, the triceps skinfold is twice the mean diameter of the adipose layer, and bone atrophies in proportion to muscle (Grant & DeHoog, 1991, p. 61). However, these assumptions lead to overestimations by 20 to 25% according to computerized tomography evidence. Revised equations have been developed that incorporate corrections for bone, the neurovascular bundle and the noncircular muscle shape (Heymsfield, McManus, Smith, Stevens, & Nixon, 1982). The equation recommended for females was used to calculate mid-arm muscle area in this study using reference data based on height, age and sex (Grant & DeHoog, 1991, pp. 65-66). See Appendix G for Procedure To

Calculate Mid-Arm Muscle Area. Percentiles for bone-free arm muscle area $(cm)^2$ were used to evaluate the mid-arm muscle area calculation (Grant & DeHoog, 1991, p. 65).

Upper arm fat area is calculated from mid-arm circumference and triceps skinfold. The equation to calculate upper arm fat area assumes the limb is cylindrical and that fat is evenly distributed. Furthermore, the calculation does not allow for variable skinfold compressibility due to age, sex, site of measurements and among individuals (Gibson, 1990). The equation recommended for females was used to calculate upper arm fat area in this study using reference data for White persons of the United States Health and Nutrition Examination Survey I of 1971 to 1974 (Frisancho, 1981). The upper arm fat area was determined according to the Procedure To Calculate Upper Arm Fat Area in Appendix G.

Blood Collection

A registered medical technologist or experienced nurse drew fasting blood samples on all three data collection days. Blood samples were taken from each subject using trace mineral free syringes with plastic pistons (Sarstedt Numbrecht, W. Germany) and 21 gauge stainless steel butterfly needles (Deseret Medical, Inc., Sandy, UT). Until separation, the whole blood samples were kept in an ice bath. Samples were centrifuged at 1,520 x g for 22 minutes at 40^{o} in a Beckman TJ-6 centrifuge to separate red blood cells and serum. Acid washed plastic tubes were issued to store and freeze serum until it was analyzed.

Hematocrit Measures

The hematocrit represents the percentage of the red cells in a volume of whole blood (Grant & DeHoog, 1991, p. 108). In the case of iron deficiency anemia, the hemoglobin level decreases before there is a decrease in hematocrit. It is not until the advanced stages of iron deficiency anemia that both the hemoglobin and hematocrit are impaired. Although determining the hematocrit is a common clinical test to diagnose iron deficiency, there are several limitations including relative insensitivity since the hematocrit does not fall until the latter stages of iron deficiency anemia. Also, there is a lack of specificity and values are dependent upon age and sex of the individual (Gibson, 1990, pp. 354-355). Normal hematocrit values for females 13 to 16 years are $\geq$ 36% and a deficiency is $<$ 31%. During the second trimester of pregnancy, normal values are $\geq$ 35% and a deficiency is $<$ 30%. During the third trimester of pregnancy, normal values are $\geq$ 33% and a deficiency is $<$ 30% (Grant & DeHoog, 1991, p. 108).

A small amount of blood was transferred into a heparinized capillary tube and centrifuged until there was a reduction in red cells to a constant packed cell volume. To calculate the hematocrit, the height of the column of packed red cells was compared to the height of the entire column of red cells and plasma (Gibson, 1990, p. 355). Blood samples from each of the three data collection days were used to assess blood hematocrit.

Hemoglobin Measures

A diagnostic reagent kit (Procedure No. 525, Sigma Chemicals, Inc.; St. Louis, MO) was used to determine blood hemoglobin concentration. The colorimetric endpoint reaction was determined at 540 nm using a spectrophotometer (Beckman Instruments; Fullerton, CA). The principle of the method is based on the reaction between hemoglobin and Drabkin's Reagent which contains potassium ferricyanide, potassium cyanide and sodium bicarbonate. The action of ferricyanide converts most forms of hemoglobin in circulating blood to methemoglobin. Cyanmethemoglobin is formed through the reaction between methemoglobin and cyanide. The absorbance of cyanmethemoglobin (at 540 nm) is proportional to the amount of hemoglobin in the blood (Eilers, 1967).

Acceptable hemoglobin values for females less than 16 years are $\geq$ 12.0 g/dL and a deficiency is < 10.0 g/dL. During the second trimester of pregnancy acceptable hemoglobin values are $\geq$ 11.0 g/dL and deficient values are < 9.5 g/dL. During the third trimester of pregnancy acceptable hemoglobin values are $\geq$ 10.5 g/dL and deficient values are < 9.0 g/dL (Grant & DeHoog, 1991, p. 109).

See Appendix H for Procedure To Measure Hemoglobin Concentration. Blood samples from all three data collection days were used to assess blood hemoglobin.

Serum Transferrin Measures

The SPQTM antibody reagent set II for transferrin (TRF) was used to quantitatively determine specific human serum proteins by immunoprecipitin analysis using the COBAS FARA II centrifugal analyzer (INCSTAR Corporation; Stillwater, MN). A mixture of soluble antigen and specific antibodies to that antigen results in the formation of insoluble antigen-antibody complexes or immunoprecipitates which are the basis for the precipitin test. Quantification of antigen by the addition of antibody in solution to form antigen-antibody complexes is referred to as immunoturbidimetry. These complexes scatter light and reduce the measured transmitted light in proportion to their concentration. Semiautomated immunoturbidimetric assays (ITA) for proteins using centrifugal analyzers have been developed comparable to traditional assays (e.g., radial immunodiffusion (RID)) (Finley, Williams & Byers, 1976).

See Appendix H for Procedure To Measure Serum Transferrin. Total iron-binding capacity (TIBC) was calculated from serum transferrin (TIBC = serum transferrin (g/L)/0.007) (Tietz, 1994, p. 2065). Blood samples from the initial data collection day were used to assess serum transferrin.

Analysis Of Serum Iron

A wet ashing procedure was used to prepare serum iron samples for the atomic absorption spectrophotometry analyses. The mineral analyses procedure used has been validated using National Institute of Standards and Technology (NIST) standard reference materials which certifies a large number of elements in plant and animal material (Hill, Patterson, Veillon & Morris, 1986; Parr, 1985). See Appendix H for Procedure To Measure Serum Iron. Samples were analyzed using a Perkin-Elmer Model 5100 PC atomic absorption spectrophotometer (Perkin Elmer; Norwalk, CT) at 248.3 nm for iron using reference materials certified by the NIST (Parr, 1985).

Standards for iron and control samples of serum were also analyzed. Serum iron was analyzed using blood samples drawn on all three days of data collection.

Transferrin saturation (%) was calculated using both serum iron and TIBC (transferrin saturation (%) = 100 x serum iron/TIBC) (Tietz, 1994, p. 2064). Transferrin saturation (%) was calculated for initial blood samples.

Measures Of Glucose Control

The major carbohydrate present in the peripheral blood is glucose. The Roche® reagent for glucose, an in vitro diagnostic reagent system was used with the COBAS Chemistry Systems to quantitatively determine serum glucose concentration (Roche Diagnostic Systems; Nutley, NJ). The glucose method is based on the principle that the enzyme hexokinase (HK) catalyzes the reaction between glucose and adenosine triphosphate (ATP) to form glucose-6-phosphate and adenosine diphosphate (ADP). In addition, in the presence of NAD, the enzyme glucose-6-phosphate dehydrogenase (G6PD), oxidizes glucose-6-phosphate to 6-phosphogluconate. Finally, the increased concentration of NADH is directly proportional to the concentration of glucose which is measured with a spectrophotometer at 340 nm.

A diagnostic kit for quantitating glycohemoglobins (GHb) was used to determine glycosylated hemoglobin concentration (ISOLAB; Akron, OH). Hemolysates of human red blood cells were separated into two fractions using the Glyc-Affin GHb test kit. GHb are contained in one fraction. The other fraction contains nonglycosylated hemoglobins. Spectrophotometric analysis (Beckman Instruments; Fullerton, CA) was used to quantify the percent GHb in the blood sample which reflects the blood glucose concentration over the past two to three months. The life span of the red blood cell is 120 days throughout which the glycosylation of hemoglobin occurs continuously. Total GHb reflects blood glucose control in diabetic patients and can be used as a screening procedure for diabetes mellitus (Koenig et al., 1976).

Serum fructosamine measurements have the advantage of monitoring glucose status within a shorter time period (one to three weeks) compared to GHb (two to three months). This is because the half-life of serum proteins averages 17 days compared to 60 days for hemoglobin (Baker, Johnson & Scott, 1984). Both GHb and fructosamine assays are valuable indexes of overall glucose control (Reece et al., 1991). The RoTAG™ Fructosamine Assay, a colorimetric in vitro test for the quantitative determination of glycated proteins (fructosamine) in human serum was used with the CoBAS Chemistry System (Roche Diagnostic Systems; Nutley, NJ). The RoTag™ method to measure fructosamine is based on the Baker nitroblue tetrazolium (NBT) method and is considered simple, precise and easily automated (Baker, Johnson & Scott, 1984). The correlation of fructosamine to GHb has been reported to be 0.86. Poor correlation is due to the different half-lives of fructosamine and GHb (Roche Diagnostic Systems; Nutley, NJ).

See Appendix H for Procedures To Measure Glucose, GHb, and Fructosamine. Blood samples from each of the three data collection days were used to assess serum glucose, GHb and serum fructosamine.

Serum Insulin Measures

Insulin, a small polypeptide is synthesized from proinsulin in the beta cells of the islets of Langerhans in the pancreas. Changes in endocrine physiology occur during pregnancy including increased insulin resistance (Molitch, 1993). The Equate® RIA INSULIN radioimmunoassay procedure was used to measure serum insulin (BINAX; Portland, ME). The principle of the radioimmunoassay procedure is that limited quantities of antibody are able to bind to a fixed amount of radiolabeled antigen. Binding of radiolabeled antigen decreases as a function of increased concentration of unlabeled antigen in the sample. To determine the quantity of unlabeled antigen it is necessary to separate the bound and free radiolabeled antigen. By comparing the radioactivity of the precipitate bound antibody-antigen complex after centrifugation with values established using known calibrators in the same assay system, the quantity of unlabeled antigen in an unknown is determined. The mean insulin values using the Equate® RIA Insulin assay have been reported to be 1.43-27.52 mU/ml in normal fasting subjects (BINAX; Portland, ME). See Appendix H for Procedure To Measure Insulin. Blood samples from each of the three data collection days were used to assess serum insulin.

Blood Pressure Measures

Blood pressure is commonly measured on the upper arm with a sphygmomanometer which indirectly determines the force of the pulse as an indication of arterial pressure in the vessels. Systolic pressure (numerator) refers to the heart's period of contraction; whereas, diastolic pressure (denominator) refers to the heart's period of dilation or relaxation phase (Ney, 1991).

The American College of Obstetricians has established criteria to diagnose pregnancy-induced hypertension (PIH), a common hypertensive disorder among pregnant adolescents. The criteria are:

Increase in systolic blood pressure $\geq$ 30 mmHg

Increase in diastolic blood pressure $\geq$ 15 mmHg

Systolic blood pressure $\geq$ 140 mmHg

Diastolic blood pressure $\geq$ 90 mmHg

Two or more assessments of the above criteria would diagnose PIH. Assessments need to be six hours apart (Alton & Mulchahey, 1990, p. 74).

Blood pressure readings were taken on all three data collection days using a sphygmomanometer. All subjects were in a sitting position each time the blood pressure was measured by the investigator.

Beliefs And Knowledge Assessment For Pregnant Adolescents

A scale instrument about health and nutrition during pregnancy described under the Pilot Study section was adapted for the pregnant adolescent and used to assess beliefs (Part I) and knowledge (Part II) (Appendix D). Part I of the instrument assessing belief statements during pregnancy was completed by all pregnant adolescents before and after the eight-week nutrition education program. There were 43 belief statements (food and folklore, nutritional practices, cravings and health-medical). A response was given for each statement according to a five item Likert-type scale ranging from strongly agree to strongly disagree. A Beliefs Score was determined based on the initial factor analysis results of both education programs using the Likert-type scale. Factors used to create the score were food cravings-likes and dislikes, folklore, prenatal weight gain, nutrition and cravings, and health. A pre and post test (Part II) on nutrition during pregnancy to assess knowledge of the pregnant adolescent was completed by all participants. There were 22 true-false knowledge statements (food and nutrition, substance use, and complications and weight). The questionnaire was pretested in the pilot study and administered to subjects on the first and final days of the nutrition education program by the same trained paraprofessionals.

Dietary Assessment For Pregnant Adolescents

A combination of a Nutrition Questionnaire, a 24-hour recall and a food frequency form were used to assess dietary intake. The Nutrition Questionnaire was adapted from several sources (California Dept. of Public Health, 1975; Story, 1990b). It included 12 questions to obtain information on weight history, food preparation and shopping, and other dietary information related to pregnancy. The Nutrition Questionnaire was pretested in the pilot study. The 24-hour recall (Pregnancy Dietary Intake) was adapted from Story (1990b). Information on time, place, food or beverage consumed and amounts were recorded by a trained paraprofessional. To assist with estimating portion sizes, non-biasing food models were used (Moore, Judlin & Kennemur, 1967). An interview protocol was standardized and pretested in the pilot study (Gibson, 1990). The Food Processor V (ESHA Research; Salem, OR) was used to analyze dietary intake data from the 24-hour recall. Dietary intakes of calories and selected nutrients were considered adequate when consumption was at least 67% of the RDA, or the mid-point of the Estimated Safe and Adequate Daily Dietary Intake Range (ESADDI) because the RDAs include a safety factor above the needs of the average person (Food and Nutrition Board, 1989). These results were used to calculate a Nutrition Score, assessing initial adequate intakes of calories, protein, vitamin B_6, folate, vitamin A, vitamin C, iron, zinc and calcium based on key nutrient requirements for adolescents and pregnancy (Howell, 1989; Story, 1990c). The food frequency was used as a cross-check with the 24-hour recall (Story, 1990b). The food frequency form used was adapted from the Eating Habits Checklist used by the Chickasaw Nation Native American WIC program. Foods usually eaten during a seven-day period were recorded. The total number of servings according to food groups in the Food Guide Pyramid for pregnant adolescents was used to assess qualitative dietary data (Story, 1990c; Story & Alton, 1995). This form has been recommended for pregnant adolescents (Story, 1990b) and was pretested in the pilot study.

On the first day of the nutrition education program the Nutrition Questionnaire was completed by all subjects and administered by the same trained paraprofessionals in each site. On all three days of data collection both the Pregnancy Diet Intake (24-hour recall) and Eating Habits Checklist were completed on all subjects. The 24-hour recall was completed by the same trained paraprofessionals using standardized non-biasing food models (Moore, Judlin & Kennemur, 1967). The Eating Habits Checklist was completed by each subject with assistance of the paraprofessional. See Appendix F for Dietary Intake Forms For Pregnant Adolescents.

Educational Materials For Regular EFNEP Program

The educational materials for the pregnant adolescents in the regular EFNEP education program consisted of the "Eating Right is Basic" (ERIB) curriculum (Anderson & Nierman, 1985/1992). There are 12 lessons which include the following topics: food preparation, meal planning, food storage and sanitation, shopping skills and basic nutrition. Features of the curriculum include flip charts, instructor outlines, participant handouts and activities for each lesson. Supplemental workbooks for each ERIB lesson have been developed by Oklahoma EFNEP.

Educational Materials For Pregnant Adolescents

The educational materials for the pregnant adolescents in the special education program consisted of the "Have A Healthy Baby" (HAHB) curriculum developed for pregnant adolescents 11 to 19 years (Konzelmann, Vandergraff, Wood, Barkman & Roepke, 1991). Permission to use this curriculum was received from the Expanded Food and Nutrition Education Program, Purdue University Cooperative Extension Service (Appendix C). The purpose of the program is to assist the pregnant adolescent in having a healthy baby by providing nutrition and health education. The curriculum was developed by nutrition and health professionals and was pilot tested in two counties in Indiana with high infant mortality rates. Topics include the importance of early prenatal care, prenatal weight gain, prenatal and infant nutrition as well as alcohol, smoking and drugs during pregnancy. Additional topics include economical meal planning and shopping, and nutrition related problems during pregnancy (e.g., anemia, gestational diabetes and hypertension). The format of the curriculum includes instructor outlines, and activities as well as a workbook for participants.

This program was supplemented with other educational materials including videos, activities, visuals, handouts and fact sheets. For example, a series of 16 "Teen Age Parents" (TAP) fact sheets was developed by Oklahoma State University's EFNEP (Hunt & Williams, 1992) (See sample in Appendix I). This series was reviewed by a M.D. who is board certified in obstetrics and gynecology and by a blind peer review. Topics include: Daily Food Choices, Complex Carbohydrates and Fiber, Baby Depends on the Food You Eat, Iron, Calcium, Fast Foods, Weight Gain, Morning Sickness, Heartburn, Constipation, Alcohol, Drugs and Smoking During Pregnancy. The fact sheets were written for a fifth grade reading level.

Training The Paraprofessionals

The four EFNEP paraprofessionals (urban and rural) and two paraprofessionals with the Chickasaw Nation Native American WIC program teaching the HAHB groups attended separate one-day in-depth training workshops on use of the pilot tested and revised educational materials for the "Have A Healthy Baby" program. In addition, background information on the risks of adolescent pregnancy was presented. Paraprofessionals who participated in the pilot study were excluded from the training program. All 12 paraprofessionals (including those conducting the ERIB groups) were trained to administer the Beliefs and Knowledge Survey form (Appendix D) as well as the Dietary Intake forms (Appendix F) to the pregnant adolescents. The same trained paraprofessionals in each site administered the instruments on the first and final days of the nutrition education program. The six paraprofessionals excluded from the in-depth training sessions on pregnant adolescents attended a workshop on the materials following the study.

Beliefs And Knowledge For Paraprofessionals

A scale instrument about health and nutrition during pregnancy described under the Pilot Study (p. 77) was adapted for the paraprofessional and used to assess beliefs (Part I) and knowledge (Part II) (Appendix D). A pre and post test on nutrition knowledge during pregnancy was completed by all paraprofessionals assisting with the study. Part I of the instrument to assess the frequency of food belief statements during pregnancy of clients was completed by all paraprofessionals trained to teach the nutrition program for pregnant adolescents. Part I was administered before the training session for paraprofessionals and after they had conducted the eight-week nutrition education program for pregnant adolescents. There were 43 belief statements (food and folklore, nutritional practices, cravings and health-medical). A response was given for each statement according to a four item Likert-type scale ranging from majority to hardly any. There were 22 true-false knowledge statements (food and nutrition, substance use, and complications and weight). Paraprofessionals completed the knowledge survey (Part II) before the training session and again after they had conducted the eight-week nutrition education program for pregnant adolescents.

Statistical Analysis

All data were analyzed by computer with the Statistical Analysis System (SAS) (1985) to assess the treatment effects of the nutrition programs for pregnant adolescents (HAHB program versus ERIB program) on nutrition knowledge, dietary intake, beliefs and selected health parameters. Descriptive statistics were used to summarize demographic variables. Belief statements in the Beliefs and Knowledge Survey (Appendix D) were analyzed using factor analysis (DeVellis, 1991). Dietary intakes were analyzed using the Food Processor V program (ESHA Research; Salem, OR). Group means for all other pre, post and follow-up data including the dietary analysis were analyzed using the Generalized Linear Model (GLM) procedure and the least significant differences test. The analysis of variance procedure with education group as the among subjects independent variable and the pre-post test as the within subjects independent variable was used to compare means for knowledge scores, as well as anthropometric measurements, dietary intake and blood parameters which were done over time. For all other variables, analysis of variance with education group as the independent variable was used. Correlation coefficients were calculated to identify relationships between key variables based on the hypotheses of this study. The level of significance for this study was $p \leq 0.05$ (Steel & Torrie, 1980).

CHAPTER IV

EFFECTS OF NUTRITION EDUCATION PROGRAMS ON BELIEFS AND KNOWLEDGE OF PREGNANT ADOLESCENTS

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ABSTRACT This study examines the effects of nutrition education programs on beliefs and knowledge of pregnant adolescents. The type of educational program (the regular adult Expanded Food and Nutrition Education Program [EFNEP] versus the education program especially designed for pregnant adolescents) was compared by observing the effects on beliefs and knowledge of pregnant adolescents ages 13 to 19 years taught by ten trained EFNEP paraprofessionals in nine EFNEP counties in Oklahoma. Pre and post beliefs and knowledge were evaluated on 43 pregnant adolescents after eight weeks of either nutrition education program. There was a significant increase in knowledge scores for both programs. Optimal increases in knowledge scores were identified for participants in the tenth grade. The initial belief

score indicated that all participants tended to disagree with folklore statements. Initial factor analysis results identified food cravings-likes and dislikes, folklore, prenatal weight gain, nutrition and cravings, and health as factors for the pregnant adolescents in both programs. Post factor analysis results indicated that belief statements related to cravings, folklore, health, and eating for pregnancy were identified in both education groups. Results indicate that nutrition education programs have an effect on nutrition knowledge of pregnant adolescents. However, special attention may need to be given to beliefs about folklore, cravings and health during pregnancy in programs designed for the pregnant adolescent.

INTRODUCTION

In the United States adolescent pregnancy is a major public health problem compared to other industrialized countries.[1] The national teen birth rate increased by one-fourth among 15 to 19 year olds between 1986 and 1991. In 1992 the teen birth rate declined slightly in most states among black and white 15 to 19 year olds while the number of births to teens 14 years or less increased.[2] In Oklahoma the teen birth rate for 15 to 19 year olds increased from 17th in the nation in 1991 to 13th in 1992.[3]

Pregnant adolescents are at increased nutritional risk often associated with biological, psychosocial, developmental and economic problems.[4-7] Nutrition education through schools and/or comprehensive clinic programs can help improve the nutritional status and pregnancy outcome of pregnant adolescents.[6]

The Cooperative Extension Service Expanded Food and Nutrition Education Program (EFNEP) helps low-income families acquire the knowledge, attitudes, and skills to provide a nutritionally adequate diet through paraprofessionals teaching clients which include pregnant teenagers and teenage mothers.[8,9] "Nearly all societies believe that what a mother eats during pregnancy affects both her health and that of her unborn child."[10] The importance of diet, adequate weight gain and avoiding alcohol and drugs in having a healthy baby is a message that every pregnant teenager needs to hear.[11] Paraprofessionals may have a greater impact than professionals on the pregnant teen accepting the responsibility to choose an adequate diet.[9]

A few investigators have reported on beliefs about nutrition and health during pregnancy; otherwise, documentation of these beliefs tends to be limited and subjective rather than objective.[12,13] Nutritional effects of beliefs, cravings and aversions for certain foods need to be evaluated with the total diet in mind.[10,14]

Several food taboos or superstitions about food during pregnancy have been passed down through generations.[15] Pork and fish were believed to be poisonous to a pregnant woman resulting in "rotting of the womb". Superstitious beliefs may be due to a misunderstanding or lack of knowledge about nutrition and the dietary role specific foods have during pregnancy.[12] For example, the belief that "a pregnant woman will lose a tooth with every baby if she doesn't drink milk" is not true.

A study of 100 pregnant women in Tennessee reported 69 different foods that were craved during pregnancy. Common food cravings reported were watermelon, pickles, ice cream, strawberries, apples, peaches, chocolate and candy.[16] Cravings reported among adolescents included chocolate, fruit and fruit juices, high protein main dishes, pickles, ice cream and pizza.[17] Meat, poultry and coffee were common food aversions during pregnancy.[18] Food aversions particular to adolescents included meat, eggs and pizza.[17]

Beliefs about marking the child prior to birth by consuming certain foods have been recorded.[10] Birthmarks of a specific shape have been explained by cravings for certain foods. For example, eating strawberries or chicken drumsticks is believed to result in birthmarks that take the shape of these specific foods.[19]

The practice of pica is the compulsive behavior of ingesting nonnutritional and nonfood substances (i.e., clay, dirt, laundry starch, ashes or matches).[20] Although pica has been practiced for centuries, current medical and nutritional science has limited documentation on the subject. Thirty percent of 40 low-income women (31 pregnant) interviewed in a Michigan clinic reported the ingestion of clay, starch or other nonfood items.[21] There are nutritional and medical concerns about pica practice in that the pica substance may take the place of food or in the case of eating laundry starch, lead to weight gain because the starch provides calories.[19]

Current research supports the importance of nutrition in prenatal development. Maternal nutritional status can significantly affect the health of both the mother and the infant.[7,14] Major areas of research include prenatal nutrition, substance use, complications and weight gain.

The Recommended Dietary Allowances (RDAs) have been established for pregnant adult women but not specifically for pregnant adolescents.[22,23] A balanced diet with the recommended number of calories for each individual can supply all the nutrients needed daily during pregnancy. Dietary recommendations should be individualized.[24] The use of artificial sweeteners and caffeine are concerns during pregnancy, but may be used in moderation with a few exceptions.[25]

Alcohol should be avoided during pregnancy due to the risks of fetal alcohol syndrome (FAS) and fetal alcohol effects (FAE).[26] Smoking during pregnancy has been associated with low birth weight babies and spontaneous abortion.[27]

Maternal weight gain is an important predictor of pregnancy outcome. The amount of weight gained during pregnancy influences the birth weight of the infant.[28] The National Academy of Sciences Subcommittee on Nutrition and Pregnancy[7] recommended that all pregnant women receive guidance in maintaining a healthy diet in order to achieve adequate weight gain during pregnancy. A maternal weight gain of 11.4 to 15.9 kg is recommended for a normal pregnancy in order to reduce the risk of low birth weight infants and adverse maternal health effects. Adolescents need to aim for the upper end of this range.

Carruth and Skinner[12] surveyed professionals in the field of nutrition and dietetics as well as nurses and social workers working with prenatal clients in public health clinics. They identified 26 statements as common beliefs heard relating to nutrition during pregnancy. This "belief inventory" was used in a nationwide survey of 1,771 nutrition and dietetic practitioners. Six categories were identified by factor analysis with loadings of $\geq$ 0.50 including physiological needs, practices related to healthy babies, beverage recommendations, cravings, folklore and weight. Results indicated the southeastern states were significantly different from other regions for beliefs concerning cravings and folklore. This research supports the need to individualize dietary counseling according to background, beliefs and customs in order to overcome any lack of communication between the professional and client.[10,15,29]

Carruth and Skinner surveyed 115 pregnant adolescents with a mean age of 16 years ranging from 13 to 18 years.[30] The same 26 belief items[12] were used in a game format with the pregnant adolescents. Information on sociodemographics, dietary intakes and weight gain during pregnancy was also recorded. Statistical analyses included factor analysis based on loadings of $\geq$ 0.50. Nine factors were identified including cravings, dietary needs, eating for pregnancy, dietary recommendations, meal patterns, folklore, dietary restrictions, baby's needs and mother's health. Dietary intakes and weight gain data were compared to related belief statements. Results indicated an agreement between the data from the adolescents and current recommendations for pregnancy. However, other beliefs were contradictory to current recommendations such as the need to restrict salt during pregnancy. In a subsequent study of pregnant adolescents, Pope, Skinner, and Carruth[17] investigated the beliefs about dietary cravings during pregnancy. The mean scores of 13 belief statements resulted in a large percentage of neutral responses indicating that many of the adolescents were unsure of their beliefs about dietary cravings during pregnancy.

The objective of this study was to assess the effects of nutrition education on change in beliefs and knowledge of pregnant adolescents using a nutrition education program for pregnant adolescents compared to the regular EFNEP adult program.

METHODS

Study design. This study used a pretest-posttest measure within a two independent samples design. The among subjects independent variable (type of educational program presented to pregnant adolescents) was manipulated to observe the effects on the dependent variables (beliefs and knowledge). The two educational programs implemented were the regular EFNEP adult education program and one especially designed for adolescent pregnancy.

Study participants. Subjects were pregnant adolescents ages 13 to 19 years recruited from the Oklahoma EFNEP program in both urban and rural areas, and from the Chickasaw Nation Native American WIC Program through EFNEP home economists, EFNEP paraprofessionals and the Chickasaw Nation WIC nutritionist. The study was approved by the Institutional Review Board for Protection of Human Subjects at Oklahoma State University. Informed consent was obtained from all subjects and from parents for minors. Subjects were given the nutrition education materials for participating in the nutrition education program and a total of $20 for the two days of data collection. Data reported in this study were obtained from subjects who participated in the nutrition education sessions, and completed the pre and post beliefs and knowledge instrument.

Ten trained EFNEP paraprofessionals in nine EFNEP counties in Oklahoma agreed to conduct the nutrition education classes for pregnant adolescents. Five paraprofessionals conducted the regular EFNEP program in four counties and five paraprofessionals conducted the nutrition program for pregnant adolescents in five counties. Classes were eight weeks for each program.

Nutrition education program and paraprofessional training. The curriculum for the pregnant adolescents in the regular EFNEP adult program was "Eating Right is Basic" (ERIB).[31] Topics include food preparation, meal planning, food storage and sanitation, shopping skills and basic nutrition. Features of the curriculum include flip charts, instructor outlines, and participant handouts and activities for each lesson.

The second program was the "Have A Healthy Baby" (HAHB) curriculum developed for pregnant adolescents 11 to 19 years of age.[32] Permission to use this curriculum was received from the EFNEP Program Purdue University Cooperative Extension Service. Topics include the importance of early prenatal care, prenatal weight gain, prenatal and infant nutrition as well as alcohol, smoking and drugs during pregnancy. The format of the curriculum includes instructor outlines, and activities as well as a workbook for participants. A series of 16 "Teen Age Parents" (TAP) fact sheets developed by Oklahoma State University's EFNEP supplemented the curriculum.[33] All ten paraprofessionals were trained to administer the project assessment form. Five paraprofessionals attended a one-day in-depth training workshop on use of the nutrition education program for pregnant adolescents. They also received background information on the risks of adolescent pregnancy. The five remaining paraprofessionals excluded from the special training session received training on the materials following the study.

Project assessment form. A questionnaire for collecting general demographic data and health history pertinent to pregnancy was completed by interview on the initial data collection day by the same trained paraprofessional in each county. Socioeconomic factors including age, ethnic group, educational level, size of community, type of social/financial support and type of medical care for the pregnant adolescent were identified. The questionnaire was adapted with permission from the "Have A Healthy Baby" program.[32]

Beliefs and knowledge instrument. A scale instrument about health and nutrition during pregnancy was developed. This instrument was adapted with permission from a published beliefs inventory[12] and revised according to a panel of experts review and review of the literature. The revised instrument consisted of 43 belief statements (food and folklore, nutritional practices, cravings and health-medical), and 22 knowledge statements (food and nutrition, substance use, complications and weight gain). A response was given for each belief statement according to a five item Likert-type scale ranging from strongly agree to strongly disagree. The 22 knowledge statements were true-false. The instrument was pre-tested with a total of 51 nutrition or sociology students. The pre-test knowledge score was 14.8 ± 2.0. Factor analysis results of the belief statements identified three major factors: cravings, nutritional practices, and food and folklore. Alpha coefficients and Pearson product-moment correlations were analyzed for each factor to determine the reliability and validity of the scale items. This instrument was adapted for the study of pregnant adolescents.

Beliefs and knowledge of pregnant adolescents. On the first and final days of the eight-week nutrition education program, the Beliefs and Knowledge Survey was administered to subjects by the same trained paraprofessionals.

Statistical analysis. All data were analyzed using the Statistical Analysis System (SAS).[34] Descriptive statistics were used to summarize demographic variables. The analysis of variance procedure with education group as the among subjects independent variable and the pre-post test as the within subjects independent variable was used to compare knowledge scores. The belief statements were analyzed using factor analysis.[35] A beliefs score was determined based on the initial factor analysis results of both education programs combined. Factors used to create the score were food cravings-likes and dislikes, folklore, prenatal weight gain, nutrition and cravings, and health. Based on the Likert-scale of 1 (strongly agree) to 5 (strongly disagree), and the number of belief statements in each factor (4 to 5), scores ranged from 4 (strongly agree) to 25 (strongly disagree). The effects of sociodemographic factors (age, ethnic group, educational level, size of community, type of social and financial support, or type of medical care) on the knowledge score as well as the beliefs score were evaluated using the analysis of variance procedure. The level of significance for this study was $p \leq 0.05$.

RESULTS AND DISCUSSION

Demographic data of pregnant adolescents. There were 15 pregnant adolescents in the ERIB program and 28 in the HAHB program (Table 1). More pregnant adolescents

Table 1. Demographic and health history summary of pregnant adolescent participants prior to the nutrition education programs.[a, b]

Demographic/Health History Variables	Eating Right Is Basic (ERIB) Nutrition Education	Have A Healthy Baby (HAHB) Nutrition Education
Pregnant adolescents (n)	15	28
Paraprofessionals (n)	5	5
EFNEP counties in Oklahoma (n)	4	5
Age		
13-15 (y) (n) (%)	4 (27%)	6 (21%)
16-17 (y) (n) (%)	4 (27%)	12 (43%)
18-19 (y) (n) (%)	7 (47%)	10 (36%)
Ethnic group		
White (n) (%)	5 (33%)	18 (64%)
Black (n) (%)	3 (20%)	2 (7%)
Native American (n) (%)	7 (47%)	8 (29%)
WIC enrollment [c]		
Yes (n) (%)	14 (93%)	22 (79%)
No (n) (%)	1 (7%)	6 (21%)
Grade in school		
7-10th Grade (n) (%)	4 (33%)	11 (48%)
11-12th Grade (n) (%)	8 (67%)	10 (44%)
Dropped out of school (n) (%)	0 (0%)	0 (0%)
High school graduate (n) (%)	0 (0%)	3 (11%)
Attending college (n) (%)	0 (0%)	2 (9%)
Community of residence		
Rural (n) (%)	4 (27%)	9 (32%)
Town under 10,000 (n) (%)	2 (13%)	11 (39%)
City 10,000 - 50,000 (n) (%)	7 (47%)	8 (29%)
Suburb of a city over 50,000 (n) (%)	2 (14%)	0 (0%)
Type of medical care		
Health clinic (n) (%)	7 (47%)	5 (18%)
Physician (n) (%)	5 (33%)	20 (71%)
No medical care (n) (%)	3 (20%)	3 (11%)
Month of first doctor's visit		
0 (n) (%)	2 (14%)	2 (8%)
1 (n) (%)	4 (29%)	4 (15%)
2 (n) (%)	5 (36%)	10 (39%)
3 (n) (%)	3 (21%)	8 (31%)
4-5 (n) (%)	0 (0%)	2 (8%)
Frequency of doctor's visit		
Once a month (n) (%)	12 (100%)	21 (84%)
Every two weeks (n) (%)	0 (0%)	3 (12%)
Once a week (n) (%)	0 (0%)	1 (4%)
Previous pregnancy		
Yes (n) (%)	2 (13%)	6 (21%)
No (n) (%)	13 (87%)	22 (79%)
Other children		
Yes (n) (%)	1 (7%)	4 (15%)
No (n) (%)	14 (93%)	23 (85%)

[a] A more detailed table of this demographic and health history summary is included in Appendix J (Table 1).
[b] N = number of participants with percent (%) frequency.
[c] Special Supplemental Food Program for Women, Infants, and Children.

in the ERIB group were 18 to 19 years of age while more of the HAHB group were 16 to 17 years of age. Most of the HAHB group were white while the ERIB group was predominantly Native American. Most pregnant adolescents were enrolled in WIC prior to receiving nutrition education. The majority of pregnant adolescents were attending school and did not work, nor did they know the monthly family income. Social and financial support were mostly from parents, boyfriend or husband (data not shown). More pregnant adolescents in the HAHB group lived in a town under 10,000 or rural area in southeastern Oklahoma while more of the ERIB group participants lived in a town of 10,000 to 50,000.

Health history of pregnant adolescents. The health history of pregnant adolescents in Table 1 indicates that three participants in each group were not receiving any medical care while most were seeking health care from a physician or health clinic. Most participants in each education group began health care during the second month of pregnancy and were continuing to visit the doctor once a month.

Knowledge of pregnant adolescents. Analysis of knowledge scores revealed no significant interaction between progam and time. Program did not have a significant main effect. Time did have a significant main effect ($p=0.0001$), indicating the programs resulted in a significant increase in knowledge. For all pregnant adolescents, pre and post knowledge mean scores and standard deviations were 16.2 ± 2.4 and 18.0 ± 1.8 respectively (data not shown). The significant change in knowledge scores between pre and post data indicates the value of nutrition education during pregnancy. The knowledge statements were related to food and nutrition, substance use, complications and weight gain. All of these topics were covered as part of the HAHB education program. Other than general food and nutrition, the remaining topics were not addressed in the ERIB education program. Table 2 shows the pre and post knowledge mean scores and standard deviations for each education group. Perhaps a larger sample size, particularly for the ERIB education program would have resulted in a significant difference in knowledge scores between programs.

There were no significant interactions between the socioeconomic factors age, ethnic group, size of community, type of social or financial support or type of medical care, or program and time on the pregnant adolescents' knowledge scores. However, there was a significant interaction between increase in knowledge and educational level and time from pre to post nutrition education ($p=0.04$) (data not shown). Using least significant (LS) means, the tenth grade level was observed to have a significant increase in knowledge scores compared to other grade levels. The differences according to educational level may be confounded by availability of prenatal services and education in different areas i.e., urban versus rural. Age could also be a factor in the participant's readiness and acceptance for a nutrition education program during pregnancy.

Beliefs of pregnant adolescents. Results of the initial belief score by each education group shown in Table 3 indicate that Factor 2 (folklore) had the highest score (tended to disagree) and was significantly ($p=0.03$) different between programs (data not shown). Scores of the remaining factors were not significantly different between programs (data not shown). Both groups tended to agree most with Factor 1 (food

Table 2. Comparison of pre and post mean and standard deviation (SD) knowledge scores of pregnant adolescents by education group.

	ERIB Group [a] (n = 15)	HAHB Group[b] (n = 28)
Knowledge score		
Pre nutrition education	16.5 ± 2.1	16.1 ± 2.7
Post nutrition education	17.7 ± 1.8	18.1 ± 1.8
[c]P value	0.0001	

[a] ERIB group = "Eating Right Is Basic" - EFNEP Adult Education Program.
[b] HAHB group = "Have A Healthy Baby" Program for pregnant adolescents.
[c] P value for pre-post comparison determined by analysis of variance where education group was the among subjects independent variable and pre-post test was the within subjects variable.

Table 3. Initial mean and standard deviation (SD) belief scores of pregnant adolescents by education group.

	ERIB Group [a] (n = 15)	HAHB Group [b] (n = 28)
Belief score[c]		
Factor 1: Food cravings: likes and dislikes[d]	9.5 ± 0.9	9.8 ± 0.5
Factor 2: Folklore[d]	17.3 ± 2.4	18.9 ± 2.1
Factor 3: Prenatal weight gain[e]	14.3 ± 2.2	14.2 ± 3.2
Factor 4: Nutrition and cravings[e]	13.1 ± 2.9	13.5 ± 2.3
Factor 5: Health[e]	10.9 ± 2.0	11.9 ± 2.1

[a] ERIB group = "Eating Right Is Basic" - EFNEP Adult Education Program
[b] HAHB group = "Have A Healthy Baby" Program for pregnant adolescents
[c] Beliefs score - determined based on the Likert scale of 1 (strongly agree) to 5 (strongly disagree), and the number of belief statements in each factor (4-5), scores were defined for each factor as follows: 4-5 strongly agree, 12-15 no opinion, and 20-25 strongly disagree.
[d] Factors 1 and 2 had 5 belief statements each.
[e] Factors 3, 4 and 5 had 4 belief statements each.

cravings: likes and dislikes) and Factor 5 (health). Sociodemographic variables and the five factors of the belief score shown in Table 3 were evaluated using the analysis of variance procedure. There were significant effects of ethnic group on Factor 1 (food cravings: likes and dislikes) ($p=0.01$) and Factor 3 (prenatal weight gain) ($p=0.01$). There was a significant effect of educational level on Factor 3 ($p=0.006$) and a significant effect of size of community on Factor 2 (folklore) ($p=0.04$). There were significant effects of type of medical care on Factor 2 ($p=0.04$) and Factor 3 ($p=0.007$) while there was a trend toward significance for the effect of type of medical care on Factor 1 ($p=0.06$) (data not shown).

Factor analysis of initial responses to 43 belief statements. Factors identified were based on the rotated factor pattern of the factor analysis and factor loadings ≥ 0.50. Five factors were identified by all pregnant adolescent participants in both education programs combined (Table 4). The HAHB group identified four factors: prenatal weight gain, food cravings-likes and dislikes, cravings and baby's needs, and health (data not shown). The ERIB group identified five factors: food cravings, cravings-baby and pica, cravings-sex of the child and nutrient needs, folklore, and nutrient needs (data not shown). The belief statements categorized with the factor prenatal weight gain identified by the education groups combined and the HAHB group were similar. The factor folklore was identified by the education groups combined and the ERIB group. The results of the initial factor analysis of the belief statements indicate that the ERIB group tended to agree with more statements related to folklore and cravings. These factor analysis results agree with factors identified as cravings and folklore based

Table 4. Factors identified from initial responses to 43 belief statements of all pregnant adolescent participants.[a]

Pregnant Adolescent Participants/Education Program	Factors/Belief Statements	Factor Loadings[b]
Pregnant adolescent participants in both nutrition education programs	*Factor 1: Food Cravings - Likes and Dislikes*	
	If a pregnant woman craves a food; her baby will like that food.	0.50
	A woman who eats alot of oranges during pregnancy will have a baby who likes oranges later in life.	0.60
	Pregnant women who crave salty or sour foods will have a boy.	0.71
	A woman who dislikes tomatoes during pregnancy will produce a child who dislikes tomatoes.	0.72
	Food cravings during pregnancy will determine the child's likes and dislikes in later life.	0.75
	Factor 2: Folklore	
	Beets build red blood during pregnancy.	0.57
	A woman should avoid animal foods during pregnancy.	0.57
	A pregnant woman will lose a tooth with every baby if she doesn't drink milk.	0.60
	Eating chicken legs during pregnancy will cause birthmarks on the baby.	0.76
	Eating strawberries during pregnancy will cause birthmarks on the baby.	0.76
	Factor 3: Prenatal Weight Gain	
	A pregnant woman should eat as much as she wants because she is eating for two.	0.56
	It doesn't matter what a woman eats during pregnancy because the baby will take what it needs from her body.	0.69
	It doesn't completely matter how much or how little weight is gained during pregnancy.	0.73
	Gaining lots of weight during pregnancy makes a healthy baby.	0.82
	Factor 4: Nutrition And Cravings	
	A woman should not eat fish and milk at the same meal during pregnancy.	0.50
	A father with high cholesterol levels is likely to produce a child with heart disease.	0.60
	Pregnant women crave dirt when their diets are low in minerals.	0.67
	Pregnant women crave nonfood items such as laundry starch, clay and dirt.	0.74
	Factor 5: Health	
	A father who is a drug addict is more likely to produce birth defects.	0.50
	"High blood" (high blood pressure) is caused by excess heat during pregnancy.	0.53
	A pregnant woman craves ice because she is not getting enough of certain nutrients in her diet.	0.62
	Pregnant women need a balance of hot and cold foods in their diet.	0.81

[a] A more detailed table of initial belief statement responses is included in Appendix J (Table 2).
[b] Each factor includes statements that loaded $\geq$ 0.50 and is named for the dominant concept. Not all 43 belief statements fall into one of the identified factors, only those with the greatest internal consistency (Cronbach's Coefficient Alpha at least 0.79).

on responses to similar belief statements by other pregnant adolescents.[17,30] Carruth and Skinner[30] reported that pregnant adolescents agreed with beliefs related to folklore and cravings, while responses of 97 pregnant adolescents to belief statements specific to cravings tended to be neutral.[17]

Factor analysis of post responses to 43 belief statements.

Four factors (food cravings-likes and dislikes, health and folklore, prenatal weight gain, and health) were identified by all pregnant adolescent participants in both education programs combined from the post factor analysis (data not shown). Statements related to health were more prevalent compared to the initial factor analysis of both education groups. Table 5 presents the factors according to post responses of pregnant adolescents by nutrition education program. Compared to the initial factors identified by the HAHB group, post factors related more to folklore and less to prenatal weight gain. Folklore statements remained prevalent and statements related to prenatal weight gain remained unidentified as a separate factor in the post factor analysis of the ERIB group compared to the initial factor analysis. The post factor analysis of the two separate education groups identify similar factors compared to the initial factor analysis which identified more different factors. Prenatal weight gain was identified as a separate factor of the post factor analysis of the education groups combined. It could be that the smaller sample size in the factor analysis of the separate education groups makes a difference in identifying statements related to prenatal weight gain as a factor. Or, because prenatal weight gain was not identified by the HAHB group in the post factor analysis, this could be an indication that misconceptions about weight gain were

Table 5. Factors identified from post responses to 43 belief statements of pregnant adolescent participants by nutrition education programs.[a]

Nutrition Education Program	Factors/Belief Statements	Factor Loadings[b]
"Have a healthy baby" (HAHB)	*Factor 1: Food Cravings and Folklore*	
	A woman should not eat fish and milk at the same meal during pregnancy.	0.53
	A pregnant woman who eats alot of oranges during pregnancy will have a baby who likes oranges later in life.	0.53
	All pregnant women have cravings.	0.54
	Beets build red blood during pregnancy.	0.61
	Eating lots of sweets during pregnancy produces a more mild manner child than not eating sweets.	0.68
	"High blood" (high blood pressure) is caused by excess heat during pregnancy.	0.74
	A smaller weight gain during pregnancy allows for an easier delivery.	0.83
	A woman who dislikes tomatoes during pregnancy will produce a child who dislikes tomatoes.	0.86
	Factor 2: Cravings And Baby's Needs	
	The child of a mother who dislikes meat during pregnancy will also dislike meat.	0.56
	Pregnant women who crave sweets will have a girl.	0.57
	Birth defects are mostly the fault of the mother.	0.61
	Pregnant women who crave salty or sour foods will have a boy.	0.63
	Eating chicken legs during pregnancy will cause birthmarks on the baby.	0.69
	A pregnant woman should give into her cravings or she will mark the baby.	0.77
	Eating strawberries during pregnancy will cause birthmarks on the baby.	0.84
"Eating right is basic" (ERIB)	*Factor 1: Cravings and Baby's Needs*	
	A pregnant woman should eat more sodium rich foods and less meats and high-calorie foods to decrease high blood pressure.	0.52
	Pregnant woman who crave sweets will have a girl.	0.57
	A smaller weight gain during pregnancy allows for an easier delivery.	0.76
	A pregnant woman should eat as much as she wants because she is eating for two.	0.88
	A woman should avoid animal foods during pregnancy.	0. 88
	Pregnant women who crave salty or sour foods will have a boy.	0.88
	Eating chicken legs during pregnancy will cause birthmarks on the baby.	0.93
	A pregnant woman should give into her cravings or she will mark the baby.	0.93
	Eating strawberries during pregnancy will cause birthmarks on the baby.	0.93
	Eating lots of sweets during pregnancy produces a more mild manner child than not eating sweets.	0.99
	Factor 2: Food Cravings and Folklore	
	Beets build red blood during pregnancy.	0.50
	Whatever a pregnant woman craves, she should eat.	0.74
	Food cravings during pregnancy will determine the child's likes and dislikes in later life.	0.88
	If a pregnant woman craves a food, her baby will like that food.	0.92

Factor 3: Health	
Pregnant women crave nonfood items such as laundry starch, clay and dirt.	0.50
A pregnant woman craves ice because she is not getting enough of certain nutrients in her diet.	0.51
A father with high cholesterol levels is likely to produce a child with heart disease.	0.58
A father who is a drug addict is more likely to produce birth defects.	0.75
Pregnant women crave dirt when their diets are low in minerals.	0.78
Factor 4: Eating For Pregnancy	
Pregnant women who crave sweets will produce a more hyperactive child.	0.50
If a pregnant woman craves a food, her child will like that food.	0.50
Women will crave pickles and ice cream during pregnancy.	0.67
Pregnant women need a balance of hot and cold foods in their diet.	0.81

A woman who eats alot of oranges during pregnancy will have a baby who likes oranges later in life.	0.93
Factor 3: Health	
A father with high cholesterol levels is likely to produce a child with heart disease.	0.59
"High blood" (high blood pressure) is caused by excess heat during pregnancy.	0.73
It doesn't completely matter how much or how little weight is gained during pregnancy.	0.83
It doesn't completely matter what a woman eats during pregnancy because the baby will take what it needs from her body.	0.97
Factor 4: Eating For Pregnancy	
Pregnant women crave nonfood items such as laundry starch, clay and dirt.	0.54
Pregnant women who crave sweets will produce a more hyperactive child.	0.64
All pregnant women have cravings.	0.70
Women eat better when they become pregnant.	0.79

[a] A more detailed table of post belief statement responses is included in Appendix J (Table 3).

[b]Each factor includes statements that loaded $\geq$ 0.50 and is named for the dominant concept. Not all 43 belief statements fall into one of the identified factors, only those with the greatest internal consistency (Cronbach's Coefficient Alpha at least 0.79).

clarified as a result of the HAHB program (i.e., lesson on weight gain during pregnancy). Results of the post factor analysis could indicate that the type of education program did not have an effect on statements related to folklore.

Further assessment of the paraprofessionals influence on the beliefs of the pregnant adolescent is needed. This sample of paraprofessionals included a mixture of those working only with pregnant adolescents and those who worked with the traditional EFNEP clients and pregnant adolescents. This could make a difference in their teaching style and/or approach to working with clients of a specific group such as pregnant adolescents. A study of EFNEP paraprofessionals in New York State showed that paraprofessionals as well as professionals did not accurately perceive their clients in regards to health, nutrition, resource management, learning and knowing.[36]

Conclusions. There was a significant increase in the knowledge scores for both programs. The knowledge statements addressed the areas of food and nutrition, substance use, and pregnancy complications and weight gain. Both education groups combined tended to disagree with folklore statements according to the initial belief score which was significantly different between programs. The results of the initial factor analysis of the pregnant adolescents in the HAHB group identified prenatal weight gain, cravings and health as concepts while those in the ERIB group identified the concepts of cravings, folklore, and nutrient needs. Post factor analysis of the belief statements were similar for each education group. Factors identified related to cravings, folklore, health, and eating for pregnancy. Limitations of comparing two programs in a controlled study are recognized including confounding factors which could influence differences due to socioeconomic variables such age, ethnic group, and educational or economic levels.

IMPLICATIONS FOR NUTRITION EDUCATORS

The significant improvement in knowledge scores of the pregnant adolescents participating in both education groups supports the importance of nutrition education for the pregnant adolescent. Although the knowledge scores of pregnant adolescents participating in each program were not significantly different, this could have been due to the smaller sample size of the ERIB group. Change in knowledge scores were affected by grade and tenth grade was identified as an optimal level. Nutrition education programs for pregnant adolescents should consider age and grade of participants.

Professionals cannot assume that pregnant adolescents or paraprofessionals without special training are able to adapt general nutrition information to meet the specific needs of pregnant adolescents. Nutrition education programs for pregnant adolescents may need to clarify belief statements related to cravings (including the practice of pica) and folklore. The lesson on prenatal weight gain included in the HAHB program apparently clarified some misconceptions of pregnant adolescents and paraprofessionals regarding components of weight and weight gain recommendations for the pregnant adolescent. It is important that paraprofessionals working with pregnant adolescents be knowledgeable of current nutrition and health recommendations concerning the importance of adequate weight gain. Results of this study support the importance of specialized training for paraprofessionals. Further investigation may be necessary to identify whether certain beliefs particularly those related to cravings, folklore, prenatal weight gain and health are specific to certain cultural groups, i.e., Native American or black, regional areas or financial status. The advantage of an eight-week nutrition education program taught by EFNEP paraprofessionals is the ongoing support for the pregnant adolescent while at the same time she is learning important nutrition and health information for herself and her baby.

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CHAPTER V

EFFECTS OF NUTRITION EDUCATION PROGRAMS ON ANTHROPOMETRIC MEASUREMENTS AND PREGNANCY OUTCOMES OF ADOLESCENTS

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ABSTRACT

Objective The effects of the Expanded Food and Nutrition Education Program (EFNEP) Eating Right Is Basic (ERIB) curriculum and of a special nutrition education program (Have A Healthy Baby (HAHB)) for pregnant adolescents were evaluated on anthropometric measurements and pregnancy outcomes for pregnant adolescents.

Design and setting The effects of the ERIB program and the HAHB program for pregnant adolescents were evaluated; the teens were taught by twelve trained EFNEP paraprofessionals in nine counties in Oklahoma. Data were collected before and after participation in the eight-week nutrition education program and at a follow-up session at least one month after delivery. Anthropometric measurements included weight and

stature to calculate body mass index (BMI), and upper mid-arm circumference and triceps skinfold thickness to calculate mid-arm muscle area (MAMA) and arm fat area (AFA). Blood pressure measurements were also obtained. Follow-up data included total weight gain during pregnancy and infant birth weight.

Subjects Fourteen pregnant adolescents 14 to 19 years of age participated in the ERIB program and 18 participated in the HAHB program for pregnant adolescents.

Main outcome measures The hypothesis was that there would be no effect due to program and time for anthropometric measurements of pregnant adolescents. Furthermore, there would be no difference due to program for prenancy outcome of pregnant adolescents.

Statistical analyses performed The analysis of variance procedure with education group as the among subjects independent variable and the pre-post test as the within subjects independent variable was used to compare means for anthropometric and pregnancy outcome variables. Descriptive statistics were calculated for demographic information.

Results There was no significant difference between programs for average reported prenatal weight gain; 16.6 kg for the HAHB group and 14.8 kg for the ERIB group. Average birth weight for infants of participants in both programs was 3.4 kg. Eight weeks during pregnancy may not have been enough time to detect significant interactive effects between program and time in anthropometric measurements.

Applications/conclusions Adequate prenatal weight gain and infant birth weight point to the importance of addressing weight issues in nutrition education programs designed for pregnant adolescents. Prenatal weight issues need to be presented in practical terms emphasizing diet, growth and the components of weight gain during pregnancy.

Adolescent pregnancy is a public health problem in the United States today (1). Pregnancy is increasing among adolescents less than 16 years of age and they are at a greater risk for physical and psychosocial problems associated with adolescent pregnancy (2). Unfavorable outcomes of adolescent pregnancy include preterm and low birth weight babies, as well as the increased incidence of pregnancy-induced hypertension, anemia and sexually transmitted disease. Nutrition care of the adolescent needs to begin early in pregnancy with particular attention to the unique factors that may affect nutritional status (3,4). Barriers to adolescent prenatal care include young age, limited income and education, unmarried status and inaccessibility of care. A tendency toward limited use of health care has been demonstrated by black and Native Americans (5,6).

Low prepregnancy weight is associated with increased risk of low birth weight infants particularly among younger adolescents (7). Data from the National Collaborative Perinatal Project (NCPP) of the National Institutes of Health indicated a U-shaped relationship between perinatal mortality rate and prenatal weight gain based on mothers' original weight status (8). Increased birth weight has been associated with increased prepregnancy weight, weight gain and percent of standard weight for height in teens and adults (9,10).

Positive correlations between total maternal weight gain and infant birth weight have been demonstrated (7,11,12). Birth weight of infants born to teenagers was lower ($P<0.05$) than in adult women (13).

Factors associated with maternal weight gain and infant birth weight were evaluated prospectively in 696 pregnant adolescents who delivered by 37 weeks gestation. Prenatal weight gain was associated with ethnicity (both Hispanics and blacks gained less weight compared to whites), parity and pregnancy-related hypertension. Increased birth weight was associated with maternal weight gain (23 g/kg) for the total sample (14).

Appropriate weight gain for the pregnant adolescent is controversial because of the potential for improving pregnancy outcome through weight gain modification (8,15-17). In general, recommending larger total weight gains of 14 kg to 18 kg may be appropriate for pregnant adolescents. The median weight gain at term was 14.2 kg to 15.5 kg in a cohort of 1,419 low-income pregnant adolescents in New Jersey which is significantly greater than gains reported for pregnant adults (15).

Infant birth weight is influenced by gestational age of the mother. Pregnant adolescents with a gynecological age (GA=chronologic age minus age at menarche) of less than two years are at nutritional risk because of the compromises imposed by pregnancy on their own growth and developmental needs (7). A GA of two years or less is considered high nutritional risk because growth needs must be met in addition to the nutrient requirements of pregnancy (1,18). Females with a GA of four years are considered physiologically mature so that nutritional requirements are similar to adult pregnant women (19).

Research reported by Frisancho and coworkers (13,20) supports the hypothesis that there is competition for nutrient requirements between the younger pregnant adolescent still in rapid growth and the fetus. Compared to older women, fetuses of females under 16 years of age have been observed to grow more slowly (20-23).

It has been suggested that younger adolescent mothers 13 to 16 years old gain more weight (approximately 16 kg) compared to adolescent mothers at least 17 years of age in order to improve infant birth weight (13). However, in teenage participants in the NCPP, higher prenatal weight gains were associated with younger age (13 years) and lower birth weights. Increased fluid retention in younger adolescents was suggested as a reason for the failure to associate increased prenatal weight gains with increased birth weights (19). In other studies of pregnant adolescents, the risk of delivering a small-for-gestational-age infant was greater with weight gain less than 4.3 kg at 24 weeks gestation or with maternal weight gains less than the 25th percentile (24,25). Among teenage mothers, arm fat area depletion was associated with the risk of delivering a low birth weight baby (26,27). These studies stress the importance of early weight gain and anthropometric monitoring for the pregnant adolescent.

Although one of the strongest predictors of infant birth weight is weight gain during pregnancy, other factors influencing pregnancy outcome include gestational age; gynecologic age/growth potential; prepregnancy weight status; pattern of weight gain; substance use including cigarettes, drugs and alcohol; sexually transmitted diseases; and stress. Mean total weight gain and infant birth weight were not significantly different between a group of pregnant adolescents (14 to 17 years) and pregnant young adults (18 to 25 years) in a retrospective examination of maternal characteristics and monthly weight gains (28). Studies of adolescents have identified a significant relationship between low birth weight infants (29) and low pregravid weight (30) and smoking during pregnancy.

Because the optimal weight gain for the pregnant adolescent is unknown, a multifactorial causal model that associates adolescent maternal weight gain and low birth weight has been proposed to include "incomplete maternal growth, reproductive immaturity, diminished maternal body size, nutritional deficiencies, socioeconomic and behavioral factors, and maternal emotional stress." All factors and their interactions need to be considered before making weight gain recommendations for adolescent pregnancy (31,32). A method to individualize appropriate weight gain for pregnant adolescents has been published (1).

A report of 50 prenatal patients (14 to 35 years) at the Wewoka Indian Health Center in Oklahoma indicated that 82% of the patients did not know how much weight they should gain during pregnancy (33). A normal weight gain pattern for adolescents 17 years and younger is approximately 16 kg (34,35). Negative attitudes toward weight gain among adolescents could adversely affect prenatal weight gain (36).

In 1990, the National Academy of Sciences Subcommittee On Nutrition and Pregnancy (37) recommended that all pregnant women receive guidance in maintaining a healthy diet in order to achieve adequate weight gain during pregnancy and established ranges for optimal weight gains according to prepregnancy weight-for-height status and BMI. Recommendations for weight gains in young adolescents and blacks were the higher recommendation of each range (37).

Significant improvements in birth weights and/or the incidence of low birth weight infants as a result of nutrition intervention during pregnancy through the Special Supplemental Food Program for Women, Infants and Children (WIC) have been demonstrated by several studies including adult women (38) as well as pregnant adolescents (39-41). Follow-up evaluations of an EFNEP nutrition program for pregnant adolescents in Kentucky indicated a reduced incidence of low birth weight babies being born to EFNEP participants compared to the state average (42). A mean weight gain of 16.8 kg and infant birth weight of 3,377 g were reported for teenagers participating in a teen obstetric clinic and school nutrition education program (35). The importance of comprehensive prenatal care also has been reported (12,43).

Limited studies exist evaluating anthropometric and pregnancy outcome measurements as a result of nutrition education programs designed for low income pregnant adolescents. The purpose of the present investigation was to evaluate the effects on anthropometric measurements and pregnancy outcome of nutrition education programs for pregnant adolescents 14 to 19 years of age taught by paraprofessionals.

The hypothesis formulated before data collection was that there would be no difference due to program and time for anthropometric measurements of pregnant adolescents. Furthermore, there would be no difference due to program for pregnancy outcome of pregnant adolescents.

PROCEDURES AND METHODS

Study Design

This study used a pretest-posttest measure within a two-independent samples design. The among subjects independent variable (type of educational program presented to pregnant adolescents) was manipulated to observe the effects on the dependent variables (anthropometric and pregnancy outcome measurements). The two educational programs were the ERIB adult education program and the HAHB nutrition education program especially designed for pregnant adolescents.

Study Participants

Subjects were pregnant adolescents ages 14 to 19 years recruited from the Oklahoma EFNEP program in both urban and rural areas, and from the Chickasaw Nation Native American WIC Program through EFNEP home economists, EFNEP paraprofessionals and the Chickasaw Nation WIC nutritionist. The study was approved by the Institutional Review Board for Protection of Human Subjects at Oklahoma State University. Informed consent was obtained from all subjects and from parents for minors. Subjects were given the nutrition education materials for participating in the nutrition education program and a total of $30 for the three days of data collection. Data reported in this study were obtained from subjects who participated in one of the programs and all three data collection days.

Twelve trained EFNEP paraprofessionals in nine EFNEP counties in Oklahoma agreed to conduct the nutrition education classes for pregnant adolescents. Six paraprofessionals conducted the ERIB program and six paraprofessionals conducted the HAHB program. Classes were eight weeks for both programs.

Nutrition Education Program and Paraprofessional Training

The curriculum for the pregnant adolescents in the regular EFNEP adult program was, "Eating Right is Basic" (ERIB) (44). Topics include food preparation, meal planning, food storage and sanitation, shopping skills and basic nutrition. Features of the curriculum include flip charts, instructor outlines, and participant handouts and activities for each lesson.

The second educational program was the "Have A Healthy Baby" (HAHB) curriculum developed for pregnant adolescents 11 to 19 years of age (45). Permission to use this curriculum was received from the EFNEP Program, Purdue University Cooperative Extension Service. Topics include the importance of early prenatal care, prenatal weight gain, prenatal and infant nutrition as well as alcohol, smoking and drugs during pregnancy. The format of the curriculum includes instructor outlines, and activities as well as a workbook for participants. A series of 16 "Teen Age Parents (TAP)" fact sheets developed by Oklahoma State University's EFNEP supplemented the curriculum (46).

All 12 paraprofessionals were trained to administer the project assessment form used. Six paraprofessionals attended a one-day in-depth training workshop on use of the HAHB program for pregnant adolescents. They also received background information on the risks of adolescent pregnancy. The six remaining paraprofessionals excluded from the special training sessions received training on the HAHB materials following the study.

Data Collection Days For Pregnant Adolescents

There were three days of data collection for all pregnant adolescent participants: (1) one prior to the eight-week nutrition education program, (2) one following the eight-week nutrition education program, and (3) one at least one month following birth of the infant. Data collection days were planned separately within each county through the local WIC clinics and county extension offices.

Project Assessment Form

A questionnaire for collecting general demographic data, health history pertinent to pregnancy, and follow-up data on the mother and infant after birth of the infant were completed by interview on the initial and follow-up days of data collection by the same trained paraprofessional in each county. Socioeconomic factors including age, ethnic group, educational level, size of community, type of social/financial support, and type of medical care for the pregnant adolescent were identified. Follow-up information included total weight gain during pregnancy and birth weight of the infant. The questionnaire was adapted with permission from the HAHB program (45).

Anthropometric Measures

Measurements were recorded by the EFNEP nutritionist (D.J.H) at each county site using the same instruments within each site to collect pre, post and follow-up anthropometric data. Stature and weight were measured on all three days of data collection. A stadiometer was used to measure stature (47). Fasting subjects were weighed in the morning of each data collection day using a leveled platform, calibrated scale with a beam and moveable weights. Body mass index (BMI) was calculated as weight/height^2 (kg/m^2) (48). Prepregnancy BMI was calculated using prepregnancy weights reported by the pregnant adolescents and assessed according to recommended standards (37). Recommendations adapted from the Metropolitan Life Insurance Company, 1959 tables for height and weight were used to assess prepregnancy weight status for the adolescent. Prepregnancy weight status was categorized as under, normal, over or obese according to a table suggested for adolescent pregnancy (7). Total weight gain during pregnancy was obtained from each subject at the follow-up interview.

Mid-arm circumference was measured with an insertion tape (49). Triceps skinfold, the recommended single skinfold thickness to measure with female adolescents, was determined using calibrated Lange calipers (Cambridge Scientific Industries, Cambridge, MD) (50). The combination was used to calculate the upper mid-arm muscle area (MAMA) and upper arm fat area (AFA) using standard calculations (47,51). Percentiles for triceps skinfold measurements based on data from the U.S. Health and Nutrition Examination Survey I (1971-1974) were used as reference data for adolescent females (52). Percentiles for bone-free arm muscle area and arm fat area were used to evaluate the MAMA calculation (51).

Blood pressure measurements were taken by the EFNEP nutritionist (D.J.H.) on all three days of data collection using the upper arm with a sphygmomanometer. All subjects were in a sitting position.

Stat

Statistical Analyses

All data were analyzed by computer using a statistical package SAS (53), to assess the effects of the HAHB program for pregnant adolescents and the ERIB program on anthropometric and pregnancy outcome measurements. Descriptive statistics were used to summarize demographic variables. The analysis of variance procedure with education group as the among subjects independent variable and the pre-post test as the within subjects independent variable was used to compare means for weight, height, BMI, MAMA and AFA variables. For follow-up variables, analysis of variance with education group as the independent variable was used. The level of significance for this study was $P \leq 0.05$.

RESULTS

Demographic Data

A summary of demographic data in Table 1 indicates that most of the pregnant adolescents in both groups were at least 16 years of age. The HAHB group had more 14 to 15 year olds in the 8th through 10th grades compared to the ERIB group with more of the pregnant adolescents in at least the 11th to 12th grades. Most of the pregnant adolescents were white with Native American being the largest minority group. Most of the pregnant adolescents in both groups were enrolled in WIC at the time they began the nutrition education program (data not shown). Most pregnant adolescents were not working, nor did they know the amount of the monthly family income. Parents provided the majority of social and financial support in both education

Table 1
Demographic and health history summary of pregnant adolescent participants prior to the nutrition education programs[a,b]

Demographic/Health history variables	Eating right is basic (ERIB) nutrition education	Have a healthy baby (HAHB) nutrition education
Pregnant adolescents (n)	14	18
Paraprofessionals (n)	6	6
EFNEP counties in Oklahoma (n)	4	5
Age		
14-15 (y) (n) (%)	1 (7%)	4 (22%)
16-17 (y) (n) (%)	5 (36%)	6 (33%)
18-19 (y) (n) (%)	8 (57%)	8 (44%)
Ethnic group		
White (n) (%)	6 (43%)	13 (72%)
Black (n) (%)	3 (21%)	1 (6%)
Native American (n) (%)	5 (36%)	4 (22%)
WIC enrollment[c]		
Yes (n) (%)	13 (93%)	14 (78%)
No (n) (%)	1 (7%)	4 (22%)
Grade in school		
8-10th Grade (n) (%)	1 (8%)	7 (47%)
11-12th Grade (n) (%)	11 (92%)	6 (40%)
Dropped out of school (n) (%)	0 (0%)	0 (0%)
High school graduate (n) (%)	0 (0%)	0 (0%)
Attending college (n) (%)	0 (0%)	2 (13%)
Community of residence		
Rural (n) (%)	3 (21%)	6 (33%)
Town under 10,000 (n) (%)	3 (21%)	8 (44%)
City 10,000 - 50,000 (n) (%)	6 (43%)	4 (22%)
Suburb of a city over 50,000 (n) (%)	2 (14%)	0 (0%)
Type of medical care		
Health clinic (n) (%)	6 (43%)	2 (11%)
Physician (n) (%)	6 (43%)	14 (78%)
No medical care (n) (%)	2 (14%)	2 (11%)
Month of first doctor's visit		
0 (n) (%)	1 (8%)	1 (6%)
1 (n) (%)	5 (39%)	3 (18%)
2 (n) (%)	4 (31%)	7 (41%)
3 (n) (%)	3 (23%)	5 (29%)
4-5 (n) (%)	0 (0%)	1 (6%)
Frequency of doctor's visit		
Once a month (n) (%)	11 (92%)	15 (94%)
Every two weeks (n) (%)	1 (8%)	1 (6%)
Once a week (n) (%)	0 (0%)	0 (0%)
Previous pregnancy		
Yes (n) (%)	4 (29%)	3 (18%)
No (n) (%)	10 (71%)	15 (83%)
Other children		
Yes (n) (%)	1 (7%)	2 (11%)
No (n) (%)	13 (93%)	16 (89%)

[a] A more detailed demographic and health history summary is included in Appendix J (Table 4).
[b] N = number of participants with percent (%) frequency.
[c] Special Supplemental Food Program for Women, Infants, and Children.

groups (data not shown). More pregnant adolescents in the ERIB group lived in a city 10,000 to 50,000 while more of the HAHB group lived in a town under 10,000 or a rural area of southeastern Oklahoma.

Health History

Health history variables in Table 1 indicate that pregnant adolescents were seeking health care from either a health clinic or private physician. Most adolescents were visiting the doctor once a month and began their initial visit during the first, second or third month of pregnancy (data not shown). This was a first pregnancy for most of the participants. Three pregnant adolescents had other children. Among those participants who responded to the optional question regarding health history, responses to the variables diabetes, high blood pressure, medication for medical condition, and cigarette use were positive most often (data not shown).

Anthropometric Measures

Most pregnant adolescents in each education group were normal weight prior to pregnancy (Table 2). The average prenatal weight gain for the HAHB group was 16.6 kg while the average weight gain for the ERIB group was 14.8 kg, which was not significantly different between programs (Table 3). For pre and post education weight gain, there was no significant interaction between program and time; however, there was a time main effect on pre and post education weight gain indicating a significant increase in weight for participants in both programs (data not shown). There was no significant interaction between program and time for pre and post education BMI; however, there was a significant main effect for pre and post education BMI indicating

Table 2

Mean anthropometric measurements of pregnant adolescent participants of two eight-week nutrition education programs at pre, post and one month after birth [a,b]

Anthropometric variables	Eating right is basic (ERIB) nutrition education (n = 14)	Have a healthy baby (HAHB) nutrition education (n = 18)
Prepregnancy weight [c]		
Underweight (n) (%)	1 (7%)	4 (22%)
Normal weight (n) (%)	9 (64%)	10 (56%)
Overweight (n) (%)	3 (21%)	1 (5%)
Obese (n) (%)	1 (7%)	3 (17%)
Body mass index (kg/m²)		
Prepregnancy	23.8 ± 4.3	23.2 ± 4.3
Pre nutrition education	26.2 ± 5.6	25.0 ± 4.7
Post nutrition education	28.8 ± 6.6	27.4 ± 4.9
Post delivery	26.0 ± 5.1	25.3 ± 5.2
[d]P value	0.0001	
Blood Pressure		
Pre nutrition education	111 ± 9/74 ± 8	108 ± 7/66 ± 7
Post nutrition education	111 ± 6/69 ± 10	111 ± 6/69 ± 8
Post delivery	109 ± 7/70 ± 6	109 ± 5/69 ± 7

[a] A more detailed chart of anthropometric measurements is included in Appendix J (Table 5).
[b] All means are ± standard error unless otherwise noted.
[c] N = number of participants with percent (%) frequency.
[d] P value for pre-post nutrition education comparison determined by analysis of variance where education group was the among subjects independent variable and pre-post test was the within subjects independent variable. Significant main effect was due to time from pre to post nutrition education.

Table 3
Data collected from pregnant adolescent participants one month post delivery [a,b]

Variables	Eating right is basic (ERIB) nutrition education (n=14)[c]	Have a healthy baby (HAHB) nutrition education (n=18)	P[d]
Prenatal weight gain (kg)	16.6 ± 8.4	14.8 ± 5.3	0.45
Infant birth weight			
Mean (kg)	3.2 ± 0.5	3.5 ± 0.6	0.45
Length mean (cm)	49.8 ± 2.5	50.7 ± 3.3	0.41
No. of days in hospital			
Mother (mean)	3.1 ± 1.1	2.3 ± 1.3	0.05
Infant (mean)	3.1 ± 1.1	5.2 ± 12.7	0.53
Babys' weight at one month			
Mean (kg)	4.3 ± 0.8	4.4 ± 0.8	0.81
Method of feeding			
Breast (n) (%)	2 (13%)	5 (28%)	
Bottle (n) (%)	12 (80%)	13 (72%)	
Combination (n) (%)	1 (7%)	0 (0%)	0.20

[a] A more detailed chart of follow-up data is included in Appendix J (Table 6).
[b] N = number of participants with percent (%) frequency unless otherwise noted.
[c] One participant delivered twins.
[d] P value as determined by a two sample t test is associated with the null hypothesis that mean follow-up values are not significantly different between the "ERIB" and "HAHB" groups.

there was a significant increase in pre and post education BMI for participants in both education programs (Table 2). For systolic blood pressure there was no significant interaction between program and time, neither was there a significant main effect due to time. For diastolic blood pressure there was a significant interaction between program and time. The ERIB group had a significant decrease in blood pressure, whereas there was no significant change in diastolic blood pressure in the HAHB group (Table 2).

Follow-up Data

The majority of babies born were male in both groups with a set of twin boys born to a mother in the ERIB group (data not shown). Mean birth weight, length, or weight at one month were not significantly different between education groups (Table 3). Length of hospital stay for mothers in the HAHB group was significantly lower ($P=0.05$) than in the ERIB group. One premature baby was born in each education group (data not shown), which could account for variation in the length of hospital stay for infants (Table 3). Most adolescent mothers fed their infants formula and continued their enrollment in WIC. Two mothers (13%) in the ERIB group and five mothers (28%) in the HAHB group breast fed their babies (Table 3).

DISCUSSION

The health history findings of this sample of pregnant adolescents point toward a pattern of seeking early prenatal care and early participation in WIC. Barriers to adolescent prenatal care reported by others were not evident (5,6). Perhaps education alleviates barriers to health care.

Prenatal assessment needs to include measurements of stature, weight and weight gain monitoring. The prenatal weight history should be completed early in prenatal care. Information needs to include prepregnancy weight as well as current weight, weight gain in previous pregnancies, attitude towards weight gain, and exercise patterns (7).

Most of the pregnant adolescents in both education groups were normal weight prior to pregnancy. There was a tendency toward overweight in the ERIB group while there were both underweight and obese participants in the HAHB group. Prepregnancy weight status indirectly reflects maternal energy stores and is important in assessing weight status and weight gain during pregnancy. Appropriate reference data to assess prepregnancy weight status for pregnant adolescents are not available. Prepregnancy weight is usually obtained from the client retrospectively (7). Hediger et al (15) found self-reported weights to be reliable ($r > 0.90$) during adolescent pregnancy with the exception of overweight teenagers who tend to underreport their weight. It has been reported that adolescent prenatal clients estimate fairly accurate prepregnancy weights which can be used to determine prenatal weight gain (54). Ideally, weight needs to be monitored during pregnancy to assess the pattern and amount of weight gain (7). Because each education program was eight weeks in duration and pregnant adolescent participants were at different stages in pregnancy, it was not feasible to monitor accurately the pattern and amount of weight gain throughout the entire pregnancy.

The mean prepregnancy BMI for both groups was similar, approximately 23 to 24 kg/m^2 which according to the Institute of Medicine guidelines is within the normal range of 19.8 to 26.0 (37). A relationship between low prepregnancy weight for height and low infant birth weight has been reported in adolescents (9). Other reports indicate an independent relationship between maternal prepregnancy weight-for-height or maternal weight to birth weight and weight gain (17). For example, birth weights of infants born to overweight adolescents were not greater than infants born to underweight or normal-weight adolescents with the exception of low weight gains ($<$11.1 kg to 12.3 kg at term). Likewise, birth weight was not improved with excessive weight gains ($>$17.9 kg to 19.3 kg at term) for Puerto Rican and black adolescents (15). Both education groups in this study showed similar significant changes in BMI between pre and post nutrition education and between post nutrition education and post delivery. The mean post delivery BMI of approximately 25 to 26 kg/m^2 increased compared to the prepregnancy BMI indicating the adolescents retained some of the weight gained in pregnancy. Similar changes in BMI were reported among pregnant adolescents classified as growing and nongrowing (23).

Mean weight gains for both groups were close to the recommended weight gain of 15.9 kg for normal weight adolescents. The mean weight gain of pregnant adolescents attending a health clinic and nutrition education program was 37 $\pm$ 16 lb (16.8 kg $\pm$ 7.3 kg) (35). Hediger et al (15) reported a median weight gain at term of 14.2 kg to 15.5 kg with a greater initial weight-gain velocity for pregnant adolescents compared to adult women. This same amount and pattern of weight gain among younger adolescents compared to older adolescents has been reported (16). Incomplete growth, small maternal size and low GA are factors that contribute to the higher weight gain recommended for adolescent pregnancy (15). It has been hypothesized that there is competition for nutrients between the mother and fetus (20,21). The amount of total maternal weight gained and retained indicated by the mean post delivery BMI could be related to growth during adolescence for participants in both education groups.

Studies have shown that prenatal weight gain is the most important modifiable predictor of infant birth weight in adolescents (31,41). Inadequate weight gain has been associated with low birth weight infants. As weight gain approaches 15.9 kg for pregnant adolescents, the incidence of low birth weight infants decreases (7). We suggest that the adequate maternal weight gain contributed to the low incidence of premature births and the mean birth weights of 3.2 kg to 3.5 kg for infants born to participants in each education group. Superior birth outcome of adolescents was associated with prenatal weight gains equal to the higher end of the Institute of Medicine's recommendations for normal weight, underweight and overweight women (55).

Monitoring of skinfold and arm circumference measurements may be more useful in assessment of protein-energy reserves in high-risk rather than routine pregnancy situations. Reference data for prenatal body fat patterns during adolescence are not currently available (7,52). Perhaps eight weeks during pregnancy is not enough time to identify significant differences for the parameters of height, mid-arm circumference, triceps skinfold thickness, MAMA or AFA. These parameters in addition to weight and BMI could be an indication of growth or weight retention. Growing gravidas have shown increased tricep skinfold thickness and arm fat area in the postpartum period (23). Furthermore, several studies using anthropometric predictors have associated changes in MAMA and AFA, and low birth weight indicating growth during adolescence (23,26,27). In these studies measurements were assessed between 19 to 35 weeks gestation and again at four to six weeks postpartum. In this study, the pre and post eight-week nutrition education data were taken on participants at different stages in pregnancy which could be a factor contributing to the lack of significant interactive effects between programs and time in anthropometric measurements.

Both early prenatal care and WIC participation have been associated with the prevention of low birth weight infants (3,39,40). Due to both the low incidence of low birth weight infants and prenatal health concerns (e.g., cigarette use or pregnancy induced hypertension) in this study, support is given to early prenatal care and WIC participation contributing to a positive pregnancy outcome. Further research is needed to document the costs and benefits of nutrition education using paraprofessionals and WIC programs.

APPLICATION

This study and others suggest that adolescents receiving early prenatal care, nutrition education and WIC participation, gain adequate weight to support pregnancy, growth during adolescence and positive pregnancy outcome. Use of a special curriculum addressing weight issues for the adolescent is important because the changes that occur are possibly due to growth as well as pregnancy. It is important that the adolescent understand the components of prenatal weight gain. A special curriculum can present activities addressing weight issues in practical terms. For example, one activity lists all of the major components of weight gain during pregnancy which stresses to the adolescent that weight gain is not all due to the baby or fat (45). Another activity suggests filling a one gallon jug with red colored water to represent normal blood volume and a 2 L soda bottle also with red colored water to represent the added blood volume due to pregnancy which accounts for 1.6 kg of weight. Furthermore, nutrition educators need to provide information on calorie and nutrient intakes for the adolescent in order to achieve the recommended pattern and amount of weight gain during pregnancy. The paraprofessionals in both education groups of this study were an advantage in that the pregnant adolescent had ongoing support and follow-up which could have also contributed to achieving the recommended prenatal weight gains and positive pregnancy outcomes. Limitations of comparing two programs in a controlled study are recognized including confounding factors such as age, ethnic group, and economic or educational levels which could influence program effects.

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CHAPTER VI

EFFECTS OF NUTRITION EDUCATION PROGRAMS ON HEMATOLOGIC, GLUCOSE AND INSULIN PARAMETERS, AND DIETARY INTAKES OF PREGNANT ADOLESCENTS

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ABSTRACT

Objective The effects of the adult Expanded Food and Nutrition Education Program (EFNEP) Eating Right Is Basic (ERIB) and a special nutrition education program (Have A Healthy Baby) for pregnant adolescents were evaluated. The educational programs for pregnant adolescents were taught by paraprofessionals and evaluated for hematologic, glucose, and insulin parameters as well as dietary intakes.

Design and Setting The regular EFNEP nutrition education program and a special nutrition education program for pregnant adolescents were implemented; the teens were taught by twelve trained EFNEP paraprofessionals in nine counties in Oklahoma. Data were collected before and after participation in the eight-week nutrition education

programs and at a follow-up session at least one month after delivery. Blood samples were analyzed for hematocrit, hemoglobin, serum transferrin, total iron-binding capacity (TIBC), serum iron, transferrin saturation, serum glucose, glycosylated hemoglobin, serum fructosamine and serum insulin. Dietary analyses were based on 24-hour dietary recalls and food frequencies.

Subjects Fourteen pregnant adolescents 14 to 19 years of age participated in the regular EFNEP nutrition education program and 18 pregnant adolescents participated in the special nutrition education program for pregnant adolescents.

Main outcome measures The hypothesis formulated before data collection was that there would be no effect due to program and time for hematologic, glucose and insulin parameters as well as dietary intakes.

Statistical analyses performed The analysis of variance procedure with education group as the among subjects independent variable and the pre-post test as the within subjects independent variable was used to compare means for hematologic, glucose and insulin parameters as well as dietary intake (nutrients and servings from the food groups). Descriptive statistics were used to analyze demographic information.

Results Twenty-five percent of the sample were initially anemic. Pre and post education mean fructosamine values were higher than recommended values. Otherwise, hematologic, glucose and insulin blood measures were within the normal parameters recommended for adolescent pregnancy. The special nutrition education program for pregnant adolescents promoted improvement in dietary iron. Food frequency data indicated that foods from the "other" group decreased for participants in both nutrition education programs. Initial food frequency data showed that participants in both programs were not meeting the recommended number of servings for the milk, vegetable and bread/cereal groups. Postpartum data showed a calorie decrease to less than 67% of the RDA for over one-half of the sample.

Applications/conclusions Nutrition education programs for pregnant adolescents need to address the importance of preventing iron deficiency anemia and explain the importance of screening for gestational diabetes mellitus (GDM) during pregnancy. Use of the Food Guide Pyramid for pregnant adolescents should stress the importance of a balanced diet from all food groups particularly the milk, vegetable and bread/cereal groups both during pregnancy and the postpartum period.

INTRODUCTION

Adolescent pregnancy is a major public health problem in the United States (1-3). Adolescent pregnancy occurs in all ethnic groups and in individuals from all socioeconomic levels (4). In 1990, almost 17% (7,718) of all live births in Oklahoma were to adolescents (<20 years old), 113 of these were to mothers less than 15 years of age (5,6).

Nutrient needs and requirements are significantly increased during adolescence to meet the demands of rapid physical growth. The additional nutrient requirements of pregnancy place adolescents at high nutritional risk (7,8). Iron deficiency anemia and gestational diabetes mellitus (GDM) are possible complications of adolescent pregnancy (9).

A common nutritional problem for female adolescents is iron deficiency anemia (10,11). Low iron stores are a particular concern for nonpregnant adolescents because there is increased risk for developing iron deficiency anemia during pregnancy (3,4). Average iron intakes of adolescent females 13 to 15 years old were 14.9 mg per day with a significant positive correlation between iron and energy intakes ($P < 0.001$) suggesting a basis for the problem of low iron stores (12). The 1987-88 USDA Nationwide Food Consumption Survey identified low iron and zinc intakes for female adolescents aged 11 to 18 years (13). The mean caloric intake reported in the National Health and Examination Nutrition Survey II for females 15 to 17 years was 1,731 kcal/day. It is estimated that 6 mg of iron per 1,000 kcal is provided by the average American diet (7).

Iron deficiency anemia is common in adolescent pregnancy (3). Major physiologic changes occur during pregnancy that contribute to iron deficiency anemia. These include changes in blood volume, increased iron demands (a single pregnancy requires a total of 1,200 mg of iron), and low or absent iron stores (9,14). Blood volume expansion begins during the first trimester peaking at 32 to 34 weeks gestation. At this time the hemoglobin, hematocrit and red blood cells will be lowest with increases of 6 to 8% at 40 weeks. This phenomenon occurs with or without iron supplements during pregnancy (15). Iron deficiency anemia results in decreased hemoglobin production and a reduction in the amount of oxygen carried to body cells and tissues. Iron containing enzymes may be reduced as well. Perinatal morbidity may increase with iron deficiency anemia causing prematurity, low birth weight, postpartum hemorrhage, decreased maternal well-being, maternal transfusion and compromised fetal iron status (9,14). Low maternal hemoglobin values have been associated with lowered infant birth weight (16). Increased rate of premature births among black women was associated with several risk factors including increased incidence of anemia, underweight, and urinary tract infections as well as socioeconomic factors (less than 20 years of age, single, less than a high school education and receiving welfare support) (17). A study of more than 800 inner city gravidas 12 to 29 years found an association between low birth weight and iron deficiency. Lower mean energy and iron intakes early in pregnancy as well as lower mean corpuscular volume were significantly associated with iron deficiency (18). Participation in the Special Supplemental Food Program for Women, Infants, and Children (WIC) indicated a positive and significant increase in hemoglobin and hematocrit values (19). The RDA for iron during pregnancy is 30 mg per day (20). During the second and third trimesters, an iron supplement of 30 mg per day is recommended by the Institute of Medicine in order to prevent anemia and maintain iron stores (8).

All pregnant women should be screened for GDM including pregnant teenagers. GDM is defined by the National Diabetes Data Group as "carbohydrate intolerance of variable severity with onset of first recognition during pregnancy" (9,21). Early treatment may help to prevent perinatal complications. At a multiethnic (Mexican-American, white, black and Indochinese) pregnancy clinic, the incidence of GDM was 1.4% out of 137 teenagers 12 to 18 years of age who were screened between 24 and 34 weeks of gestation. Abnormal screening tests were reported in 5.8% of the teenagers.

More than half of the teenagers with GDM were obese and 54% had excessive prenatal weight gains. The incidence of macrosomia was 8.7% for the total sample (22).

There is a high incidence of non-insulin-dependent diabetes mellitus among the Pima Indians of Arizona and a glucose tolerance test is a routine part of their prenatal care. The prevalence of abnormal glucose tolerance in the offspring of 15 to 24 year olds was significantly associated with maternal glucose values when diabetes was previously diagnosed (23). Additional studies indicate a high incidence of GDM among other Native Americans (24). This is a particular concern in Oklahoma having the highest Native American population in the nation (25).

Nutritional assessment needs to include monitoring blood glucose levels, urine ketones, appetite, and weight gain in order to individualize an appropriate meal plan throughout pregnancy (26). A survey of 42 Arkansas dietitians counseling patients with GDM reported laboratory assessments of fasting blood glucose used by 89% and glycated hemoglobin used by 21% (27). Glycohemoglobin monitoring is useful as an indication of long-term blood glucose control and levels greater than 7% are an indication of abnormal control. Normal glycohemoglobin values during pregnancy should be in the range of 5 to 7% (28,29). Fructosamine levels also can be used to monitor long-term blood glucose control. The advantage of monitoring fructosamine levels is that glucose status can be determined over a shorter period of time (30). Insulin resistance is associated with a number of changes in renal and endocrine functions of adolescent pregnancy (31). Excess weight gain decreases carbohydrate tolerance further and should be avoided (9).

The Expanded Food and Nutrition Education Program (EFNEP) has begun to work with pregnant adolescents (32-35). The effectiveness of nutrition education materials designed especially for EFNEP pregnant adolescent participants has not been evaluated combining laboratory data and dietary assessment.

The hypothesis formulated before data collection was that there would be no difference due to program and time for hematocrit, hemoglobin, serum iron, serum glucose, glycosylated hemoglobin, serum fructosamine, serum insulin and dietary intakes of pregnant adolescents.

METHODS

Study Design

This study used a pretest-posttest measure within a two-independent samples design. The among subjects independent variable (type of educational program presented to pregnant adolescents) was manipulated to observe the effects on the dependent variables (hematocrit, hemoglobin, serum iron, glucose parameters and insulin as well as dietary intakes). For serum transferrin, total iron-binding capacity (TIBC) and transferrin saturation, analysis of variance with education group as the independent variable was used. The two educational programs implemented were the regular EFNEP adult education program and one that was especially designed for the pregnant adolescent. Limitations of comparing two programs in a controlled study are recognized including confounding factors such as age, ethnic group, and economic or educational levels which could influence program effects.

Study Participants

Subjects were pregnant adolescents ages 14 to 19 years recruited from the Oklahoma EFNEP program in both urban and rural areas, and from the Chickasaw Nation Native American WIC Program through the EFNEP home economists, EFNEP paraprofessionals and the Chickasaw Nation WIC nutritionist. The study was approved by the Institutional Review Board for Protection of Human Subjects at Oklahoma State University. Informed consent was obtained from all subjects and from parents for minors. Subjects were given the nutrition education materials for participating in the nutrition education program and a total of $30 for the three days of data collection. Data reported in this study were obtained from subjects who participated in the nutrition education and all three data collection days.

Twelve trained EFNEP paraprofessionals in nine EFNEP counties in Oklahoma agreed to conduct the nutrition education classes for pregnant adolescents. Six paraprofessionals conducted the regular EFNEP program and six paraprofessionals conducted the nutrition program for pregnant adolescents. Classes were eight weeks for both programs.

Nutrition Education Program And Paraprofessional Training

The curriculum for the pregnant adolescents in the regular education group was the EFNEP curriculum, "Eating Right is Basic (ERIB)" for adults (36). Topics include food preparation, meal planning, food storage and sanitation, shopping skills and basic nutrition. Features of the curriculum include flip charts, instructor outlines, and participant handouts and activities for each lesson.

The special education group used a curriculum, "Have A Healthy Baby (HAHB)" designed for pregnant adolescents 11 to 19 years of age (37). Permission to use this curriculum was received from the EFNEP Program, Purdue University Cooperative Extension Service. Topics include the importance of early prenatal care, prenatal weight gain, prenatal and infant nutrition as well as alcohol, smoking and drugs during pregnancy. The format of the curriculum includes instructor outlines, and activities as well as a workbook for participants. A series of 16 "Teen Age Parents (TAP)" fact sheets developed by Oklahoma State University's EFNEP supplemented the curriculum (38). All 12 paraprofessionals were trained to administer the project assessment form used. Six paraprofessionals attended a one-day in-depth training workshop on use of the nutrition education program for pregnant adolescents. They also received background information on the risks of adolescent pregnancy. The six remaining paraprofessionals excluded from the special training sessions received training on the materials following the study.

Data Collection Days For Pregnant Adolescents

There were three days of data collection for all pregnant adolescent participants: (1) one prior to the eight-week nutrition education program, (2) one following the eight-week nutrition education program, and (3) one at least one month following birth of the infant. Data collection days were planned separately within each county through the local WIC clinics and county extension offices.

Project Assessment Form

A questionnaire for collecting general demographic data, health history pertinent to pregnancy, and follow-up data on the mother and infant after birth of the infant was completed by interview on the initial and follow-up days of data collection by the same trained paraprofessional in each county. Socioeconomic factors including age, ethnic group, educational level, size of community, type of social/financial support, and type of medical care for the pregnant adolescent were identified. Follow-up information included total weight gain during pregnancy and birth weight of the infant. The questionnaire was adapted with permission from the "Have A Healthy Baby" program (37).

Blood Analyses

A registered medical technologist drew the fasting blood samples on all three data collection days. Blood samples were taken from each subject using trace mineral free syringes with plastic pistons (Sarstedt, Numbrecht, W. Germany) and 21 gauge stainless steel butterfly needles (Deseret Medical, Inc., Sandy, UT). Whole blood samples were kept on ice until the separation of serum, and hemoglobin and glycosylated hemoglobin analyses.

To measure hematocrit, a small amount of blood was centrifuged in a heparinized capillary tube until there was a reduction in red cells to a constant packed cell volume. The cyanmethemoglobin method was used to analyze whole blood hemoglobin (Procedure No. 525, Sigma Chemicals, Inc., St. Louis, MO). Blood samples from all three days of data collection were used to analyze the hematocrit and hemoglobin. Serum transferrin was analyzed using the SPQTM antibody reagent set II for transferrin (TRF) to quantitatively determine specific human serum proteins by immunoprecipitin analysis using the COBAS FARA II centrifugal analyzer (INCSTAR Corporation, Stillwater, MN). Blood samples from the initial data collection day were used to assess serum transferrin. TIBC was calculated from serum transferrin (TIBC = serum transferrin (g/L)/0.007) (39). The level of serum iron was analyzed by ashing samples and using flame atomic absorption spectrophotometry (AAS) analysis (Perkin-Elmer Model 5100 PC, Norwalk, CT). Transferrin saturation (%) was calculated using both serum iron and TIBC (transferrin saturation (%) = 100 x serum iron/TIBC) (39). Transferrin saturation (%) was calculated for initial blood samples.

Serum glucose was measured using the Roche COBAS FARA II Clinical Analyzer (Roche Diagnostic Systems, Nutley, NJ). A diagnostic kit for quantitating glycohemoglobins (GHb) was used to assess glycemic control (ISOLAB, Inc., Akron, OH). Spectrophotometric analysis (Beckman Instruments, Fullerton, CA) was used to quantify the percent GHb in the blood sample which measures the average blood glucose concentration over the past two to three months. The RoTAG Fructosamine Assay was used to quantitatively determine glycated proteins (fructosamine) (Roche Diagnostic Systems, Nutley, NJ). Serum insulin was measured using the Equate RIA insulin radioimmunoassay procedure (BINAX, Portland, ME).

Dietary Data Collection

A combination of a 24-Hour Recall, Food Frequency Form, and Nutrition Questionnaire were used to assess dietary intake. The 24-Hour Recall (Pregnancy

Dietary Intake) included information on time, place, food or beverage consumed and amounts recorded by a trained paraprofessional. The Food Processor V (ESHA Research, Salem, OR) was used to analyze dietary intake data for the 24-Hour Recall. The Recommended Dietary Allowances (RDAs) for pregnancy were used as standards to compare values for calories and each nutrient consumed (20). Dietary intakes of calories and selected nutrients were considered adequate when mean consumption was at least 67% of the RDA for calories, protein, vitamin B_6, vitamin B_{12}, folate, vitamin A, vitamin C, iron, zinc and calcium (20).

The mean percent distribution of nutrients was grouped as less than 67% or at least 67% of the RDA for calories and the nutrients analyzed because the RDAs include a safety factor (20). In an effort to assess diet adequacy, a nutrition score was calculated based on intakes of calories, protein, vitamin B_6, vitamin A, vitamin C, iron, zinc and calcium. These nutrients were identified as key nutrients for adolescents and pregnancy (3,40). Each nutrient was assigned two points if it was at least 67% of the RDA or one point if below 67% of the RDA. Thus, the highest possible score for the nine nutrients was eighteen and the lowest possible score was nine.

The Food Frequency Form was adapted from the Eating Habits Checklist used by the Chickasaw Nation Native American WIC program. Foods usually eaten during a seven day period were recorded. The total servings of foods consumed in each category were compared to the Food Guide Pyramid for pregnant adolescents (7). The Nutrition Questionnaire was adapted from several sources (7,41). It included 12 questions to obtain information on weight history, food preparation and shopping, and other dietary information related to pregnancy.

Statistical Analyses

All data were analyzed using the Statistical Analysis System (SAS) (42). Descriptive statistics were used to summarize demographic variables. The analysis of variance procedure with education group as the among subjects independent variable and the pre-post test as the within subjects independent variable was used to compare means for the hematocrit, hemoglobin, serum iron, glucose parameters, insulin and dietary intakes. For serum transferrin, total iron-binding capacity (TIBC), and transferrin saturation, analysis of variance with education group as the independent variable was used. Relationships between selected laboratory and dietary variables were evaluated using Pearson's correlation coefficients. The effects of sociodemographic factors (age, ethnic group, educational level, size of community, type of social and financial support, or type of medical care) on the nutrition score were evaluated using the analysis of variance procedure. The level of significance for this study was $P \leq 0.05$.

RESULTS AND DISCUSSION

Demographic Data

A summary of demographic data in Table 1 indicates that most of the pregnant adolescents in both groups were at least 18 years of age. Native American was the largest minority group among the predominantly white sample of pregnant adolescents.

Table 1
Demographic and health history summary of pregnant adolescent participants prior to the nutrition education programs[a,b]

Demographic/Health history variables	Eating right is basic (ERIB) nutrition education	Have a healthy baby (HAHB) nutrition education
Pregnant adolescents (n)	14	18
Paraprofessionals (n)	6	6
EFNEP counties in Oklahoma (n)	4	5
Age		
14-15 (y) (n) (%)	1 (7%)	4 (22%)
16-17 (y) (n) (%)	5 (36%)	6 (33%)
18-19 (y) (n) (%)	8 (57%)	8 (44%)
Ethnic group		
White (n) (%)	6 (43%)	13 (72%)
Black (n) (%)	3 (21%)	1 (6%)
Native American (n) (%)	5 (36%)	4 (22%)
WIC enrollment[c]		
Yes (n) (%)	13 (93%)	14 (78%)
No (n) (%)	1 (7%)	4 (22%)
Grade in school		
8-10th Grade (n) (%)	1 (8%)	7 (47%)
11-12th Grade (n) (%)	11 (92%)	6 (40%)
Dropped out of school (n) (%)	0 (0%)	0 (0%)
High school graduate (n) (%)	0 (0%)	0 (0%)
Attending college (n) (%)	0 (0%)	2 (13%)
Community of residence		
Rural (n) (%)	3 (21%)	6 (33%)
Town under 10,000 (n) (%)	3 (21%)	8 (44%)
City 10,000 - 50,000 (n) (%)	6 (43%)	4 (22%)
Suburb of a city over 50,000 (n) (%)	2 (14%)	0 (0%)
Type of medical care		
Health clinic (n) (%)	6 (43%)	2 (11%)
Physician (n) (%)	6 (43%)	14 (78%)
No medical care (n) (%)	2 (14%)	2 (11%)
Month of first doctor's visit		
0 (n) (%)	1 (8%)	1 (6%)
1 (n) (%)	5 (39%)	3 (18%)
2 (n) (%)	4 (31%)	7 (41%)
3 (n) (%)	3 (23%)	5 (29%)
4-5 (n) (%)	0 (0%)	1 (6%)
Frequency of doctor's visit		
Once a month (n) (%)	11 (92%)	15 (94%)
Every two weeks (n) (%)	1 (8%)	1 (6%)
Once a week (n) (%)	0 (0%)	0 (0%)
Previous pregnancy		
Yes (n) (%)	4 (29%)	3 (18%)
No (n) (%)	10 (71%)	15 (83%)
Other children		
Yes (n) (%)	1 (7%)	2 (11%)
No (n) (%)	13 (93%)	16 (89%)

[a] A more detailed demographic and health history summary is included in Appendix J (Table 4).
[b] N = number of participants with percent (%) frequency.
[c] Special Supplemental Food Program for Women, Infants, and Children.

Most of the pregnant adolescents in both groups were enrolled in WIC at the time they began the nutrition education program. Most adolescents in the ERIB group were in the 11 to 12th grades while the special education group included more participants in the 8 to 10th grades. Most pregnant adolescents were not working, nor did they know the amount of the monthly family income. Parents provided the majority of social and financial support in both education groups (data not shown). More of the adolescents in the ERIB group lived in a city of 10,000 to 50,000 (suburban Tulsa) while more of the special education group lived in either a town under 10,000 or rural area in southeastern Oklahoma.

Health History

Health history variables in Table 1 indicate that pregnant adolescents were seeking health care from either a health clinic or private physician. Most adolescents were visiting the doctor once a month and began their initial visit during the first, second or third month of pregnancy. This was a first pregnancy for most of the participants. Two adolescents in the special education group had other children.

Blood Analyses

Table 2 identifies the hematologic, glucose and insulin parameters before and after participation in each of the nutrition education programs and one month following delivery of the infant. The initial hematocrit values for both education groups were significantly different ($P=0.03$) (data not shown). There was a significant interaction between program and time (pre to post education) ($P<0.05$) for hematocrit with decreasing hematocrit for participants in the ERIB group. After delivery there was no

Table 2
Pre, post and follow-up hematologic, albumin, glucose and insulin parameters of pregnant adolescents in both education programs[a]

Hematologic, albumin, glucose and insulin values	Eating right is basic (ERIB) nutrition education (n = 14)		Have a healthy baby (HAHB) nutrition education (n = 18)
Hematocrit (%)			
Pre nutrition education	39.2[b] ± 6.0		35.4[c] ± 2.4
Post nutrition education	38.1 ± 5.6		35.7 ± 3.4
P value [d,e]		0.05	
Post delivery	41.1 ± 3.0		39.8 ± 4.3
P value [d,f]		0.0001	
Hemoglobin (g/dL)			
Pre nutrition education	12.5 ± 1.6		12.0 ± 1.2
Post nutrition education	11.3 ± 1.5		12.0 ± 1.6
Post delivery	13.3 ± 2.0		13.7 ± 2.1
P value [d,f]		0.0001	
Serum transferrin (mg/dL)[g]			
Pre nutrition education	329.6[h] ± 74.3		337.7 ± 65.8
TIBC (mg/dL)[i]			
Pre nutrition education	470.9[j] ± 106.1		482.5 ± 94.0
Serum iron (mg/L)[k]			
Pre nutrition education	1.05[l] ± 0.5		1.28[m] ± 0.4
Post nutrition education	0.97 ± 0.3		0.93 ± 0.5
Post delivery	0.84 ± 0.5		1.22 ± 0.6
Transferrin saturation (%)[n]			
Pre nutrition education	24.2[o] ± 13.6		27.3[o] ± 10.2
Serum albumin (g/dL)[p]			
Pre nutrition education	4.8 ± 0.6		4.5 ± 0.6
Post nutrition education	4.7 ± 0.9		4.1 ± 0.4
P value [d,q]		0.01	
Post delivery	5.4 ± 1.0		5.1 ± 0.4
P value [d,f]		0.0001	
Serum glucose (mg/dL)[r]			
Pre nutrition education	79.9 ± 22.5		76.6 ± 15.0
Post nutrition education	82.9 ± 18.2		86.4 ± 23.0
Post delivery	87.3 ± 16.9		103.3 ± 18.8
P value [d,f]		0.007	

Glycosylated hemoglobin (%)[s]			
Pre nutrition education	5.8 ± 1.3		6.2 ± 1.2
Post nutrition education	5.8 ± 1.2		6.5 ± 1.1
Post delivery	5.6 ± 1.1		5.9 ± 1.4
Serum fructosamine (μmol/L)[t]			
Pre nutrition education	340.2 ± 97.7		349.2 ± 68.8
Post nutrition education	321.6 ± 66.0		314.2 ± 57.3
P value [d,q]		0.05	
Serum insulin (μU/mL)[u]			
Pre nutrition education	30.5 ± 29.5		25.6 ± 10.6
Post nutrition education	34.3 ± 36.3		38.8 ± 29.6
Post delivery	20.5 ± 9.6		24.0 ± 7.8
P value [d,f]		0.02	

[a] N = Mean ± standard deviation of hematocrit, hemoglobin, serum transferrin,TIBC, serum iron, transferrin saturation, serum albumin, serum glucose, glycosylated hemoglobin, serum fructosamine, and serum insulin values.
[b] 5 hematocrit values missing.
[c] 1 hematocrit value missing.
[d] P value determined by analysis of variance where education group was the among subjects independent variable and pre-post test was the within subjects independent variable.
[e] Indicates significant interaction between program and time pre to post education.
[f] Significant main effect was due to time from post education to post delivery.
[g] Normal = 75 - 425 mg/dL.
[h] 3 serum transferrin values missing.
[i] TIBC = serum transferrin (g/L)/0.007. (Normal = 250-450 mg/dL).
[j] 3 TIBC values missing.
[k] Normal = .8 - 1.5 mg/L.
[l] 2, 6 and 4 serum iron values missing from pre, post and post time periods respectively.
[m] 3, 7 and 9 serum iron values missing from pre, post and post time periods respectively.
[n] Anemia = transferrin saturation (%) < 15%, transferrin saturation (%) = 100 x serum iron/TIBC.
[o] 3 transferrin saturation values missing from each education group.
[p] Normal = 3.9-5.1 g/dL.
[q] Significant main effect was due to time from pre to post education.
[r] Normal = 64 - 112 mg/dL.
[s] Normal = 4 - 8%.
[t] Normal = 200 - 285 μmol/L.
[u] Normal = 1 - 25 μU/mL.

significant interaction between program and time, but time was a significant main effect for hematocrit ($P<0.0001$) from post education to post delivery. There was no significant interaction between program and time (pre to post education) for hemoglobin or time main effect. After delivery there was no significant interaction between program and time (post education to post delivery) for hemoglobin, but time did have a significant main effect ($P<0.0001$), indicating there was a significant increase in hemoglobin for both programs. Initial mean serum transferrin levels were 329.6 mg/dL (range 216.4 to 466.1 mg/dL) for the ERIB group and 337.7 mg/dL (range 215.0 to 464.7 mg/dL) for the HAHB group. Table 2 indicates that mean TIBC, serum iron and transferrin saturation values were within the recommended ranges. There was no significant interaction between program and time for serum iron. TIBC, serum iron and transferrin saturation were not significantly different between programs.

For the pregnant adolescent during the first trimester, recommended hematocrit values are >36% and hemoglobin values are >12.0 g/dL. Throughout the rest of pregnancy desirable hematocrit values are >33% and hemoglobin values are >11.0 g/dL (9). In blacks, normal hemoglobin levels may be 1.0 g/dL less than the recommended values (9). The hematocrit is the percentage of the red cells in a volume of whole blood and is used to diagnose iron deficiency anemia. Hemoglobin is a more direct measure of iron deficiency than hematocrit. The significant time effect with both the hematocrit and hemoglobin values for both groups between the post education and post delivery period could be due to the hemodilution of the blood during pregnancy and/or a decrease in iron requirements after delivery. Increased post delivery serum albumin values support the increases in both hematocrit and hemoglobin values from post education to post delivery as being due to blood hemodilution (Table 2). Stroble, Vaughn, Manore and Spicher (43) assessed pregnant adolescents during the second trimester and found that erythrocyte counts ($P < 0.001$), hemoglobin ($P < 0.001$), hematocrit ($P < 0.001$) and serum B_{12} levels ($P < 0.05$) were significantly lower than non-pregnant control subjects. Then, during the post-partum assessment there was a significant increase compared to the third trimester for all parameters ($P < 0.05$) due to normal physiological adjustments of pregnancy. The initial incidence of anemia among participants in this study coincides with reports in the literature. Hemoglobin values < 11.0 g/dL were identified for two different participants both initially and at post delivery while hemoblobin values < 11.0 g/dL were identified for eight participants (five in the ERIB group and three in the HAHB group) for the post education data collection. In a study of 99 low-income pregnant adolescents, 59% of the sample were anemic prior to participating in nutrition prenatal classes (44).

The protein which binds iron and serves as the iron transport protein in plasma is transferrin. The percent saturation of transferrin (the ratio of serum iron and total iron binding capacity) (TIBC), can be used to assess iron deficiency. In pregnancy, a percent saturation of < 15% is the value used to indicate anemia (9). Baseline values for TIBC and transferrin saturation indicated that anemia was not a major problem for the participants in either group but data are limited in terms of standards for pregnant adolescents.

The intracellular iron storage protein indicating iron reserves is serum ferritin which is a sensitive and specific indicator of iron deficiency anemia. Serum ferritin was not assessed in this study and one limitation was that pregnant adolescent participants in the education programs were at different times in their pregnancy. In a study of 72 medically indigent white and black women with a mean age of 16 years, the use of a multivitamin/multimineral supplement with iron that would maintain adequate hematologic values as well as maternal iron stores during pregnancy and through 12 weeks postpartum was evaluated. Both the treatment and control groups showed the lowest mean serum iron at 32 weeks. The group taking the iron supplement decreased by 6% and the non-iron treated group decreased by 26%. Serum ferritin levels of the treated group were statistically higher throughout pregnancy. By 12 weeks postpartum both groups returned to baseline levels (15).

Routine prenatal monitoring of hematocrit and hemoglobin values is a preventive measure to detect iron deficiency anemia. Multiple parameters of iron status should be assessed (45). Although a daily supplement of 30 mg of ferrous iron is recommended during the second and third trimesters, the recommended dose is increased to 60 to 120 mg per day if iron deficiency anemia is diagnosed during pregnancy (8). The supplement should not be taken with milk, tea, or coffee and preferably it should be taken between meals (3).

Mean serum glucose was within the normal range for both education groups at all time periods (Table 2) (but 10 individuals were above and 14 individuals were below the normal range at some time period). There was no significant interaction between program or time (pre to post education), and no significant time main effect for glucose; however, there was a significant main effect due to time (post education to post delivery). The mean glycosylated hemoglobin to assess long term glucose control was within the normal range of 4 to 8% for all individuals within each time period. There was no significant interaction between program and time and no signficant time main effect from either pre to post education, or from post education to post delivery for glycosylated hemoglobin. There was no significant interaction between program and time (pre to post education) for fructosamine; however, there was a significant time main effect (pre to post education) ($P<0.05$). The mean fructosamine values tended to be higher than the recommended normal values which could be an indication of prolonged hyperglycemia. However, a reference range is not available specific to pregnant adolescents. The advantage of this method to monitor glucose status over GHb is the shorter half-life of serum proteins (average 17 days) compared to the average of 60 days for hemoglobin (46). Post delivery fructosamine was not analyzed. There was a significant correlation between the post education glycosylated hemoglobin and fructosamine values ($r=0.34$; $P=0.05$).

For insulin there was no significant interaction between program and time (pre to post education) and no significant time main effect; however, there was a significant time main effect (post education to post delivery) for both program groups ($P<0.05$). Insulin was greater than normal during pregnancy compared to post delivery which was within normal fasting values. Comparable insulin values were reported in a study of Pima Indian women during pregnancy without non-insulin-dependent diabetes (47).

The post education serum glucose and insulin values for all participants were significantly correlated ($r=0.49$; $P=0.004$). Increased insulin resistance and decreased glucose levels during pregnancy reflect the normal physiological changes that occur during pregnancy (9,30,31). Furthermore, hyperinsulinemia and insulin resistance may be the mechanism associated with maintaining adequate glucose stores because there is speculation of competition for nutrients between young still growing mothers and the fetus (3,48).

Dietary Intake

Table 3 identifies the mean percent of Recommended Dietary Allowances (RDAs) for pregnant adolescents for calories, protein, iron and six other nutrients. The mean percent distribution less than, or at least 67% of the RDA is also included. There was a significant interaction between program and time (pre to post education) ($P<0.05$); with increasing iron intake between pre and post education for participants in the HAHB group.

A significant main effect due to time (between post education and post delivery) was observed for decreased intakes of vitamin A, vitamin B_{12}, calcium, phosphorus and potassium; and increased intakes of folate and iron for both education groups.

The mean percent distribution of nutrients indicates that more than one-half of the sample had intakes below 67% of the RDA for calories, folate, iron, zinc and calcium for at least one of the three dietary recalls. The nutrition score based on initial dietary intakes, indicates a range of 12.4 to 15.4 for both groups (Table 3). However,

Table 3
Pre, post and follow-up dietary intake data from 24-hour food recall form[a]

	Eating right is basic (ERIB) nutrition education (n=14)		Have a healthy baby (HAHB) nutrition education (n=18) [b]	
24-hour food recall form Nutrient	**% RDA[c]**	**% RDA Distribution[d] <67% ≥ 67%**	**% RDA[c]**	**% RDA Distribution[d] < 67% ≥ 67%**
Calories				
Pre nutrition education	66.9	7 (50%) 7 (50%)	79.6	4 (24%) 13 (77%)
Post nutrition education	61.1	8 (57%) 6 (43%)	77.2	4 (24%) 13 (77%)
Post delivery	64.1	12 (86%) 2 (14%)	80.9	10 (56%) 8 (44%)
Protein				
Pre nutrition education	115.6	2 (14%) 12 (86%)	136.7	1 (6%) 16 (94%)
Post nutrition education	106.2	2 (14%) 12 (86%)	139.5	0 (0%) 17 (100%)
Post delivery	83.0	7 (50%) 7 (50%)	164.4	0 (0%) 18 (100%)
Vitamin B_6				
Pre nutrition education	62.1	10 (71%) 4 (29%)	91.8	4 (24%) 13 (77%)
Post nutrition education	55.4	12 (86%) 2 (14%)	99.9	2 (12%) 15 (88%)
Post delivery	63.7	7 (50%) 7 (50%)	104.3	3 (17%) 15 (83%)
Vitamin B_{12}[e,f]				
Pre nutrition education	158.6	2 (14%) 12 (86%)	230.1	1 (6%) 16 (94%)
Post nutrition education	167.1	0 (0%) 14 (100%)	283.3	0 (0%) 17 (100%)
Post delivery	106.1	5 (36%) 9 (64%)	197.7	1 (6%) 17 (94%)
Folate[e,g]				
Pre nutrition education	59.9	10 (71%) 4 (29%)	75.2	9 (53%) 8 (47%)
Post nutrition education	49.9	10 (71%) 4 (29%)	69.2	9 (53%) 8 (47%)
Post delivery	78.7	7 (50%) 7 (50%)	115.2	9 (50%) 9 (50%)
Vitamin A[e,f]				
Pre nutrition education	73.8	9 (64%) 5 (36%)	123.8	1 (6%) 16 (94%)
Post nutrition education	79.1	7 (50%) 7 (50%)	159.6	2 (12%) 15 (88%)
Post delivery	39.4	11 (79%) 3 (21%)	93.8	7 (39%) 11 (61%)
Vitamin C				
Pre nutrition education	79.6	9 (64%) 5 (36%)	171.4	2 (12%) 15 (88%)
Post nutrition education	118.4	6 (43%) 8 (57%)	143.0	5 (29%) 12 (71%)
Post delivery	86.6	10 (71%) 4 (29%)	135.1	8 (44%) 10 (56%)
Iron[g,h]				
Pre nutrition education	51.0	11 (79%) 3 (21%)	52.1	12 (71%) 5 (29%)
Post nutrition education	38.7	12 (86%) 2 (14%)	67.3	9 (53%) 8 (47%)
Post delivery	61.6	9 (64%) 5 (36%)	97.8	5 (28%) 13 (72%)

Zinc				
Pre nutrition education	69.7	8 (57%) 6 (43%)	67.5	9 (53%) 8 (47%)
Post nutrition education	65.3	8 (57%) 6 (43%)	84.4	4 (24%) 13 (77%)
Post delivery	48.8	12 (86%) 2 (14%)	83.3	8 (44%) 10 (56%)
Calcium[e,f]				
Pre nutrition education	47.5	12 (86%) 2 (14%)	91.1	3 (18%) 14 (82%)
Post nutrition education	58.9	8 (57%) 6 (43%)	93.6	4 (24%) 13 (77%)
Post delivery	36.0	12 (86%) 2 (14%)	68.2	10 (56%) 8 (44%)
Nutrition score[i]				
Pre nutrition education	12.4 ± 2.0		15.4 ± 1.6	
Post nutrition education	15.6 ± 2.0		12.6 ± 2.2	
Post delivery	14.9 ± 2.8		12.1 ± 2.8	

[a] A more detailed summary of dietary intake data is included in Appendix J (Tables 7 and 8).
[b] Pre and post nutrition education 24-hour recall based on 17 dietary recalls.
[c] N = Percent of Recommended Dietary Allowances (RDA).
[d] N = Percent distribution < or ≥ 67% of the RDA.
[e] P value determined by analysis of variance where education group was the among subjects independent variable and pre-post test was the within subjects independent variable.
[f] Significant main effect was due to time from post education to post delivery. Indicates decreased intakes of vitamin B_{12} (P=0.007), vitamin A (P=0.0005), and calcium (P=0.01) for both education programs.
[g] Significant main effect was due to time from post education to post delivery. Indicates increased intakes of folate (P=0.003) and iron (P=0.003) for both education programs.
[h] Indicates significant (P=0.02) interaction between program and time pre to post education. The HAHB program showed significant (P=0.02) increases in iron intake.
[i] Nutrition score is based on initial calories, protein, vitamin B_6, folate, vitamin A, vitamin C, iron, zinc and calcium intakes being ≥ 67% of the RDA = 2 (18 maximum; 9 minimum).

the initial nutrition score was significantly lower (P=0.0001) for the ERIB group (data not shown). There was no interaction between program and time on nutrition score and no significant main effect due to time on nutrition score. Educational level was the only socioeconomic variable which had a significant effect on the nutrition score (p=0.0003). Higher scores were evident at the tenth grade and college freshmen levels. More than one-half of the sample of both education groups had calorie intakes below 67% of the RDA after delivery. A study of 108 female adolescents ages 15 to 18 in Idaho reported that 58% of the respondents were below 67% of the RDA for energy based on one 24-Hour diet recall (40). Pregnant teenagers attending a teen obstetric clinic, or one of four education programs reported mean intakes of all calculated nutrients exceeded the RDA except for iron (49). However, iron, zinc and folate intakes of pregnant adolescents (3), and pregnant and lactating women (50) have consistently been reported to be substantially less than the RDA (8).

The data collected from the Food Frequency Form identifies the number of times foods are eaten during the week from each of the five food groups and the "other" category. From the total number of servings per week, the daily average from each group was calculated in Table 4. The initial food frequency data show that the pregnant adolescents in both nutrition education programs were not meeting the recommended number of servings for the milk, vegetable and bread/cereal groups according to the Food Guide Pyramid for pregnant adolescents (3,7). There was a near significant interaction between program and time for average number of fruit servings

Table 4
Pre, post and follow-up dietary intake data from food frequency form[a]

	Eating right is basic (ERIB) nutrition education (n=14)			Have a healthy baby (HAHB) nutrition education (n=18)	
Food frequency form	**Servings (number per week)**	**Daily average (number of servings)**		**Servings (number per week)**	**Daily average (number of servings)**
Milk					
Pre nutrition education	17.6	2.6		19.2	2.8
Post nutrition education	19.2	2.9		22.7	3.3
Post delivery	12.6	1.8		17.3	2.6
P value [a,b]			0.02		
Vegetable					
Pre nutrition education	17.3	2.5		13.1	2.0
Post nutrition education	13.6	2.0		13.9	2.2
Post delivery	8.7	1.1		12.0	1.7
P value [a,b]			0.01		
Fruit					
Pre nutrition education	15.7	2.3		15.2	2.3
Post nutrition education	13.6	2.0		17.5	2.5
Post delivery	13.0	1.7		12.3	1.7
Bread/Cereal					
Pre nutrition education	30.9	4.4		34.4	5.1
Post nutrition education	25.4	3.6		34.2	4.8
Post delivery	23.1	3.4		28.8	4.1
Meat/Protein					
Pre nutrition education	20.9	3.0		23.4	3.3
Post nutrition education	16.8	2.5		21.9	3.2
Post delivery	16.6	2.4		17.5	2.5
Other					
Pre nutrition education	38.6	5.6		47.1	6.4
Post nutrition education	32.6	4.5		33.0	4.8
Post delivery	29.9	4.3		29.9	4.3
P value [a,c]			0.02		

[a] P value determined by analysis of variance where education group was the among subjects independent variable and pre-post test was the within subjects independent variable.
[b] Significant main effect was due to time from post education to post delivery.
[c] Significant main effect was due to time from pre to post education.

(P=0.08). There was a significant main effect due to time (pre to post education) indicating a significant decrease ($P<0.02$) in average servings from the "other" food group for participants in both education programs.

Significant differences also occurred between post education and post delivery. A significant main effect due to time (post education to post delivery) was observed for both programs for the decreased average number of servings from the dairy and vegetable groups. Decreased dietary intake could be due to concern with losing the weight gained during pregnancy and/or to being less conscientious about eating a nutritious diet for themselves compared to pregnancy.

Results of the post education food frequency questionnaire indicated a decrease in the number of daily servings in the "other" group. Foods in the "other" group included soda and chips. Decreased intakes of major food groups including the dairy and vegetable groups were noted for both education groups after pregnancy. This could be an indication that adolescents are cutting back on total calories and important nutrients because they are concerned about losing the weight gained during pregnancy. Decreased intakes should be a concern for nutrition educators because pregnant adolescents in each of the education groups were not meeting the recommended number of servings for the milk, vegetable and bread/cereal groups prior to their nutrition education participation. A dietary assessment of pregnant adolescents reported adequate consumption of less than two food groups daily. At least two low nutrient dense foods from the "other" group were consumed daily by 50% of the 99 subjects (44). Skinner and Carruth (51) reported that adolescents increased their consumption of breads/cereals, candy/chocolate, desserts, potatoes and vegetables during pregnancy. The recommended amounts of all food groups except dark green vegetables were consumed by pregnant teenagers attending nutrition education classes (49). Pregnant and lactating women were consuming less than recommended amounts of milk, vegetable, fruit and meat/protein food groups (50).

Vitamin and/or mineral prenatal supplements were taken by more than 75% of the pregnant adolescents (15 or 83% in the HAHB group and 11 or 79% in the ERIB group) prior to participating in both nutrition education programs. Starch, plaster and dirt consumption were not identified by any of the participants. Ice was consumed by three participants in the special education program and four participants in the ERIB education program (data not shown; see Appendix J (Table 9) for a summary of Eating Habits). Pica refers to abnormal regular cravings and ingestion of inappropriate substances which may or may not be foods (9,52). Estimates from other studies for practicing pica were 5 to 10% among 99 pregnant adolescents which included the consumption of clay, diet, matches, hair spray, cigarette butts and ashes (44). Ice consumption has also been reported among low income pregnant adolescents (44). The etiology of pica may be related to iron deficiency anemia, although pica was not reported in this study (9,52). Ice consumption was the most prevalent finding.

Relationship Between Diet and Blood Parameters

The initial nutrition score was positively correlated ($r=0.43$; $P=0.03$) with initial serum iron for all participants. Also, there was a negative trend toward significance for initial serum glucose and the initial nutrition score ($r=-0.31$; $P=0.09$). Increased hematocrit and hemoglobin values after delivery could be due to increased iron intakes through use of foods provided by the WIC program (19). Iron deficiency anemia diagnosed through the assessment of ferritin but not hemoglobin was associated with decreased iron and calorie intakes among pregnant adolescents (14,18).

IMPLICATIONS FOR NUTRITION EDUCATORS

Teenagers need a positive, supportive as well as educational atmosphere for active learning with positive reinforcement (44) which EFNEP paraprofessionals can provide (32-35). Because the hematologic parameters measured in this study did initially identify iron deficiency anemia as a problem among 25% of the pregnant adolescent participants, nutrition education programs for pregnant adolescents can address the normal physiological changes in blood volume to demonstrate preventive measures of iron deficiency anemia. For example, red colored water of different intensities can be used to show "normal blood" and "anemic blood" (9). An awareness of GDM can also be discussed stressing the importance of avoiding excessive weight gain (9). Nutrition education for pregnant adolescents needs to address the importance of iron rich foods and the role of iron in the body during pregnancy, and the postpartum period in preventing iron deficiency anemia and maintaining iron stores for the mother and fetus. Improvements in iron were evident for participants receiving the special education program and improvements in iron and folate were noted for both programs after delivery. However, the dietary intakes did not meet recommended requirements for all food groups or nutrients reported. Nutrition education for pregnant adolescents should stress the importance of a well-balanced diet. Information on meeting the recommendations of the Food Guide Pyramid for pregnant adolescents needs to emphasize the milk, vegetable, and bread/cereal groups. Foods high in ascorbic acid and meat to enhance the absorption of iron should be encouraged. Rich food sources of calcium, vitamin A, vitamin B_{12}, vitamin D, phosphorus and potassium should be stressed. Use of WIC foods should be encouraged both during pregnancy and postpartum (19). An awareness of pica and appropriate use of vitamin-mineral supplements is also important. Supplements are not intended to replace a well balanced diet. Nutritious alternatives to "empty calorie" foods in the "other" group need to be part of the nutrition education program. Activities such as reading food labels and using test tubes depicting the amount of sugar and fat in foods commonly consumed by adolescents can be used as visual aids (9). This study identifies the need to further assess postpartum dietary intakes of pregnant adolescents.

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CHAPTER VII

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The purpose of this research was to evaluate the effects of two nutrition education programs on nutrition knowledge, maternal dietary intake, beliefs and selected health parameters of pregnant adolescents. The selected health parameters included anthropometric measurements of height and weight to determine body mass index (BMI), mid-arm circumference and triceps fatfold thickness to calculate upper mid-arm muscle area and upper arm fat area, prepregnancy weight, prenatal weight gain and blood pressure. Biochemical measurements included hematocrit, hemoglobin, serum transferrin, total iron-binding capacity (TIBC), serum iron, transferrin saturation, serum glucose, glycosylated hemoglobin, serum fructosamine, and serum insulin. Birth outcomes documented included live births, evidence of birth complications, birth weight, length and infant feeding patterns.

The independent variable was the type of nutrition education program (the regular EFNEP nutrition education program for adults versus one specifically designed for the pregnant adolescent). Nutrition knowledge, dietary intake, beliefs, and selected health parameters were the dependent variables.

Thirty two pregnant adolescents between 14 and 19 years participated in one of the eight-week nutrition education programs and the three data collection days. Data were collected prior to and following the eight-week education programs and at least one month following birth of the infant. The two nutrition education programs included the regular adult EFNEP curriculum "Eating Right Is Basic" (ERIB) and a curriculum especially designed for pregnant adolescents "Have A Healthy Baby" (HAHB). Fourteen adolescents participated in the ERIB group and 18 participated in the HAHB group. Twelve trained paraprofessionals in nine counties in Oklahoma participated in the study. Sixty-four pregnant adolescents initially began the study and 43 pregnant adolescents completed the pre and post knowledge and beliefs data collection. All other data collected was reported on the 32 adolescents who participated in all data collection.

Demographic findings indicated that most of the pregnant adolescents in both groups were at least 18 years of age. Native American was the largest minority group among the predominantly White sample. Health history variables indicated that the pregnant adolescents were seeking health care from either a health clinic or private physician. Most adolescents were visiting the doctor once a month and began their initial visit during the first, second or third month of pregnancy. This was a first pregnancy for most of the participants.

For all pregnant adolescents, there was a significant main effect due to time for knowledge score ($p=0.0001$), indicating value of nutrition education during pregnancy. Results of the initial beliefs score showed that each education group tended to disagree with the factor folklore which was significantly ($p=0.03$) different between programs. Both groups tended to agree most with the factors food cravings: likes and dislikes, and health. The five factors initially identified by all pregnant adolescent participants in both education programs included food cravings: likes and dislikes, folklore, prenatal weight gain, nutrition and cravings, and health. Cravings, folklore, health, and eating for pregnancy were the post factors identified by each education group. Results indicated that nutrition education programs have an effect on nutrition knowledge of pregnant adolescents. However, special attention may need to be given to beliefs about folklore, cravings and health during pregnancy in programs designed for the pregnant adolescent.

There was no significant interaction between programs and time for BMI and weight gain. There was a significant effect due to time for BMI and weight gain. Mean prenatal weight gain was 16 kg and mean birth weight was 3.4 kg for both education groups. Addressing weight issues in nutrition education programs designed for pregnant adolescents is important and needs to be presented in practical terms emphasizing diet, growth and the components of weight gain during pregnancy.

Mean hematologic, glucose and insulin measures were within the normal parameters recommended for adolescent pregnancy. However, 25% of all participants were anemic initially. Mean serum fructosamine was above the recommended range at the pre and post education measurements. There was a significant interaction between program and time (pre to post education) ($p=0.05$) for hematocrit for participants in the ERIB group. There was no significant interaction between program and time (post education to post delivery) for hemoglobin but time did have a significant program main effect ($p<0.0001$) indicating that the increase in hemoglobin for both programs was significant. Significant time main effects were identified for glucose and insulin (post education to post delivery) and fructosamine (pre to post education). Initial food frequency data showed that the milk, vegetable and bread/cereal groups according to the Food Guide Pyramid were limited. The initial dietary intakes of both groups were rated according to a nutrition score based on intakes of at least 67% of the RDA for calories, protein, vitamin B_6, folate, vitamin A, vitamin C, iron, zinc and calcium. The initial nutrition score was significantly ($p=0.0001$) lower for the ERIB group. Both education groups decreased ($p<0.02$) the number of servings from the "other" group indicated by a significant main effect due to time (pre to post education). A significant main effect due to time (post education to post delivery) was observed for both programs for decreased average number of servings from the dairy and vegetable groups. There was a significant interaction between program and time ($p<0.05$) with increasing iron intake between pre and post education for participants in the HAHB group. A significant main effect due to time showed increased folate and iron intakes; and decreased vitamin A, vitamin D, vitamin B_{12}, calcium, phosphorus and potassium for both education groups from post education to post delivery. Post partum data showed a decrease in calories to less than 67% of the RDA for over one-half of the sample for both groups. Use of the Food Guide Pyramid for pregnant adolescents should stress the importance of a balanced diet from all food groups during pregnancy and the post partum period. Nutrition education programs for pregnant adolescents need to address the importance of preventing iron deficiency anemia and explain the importance of screening for gestational diabetes mellitus (GDM) during pregnancy.

Conclusions

The objectives of the study included assessing knowledge, maternal dietary intake, beliefs, and selected health parameters of pregnant adolescents before and after participating in a nutrition education program, and at least one month following birth of the infant. Based on the results of these analyses the following conclusions were reached.

Hypothesis One

There will be no significant effects of socioeconomic factors (age, ethnic group, educational level, size of community, type of social and financial support, or type of medical care) on the pretest of nutrition knowledge and beliefs, on dietary intake, and on eating behaviors of pregnant adolescents. Hypothesis one was rejected for the effects of socioeconomic factors on initial beliefs, dietary intake or eating behavior variables. However, there were no significant effects of socioeconomic factors on the pretest of nutrition knowledge.

The initial beliefs score included five factors as follows: Factor 1-food cravings-likes and dislikes, Factor 2-folklore, Factor 3-prenatal weight gain, Factor 4-nutrition and cravings, and Factor 5-health. There were significant effects of ethnic group on Factor 1 ($p=0.01$) and Factor 3 ($p=0.01$). There was a significant effect of educational level on Factor 3 ($p=0.006$) and a significant effect of size of community on Factor 2 ($p=0.04$). There were significant effects of type of medical care on Factor 2 ($p=0.04$) and Factor 3 ($p=0.007$) while there was a trend toward significance for the effect of type of medical care on Factor 1 ($p=0.06$). Educational level was the only socioeconomic variable which had a significant effect on the nutrition score ($p=0.0003$). Higher scores were evident at the tenth grade and college freshmen levels.

There were significant effects of socioeconomic variables on eating behavior variables. Ethnic group had significant effects on regularity of eating habits ($p=0.02$), and diet pills for weight loss ($p=0.02$). Type of social support had a significant effect on not enough food during the month ($p=0.005$). Type of financial support had significant effects on previous prenatal weight gain ($p=0.0001$), and expected prenatal weight gain ($p=0.0001$). Type of medical care had significant effects on use of vitamin mineral supplements ($p=0.0001$), diet pills for weight loss ($p=0.02$), and not enough food during the month ($p=0.04$).

<u>Hypothesis Two</u>

There will be no significant effects of socioeconomic factors (age, ethnic group, educational level, size of community, type of social or financial support, or type of medical care) on initial iron and glucose parameters of pregnant adolescents. Hypothesis two was rejected for effects of size of community on hematocrit or insulin. However, there were no significant effects of socioeconomic factors on hemoglobin, serum transferrin, TIBC, serum iron, transferrin saturation, serum glucose, or serum fructosamine.

The iron parameter hematocrit was significantly different by size of community ($p=0.0002$). Insulin was also significantly different by size of community ($p=0.0001$). Both parameters were higher for suburb of a city over 50,000 compared to towns under 10,000 and rural areas.

Hypothesis Three

There will be no significant relationship between initial BMI, prenatal weight gain, iron and glucose parameters, and the pretest of nutrition knowledge and beliefs, dietary intake, and eating behaviors of pregnant adolescents. Hypothesis three was rejected because initial BMI or prenatal weight gain and eating behaviors were correlated. Likewise, iron and glucose parameters were correlated with initial beliefs, eating behaviors and dietary intake. However, initial BMI and prenatal weight gain were not correlated with the other dependent variables and iron or glucose parameters were not correlated with initial knowledge.

There were no significant correlations between initial BMI and knowledge or beliefs. There was no significant correlation between initial BMI and the nutrition score. There were significant positive correlations for initial BMI and prepregnancy weight ($r=0.74$; $p=0.0001$), and participants' expected prenatal weight gain ($r=0.61$; $p=0.002$).

There was no significant correlation between prenatal weight gain and initial knowledge or beliefs. There was no significant correlation between prenatal weight gain and the nutrition score.

There were no relationships identified between the iron parameters and initial knowledge. There was a negative significant relationship between Factor 1 of the beliefs score, and serum transferrin ($r=-0.40$; $p=0.05$), and TIBC ($r=-0.40$; $p=0.05$). There was a significant relationship ($r=0.43$; $p=0.05$) between transferrin saturation and Factor 2 of the beliefs score. The nutrition score was positively correlated ($r=0.41$; $p=0.04$) with initial serum iron. There were significant positive relationships between prepregnancy weight and serum transferrin (r=0.46; p=0.01) and TIBC (r=0.46; p=0.01). There were significant negative relationships between prepregnancy weight, and transferrin saturation (r=-0.40; p=0.05) and albumin (r=-0.37; p=0.04).

There were no relationships identified for the glucose parameters and initial knowledge. There was a significant negative relationship between insulin, and Factor 1 (r=-0.49; p=0.008) and Factor 3 (r=-0.44; p=0.02) of the beliefs score. There was a significant negative relationship between the nutrition score and serum glucose (r=-0.38; p=0.04). There were significant negative relationships between serum fructosamine and prepregnancy weight (r=-0.37; p=0.04) and expected weight gain (r=-0.43; p=0.04).

Hypothesis Four

There will be no significant effects of socioeconomic factors (age, ethnic group, educational level, size of community, type of social or financial support, or type of medical care) or type of nutrition education program on the pregnant adolescents' change in knowledge score. There were no significant interactions between any of the socioeconomic factors, age, ethnic group, size of community, type of social or financial support, or type of medical care, or program and time on the pregnant adolescents' knowledge scores. However, there was a significant interaction between educational level and time from pre to post nutrition education (p=0.04) for increase in knowledge. This significant interaction identified the tenth grade level showing higher knowledge scores compared to other grade levels.

Hypothesis Five

There will be no significant difference in nutrition knowledge, anthropometric parameters, prenatal weight gain, dietary intake, or iron and glucose parameters due to type of nutrition education program. Hypothesis five was rejected for diastolic blood pressure, iron intake, and hematocrit. However, hypothesis five was not rejected for knowledge, anthropometric measures, prenatal weight gain, the nutrition score, food groups, nutrients other than iron, iron parameters other than hematocrit, and all of the glucose parameters.

There was no significant interaction between program and time for knowledge scores, anthropometric parameters of height, weight, BMI, mid-arm circumference, triceps skinfold thickness, MAMA or AFA. There was a significant interaction between program and time for diastolic blood pressure ($p=0.04$). There was no significant interaction between program and time for weight gain or BMI from pre to post education and no significant difference between programs for prenatal weight gain. Pre to post education nutrient differences were significant for iron ($p<0.05$) for the HAHB group indicated by a program and time interaction. There was a significant interaction between program and time (pre to post education) for hematocrit with a significant decrease in the ERIB group.

Hypothesis Six

There will be no significant difference in nutrition knowledge or dietary intake before and after each nutrition education program. Hypothesis six was not rejected for knowledge for either program indicated by a significant ($p=0.0001$) change in knowledge score. Hypothesis six was rejected for increased iron intakes for the HAHB group from pre to post education; and from post education to post delivery for increased folate and iron intakes and decreased vitamin A, vitamin D, vitamin B_{12}, calcium, phosphorus, and potassium for both education groups. Likewise, hypothesis six was rejected for decreased number of servings from the "other" group for both programs. However, hypothesis six was not rejected for all other nutrients or food groups, or the nutrition score.

Hypothesis Seven

There will be no significant effect of nutrition education on change in anthropometric, iron and glucose parameters, and blood pressure among pregnant adolescents in either program. Hypothesis seven was rejected for weight and BMI from pre to post education for both the ERIB and HAHB groups. However, hypothesis seven was not rejected for the other anthropometric variables and blood parameters for iron, glucose and insulin with the exception of post education to post delivery for hematocrit, hemoglobin, glucose, and insulin and pre to post education for fructosamine. Hypothesis seven was rejected for blood pressure results of the HAHB group.

From pre to post education there were significant increases and from post education to post delivery there were significant decreases ($p \leq 0.05$) for BMI and weight in both groups. Differences between MAMA or AFA were not significant for either group or time period. Initially, 25% of the sample were anemic. Mean serum fructosamine values were above the normal range from pre to post education. Otherwise, hematologic, glucose and insulin measures were within the normal parameters recommended for adolescent pregnancy. Both hematocrit and hemoglobin significantly ($p < 0.0001$) increased between the post education and post delivery periods for both groups due to the normal hemodilution of the blood during pregnancy. The time main effect for glucose was significant from post education to post delivery and there was a significant ($p = 0.05$) time main effect for fructosamine from pre to post education. There was a significant ($p < 0.05$) time main effect for insulin from post education to post delivery for both program groups. Pre to post education systolic blood pressure readings for the HAHB group increased significantly ($p = 0.05$) while the decrease from post education to post delivery readings had a p value of 0.06 in this group. Blood pressure measurements were not significantly different within the ERIB group.

Conclusions based on the hypotheses of this study can be summarized in terms of initial characteristics of participants, differences between nutrition education programs, and changes due to each type of nutrition education program. Initial characteristics of the participants effected initial beliefs, dietary intake and eating behaviors, and not the pretest of nutrition knowledge. Ethnic group affected the belief factors food cravings-likes and dislikes, and prenatal weight gain. Size of community affected the belief factor folklore. Type of medical care was related to the factors folklore, prenatal weight gain and health. The nutrition score was significantly higher for participants in the tenth grade and those who were college freshmen. Eating behavior variables were affected by some of the socioeconomic variables including those related to prenatal weight gain, weight control, and not enough food during the month. Ethnic group affected regularity of eating habits. Blacks responded positively to taking diet pills for weight loss compared to White or Native American participants.

Medical care from a health clinic or private physician affected use of vitamin mineral supplements.

Few initial iron and glucose parameters were significantly affected by socioeconomic factors. Size of community had a significant effect on hematocrit and insulin. Differences by community could be related to availability of health services and/or eating establishments in different areas e.g., urban versus rural.

There were relationships identified between initial BMI or prenatal weight gain and eating behaviors related to weight. The factors food cravings-likes and dislikes, folklore and prenatal weight gain were related to the iron parameters of serum transferrin, TIBC and transferrin saturation as well as insulin. Although serum glucose showed a negative trend toward significance with the nutrition score, serum iron was the only relationship positively identified with the nutrition score. Eating behavior variables related to weight correlated to iron variables. Serum fructosamine was the most significant of the glucose parameters in relation to eating behaviors related to weight.

The only socioeconomic factor showing an effect on increase in knowledge score was educational level. No significant effects were identified for age, ethnic group, size of community, type of social or financial support or type of medical care. The significant interaction between change in knowledge score and educational level showed optimal effects for participants in the tenth grade. The differences according to educational level could be related to availability of prenatal services and education in different areas e.g., urban versus rural. Age could also be a factor in the participants' readiness and acceptance for a nutrition education program during pregnancy.

There were no significant interactions between program and time for knowledge, anthropometric parameters or prenatal weight gain. There was a significant interaction between program and time for diastolic blood pressure ($p=0.04$) which was lower for the HAHB group. There was a significant program and time interaction ($p<0.05$) for increased iron intakes for the HAHB group from pre to post education. There was a significant interaction between program and time for hematocrit for participants in the ERIB group.

The HAHB program addresses the knowledge statement topics of food and nutrition, substance use, and complications and weight gain. These could have influenced the significant change in knowledge scores of the HAHB group. The paraprofessional could also have influenced this change in knowledge scores.

Significant nutrient intake changes occurred for iron for the HAHB group from pre to post education and for folate and iron for both groups from post education to post delivery. The mean percent distribution of nutrients indicated that approximately one-half of the sample had intakes below 67% of the RDA for calories, calcium, folate, copper, iron, zinc, and manganese for at least one of the three dietary recalls. Both groups had intakes of at least 67% of the RDA for most of the nine nutrients (calories, protein, vitamin B_6, folate, vitamin A, vitamin C, iron, zinc, and calcium) comprising the initial nutrition score. However, initial food frequency data showed that participants in both programs were not meeting the recommended number of servings for the milk, vegetable and bread/cereal groups. Decreases were noted for foods from the "other" group for both groups from pre to post nutrition education. Approximately one-half of the sample of both education groups had calorie intakes below 67% of the

RDA after delivery and decreased average number of servings from the dairy and vegetable food groups. Nutrient decreases were identified for calcium, vitamin A, vitamin D, vitamin B_{12}, phosphorus and potassium after delivery for both groups. This indicates that the habit of cutting back on calories and/or nutrient intake should be a concern for nutrition educators of pregnant adolescents.

Significant effects of the nutrition education programs were identified for weight and BMI during both time periods and for both education groups. The normal hemodilution of the blood during pregnancy was a factor affecting the significant changes in hematocrit and hemoglobin for both groups between post education and post delivery. Significant changes in blood pressure were identified for the HAHB group which is not clear whether or not these directly related to the program. The normal changes in weight and blood volume during pregnancy were not a direct result of the nutrition education programs. Perhaps eight weeks of education during pregnancy is not adequate to assess changes in anthropometric and blood parameters. Furthermore, there were differences among participants in each group including month of pregnancy, GA and chronological age.

Recommendations

The following recommendations for future research were developed from this study.

Although the sample size for each minority group of pregnant adolescents represented in this study was small, further investigation of the minority groups represented e.g., Native American and Black need to be assessed in terms of their effect on beliefs about nutrition during pregnancy. Other socioeconomic factors of the pregnant adolescents which need further study are differences in size of community and type of medical care. Most of the participants in this study tended to be from rural areas.

Furthermore, did the paraprofessionals influence the beliefs of the pregnant adolescents? This sample of paraprofessionals included a mixture of those working only with pregnant adolescents and those who worked with the traditional EFNEP clients and pregnant adolescents. This could make a difference in their teaching style and/or approach to working with clients of a specific group, e.g., pregnant adolescents. Professionals cannot assume that paraprofessionals can adapt the regular curriculum to fit the needs of pregnant adolescents without specialized materials and training. Further research is necessary to determine whether the paraprofessionals' age, cultural background or experience as a pregnant adolescent has an effect on their rapport, beliefs, and/or knowledge of the pregnant adolescent.

The appropriateness of culturally adapting the specialized curriculum for pregnant adolescents needs to be addressed with the Native American population particularly in Oklahoma. Further specialization may be necessary specific to individual tribes. The Beliefs and Knowledge Instrument used in this study could be adapted according to Native American beliefs and customs particularly pertinent to folklore beliefs.

Both the paraprofessionals' rapport and incentives were important factors contributing to the participants following through with the education and data collection. Perhaps eight weeks during pregnancy is not enough time to assess anthropometric and blood parameters. Twelve weeks may be a better time period to assess change in these parameters and still have the adolescent follow through with the support of the paraprofessional. Stratified sampling could be used to control for different times during pregnancy if this study were conducted with a larger sample.

A marker of maturation for pregnancy and adolescence needs further investigation to detect differences in growth and nutritional status for use in nutritional assessment studies of the pregnant adolescent population. This parameter could be used to study relationships between dietary intake and blood parameters. The effects of maturation during pregnancy can also be used to further assess adequate weight gain for the pregnant adolescent.

Serum ferritin was not assessed in this study and may be a better long term assessment of iron status. Further assessment is recommended for the iron parameters used in this study and eating behaviors related to weight. Further assessment is recommended for serum fructosamine and the behaviors related to food availability and cravings as well as glycosylated hemoglobin and behaviors related to weight. Correlations of these two glucose parameters with common eating behaviors could be studied.

Further assessment of dietary intakes of pregnant adolescents would be beneficial. The nutrients which were less than 67% of the RDA for pregnant adolescents in this study including calcium, folate, copper, iron, zinc and manganese need further study. Use of a more defined nutrition score needs to be assessed. Post pregnancy dietary intakes need to be compared to prenatal dietary intakes since the adolescents in this study showed a calorie decrease to less than 67% of the RDA for over one-half of the sample for both groups and significant decreases in calcium, vitamin B_{12}, vitamin D, vitamin A, phosphorus, and potassium for both groups.

Further investigation of the effect of specific nutrition education materials on dietary intake during adolescent pregnancy could be studied for specific nutrients and/or food groups. In this study the HAHB program showed improvement in iron and folate intakes.

Conclusions from hypothesis four indicate there is an optimal grade level to implement nutrition education programs for pregnant adolescents. Furthermore, tenth grade and college freshmen educational levels had a significant effect on the nutrition score. Further assessment of grade level and age could be evaluated.

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APPENDIXES

APPENDIX A

SOLICITATION FORMS FOR PREGNANT ADOLESCENTS

AND CONSENT FORMS

FOR PREGNANT ADOLESCENTS AND PARAPROFESSIONALS

(Solicitation Form) #1

HELP WANTED

WHO: Pregnant Teens 11 through 19

WHAT: Learn about nutrition for you and your baby.

WHY: For nutrition education research program for pregnant teens.

BENEFITS:

* Nutrition education materials for pregnant teens and baby
* Dietary Analysis
* Regular Weight Monitoring
* Regular Blood Pressure Monitoring
* Nutrient Analysis of Blood

REWARDS: To receive $10.00 for each of three data collection days, a total of $30.00 for participating in the study.

CONTACT: (Local home economist or Nutrition education assistant)
(Local nutritionist)
(Local physician)

Sponsored by the Expanded Food and Nutrition Education Program at Oklahoma State University; Stillwater, OK.

(Solicitation Form) #2

HELP WANTED

WHO: Pregnant teens 11 through 19 years

WHAT: Human nutrition education research project.

WHY: Nutrition is important for the teenager. It is especially important for the pregnant teenager and her baby. This project will evaluate the effects of a nutrition education program on nutrition knowledge, dietary intake, beliefs and selected health parameters for EFNEP and Native American pregnant teenagers.

HOW: Measurements will include height, weight (before and during pregnancy), percent body fat and blood pressure. A small blood sample will be analyzed for blood sugar, iron and other nutrients. Diet will be analyzed and a nutrition knowledge and food beliefs survey will be completed. All measurements will be taken before and after the eight week educational program. A one month follow-up after the baby is born will include the baby's length, weight and feeding patterns. The mother's dietary intake, height, weight and blood sugar and iron will again be evaluated.

WHEN: To begin December, 1993 through January 1994

WHERE: County or Tribal WIC Clinic and/or Health Dept.

BENEFITS: The nutrition education program will help the pregnant teenager take care of herself and her baby. Nutrition and health information will be provided. Blood analysis will make sure the pregnant teenager is healthy during her pregnancy. Reports on dietary intakes and blood analysis will be provided.

REWARDS: Each participant will receive a total of $30, $10.00 for each data collection day: one before and one after the education program as well as a day one month following pregnancy. All participants will receive breakfast on the three days of data collection. In addition, all participants will receive all educational materials from the program.

FOR FURTHER INFORMATION CONTACT:

Donna-Jean Hunt, MS, RD/LD
EFNEP Nutritionist
Dept. of Nutritional Sciences
HES 413
405-744-9941

*This project has been reviewed and approved by the Institutional Review Board at Oklahoma State University for research involving human subjects.

CONSENT FORM FOR PREGNANT TEENS

I, ______________________________, hereby give consent for my participation in the project entitled, "Effect of Nutrition Education Programs On Nutrition Knowledge, Dietary Intake, Beliefs and Selected Health Parameters Pregnant Adolescents". The study consists of three data collection days and eight nutrition education classes that will be conducted for one hour each week for eight weeks. Two data collection days will be within one week before and one week following the nutrition education classes. The third data collection day will be within one month following delivery of my baby. I authorize Donna-Jean Hunt, or associates or assistants of her choosing, to perform the following procedures as part of this research project:

1. For each of the three data collection days, I will not eat after 10 p.m. the night before or eat breakfast on the day I come to the local health clinic or extension office early in the morning (time and place to be arranged). An experienced nurse or medical technologist will draw a 10 milliliter (approximately 2 teaspoons) blood sample. I understand that slight bruising or discomfort may result from the venipuncture.

2. Also, on the first two data collection days, my height, weight, mid-arm circumference, triceps skinfold and blood pressure measurements will be recorded.

3. On the first day of data collection, I will complete a questionnaire that will supply general information about myself as well as my health history during this pregnancy. I will complete an optional card with my name and address if I wish to receive results of the study.

4. I will attend eight nutrition education classes (one-one hour class per week for eight weeks) conducted by a specially trained paraprofessional in my community. I will be assigned to attend either the regular EFNEP classes or those specifically designed for pregnant teenagers. I will receive the nutrition education materials specifically developed for pregnant teenagers which include nutritional information about pregnancy and feeding infants. If I am in the regular EFNEP classes, I will receive the educational materials at the end of the study instead of during the classes.

5. At the first and last nutrition education class, I will complete three forms: Beliefs and Knowledge About Health and Nutrition During Pregnancy, and a Nutrition History and Food Frequency Questionnaire.

6. During the nutrition education classes I will report my weight taken at the previous clinic visit. Weight gain during pregnancy will be recorded on a form provided.

7. On the final data collection day within one month after my baby is born, I will provide health information on myself and my baby. My height and weight will be

recorded. I will be interviewed about my dietary intake. Because another blood sample will be drawn, I will not be able to eat after 10 p.m. the night before or eat breakfast on the day the blood sample is drawn. I will come to the local health clinic or extension office early in the morning (time and place to be arranged).

8. In addition to the nutrition education materials, I will be provided with breakfast on the days of data collection. Also, I will receive $10.00 for each data collection day, a total of $30.00 for participating in the study.

The purpose of the study is to evaluate the effectiveness of EFNEP materials and the new materials developed for specific groups of pregnant adolescents. Nutrition knowledge, maternal dietary intake, beliefs and selected health parameters will be evaluated.

I understand that participation is voluntary, that information I provide will be kept confidential, that there is no penalty for refusal to participate, and that I am free to withdraw my consent and participation in this project at any time without penalty after notifying the project director.

If there is a problem identified after the blood work or blood pressure measurements are completed, my physician and I will be notified.

I may contact Donna-Jean Hunt at (405) 744-9941 or Barbara Stoecker (405) 744-8289 should I wish further information about the research. I may also contact University Research Services, 001 Life Sciences East, Oklahoma State University, Stillwater, OK 74078, Telephone: (405) 744-5700.

I have read and fully understand the consent form. I sign it freely and voluntarily. A copy has been given to me.

Date: ________________ Time ______________
Signed ____

I certify that I have personally explained all elements of this form to the subject before requesting the subject to sign it.

Signed ____
(project director or authorized representative)

CONSENT FORM FOR PARAPROFESSIONALS

I, ____________________ , hereby give consent for my participation in the project entitled, "Assessment Of Nutrition Knowledge Of Oklahoma Cooperative Extension Service (OCES)-Expanded Food and Nutrition Education Program (EFNEP) Paraprofessionals And Food Beliefs Of Their Pregnant Adolescent Clients (Urban, Rural And Native American)". The study consists of two training days and eight nutrition education classes for pregnant adolescents that will be conducted for one hour each week for eight weeks. Training days will be approximately two weeks before and two weeks following the nutrition education classes which I will be conducting. I authorize Donna-Jean Hunt, or associates or assistants of her choosing, to perform the following procedures as part of this research project:

1. I will attend an initial one-day in-depth training workshop on use of the nutrition education materials designed for pregnant adolescents or the regular nutrition education program for adults. Training will include background information on the risks of adolescent pregnancy.

2. On the initial training day, I will complete a pre and post knowledge questionnaire (Part II of Beliefs and Knowledge About Health and Nutrition During Pregnancy) before and after the training session on the same day. I will complete Part I of the questionnaire (Beliefs and Knowledge About Health and Nutrition During Pregnancy) before the training session. I will also complete these same questionnaires after I have conducted the eight week nutrition education program for pregnant adolescents.

3. On the initial training day, I will be trained to administer data collection forms to be completed by the pregnant adolescents including knowledge and beliefs questionnaire, dietary intake forms and prenatal weight gain chart.

4. After the initial training day, I will conduct a one-hour class per week for eight weeks using the nutrition education program for pregnant adolescents or the adult nutrition education program.

5. I will be provided with a complete set of nutrition education materials to conduct my classes with the pregnant adolescents.

The purpose of the study is to assess the nutrition knowledge of paraprofessionals and the food beliefs about pregnancy of their pregnant adolescent clients. Also, the effectiveness of specially trained paraprofessionals to implement a nutrition education program for pregnant adolescents will be evaluated..

I understand that participation is voluntary, that information I provide will be kept confidential, that there is no penalty for refusal to participate, and that I am free to withdraw my consent and participation in this project at any time without penalty after notifying the project director.

I may contact Donna-Jean Hunt at (405) 744-9941 or Barbara Stoecker (405) 744-8289 should I wish further information about the research. I may also contact University Research Services, 001 Life /Sciences East, Oklahoma State University, Stillwater, OK 74078, Telephone: (405) 744-5700.

I have read and fully understand the consent form. I sign it freely and voluntarily. A copy has been given to me.

Date: ____________________ Time ____________________

Signed ____

I certify that I have personally explained all elements of this form to the subject before requesting the subject to sign it.

Signed ____
(project director or authorized representative)

APPENDIX B

IRB APPROVAL FOR PREGNANT ADOLESCENTS AND PARAPROFESSIONALS

OKLAHOMA STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD
FOR HUMAN SUBJECTS RESEARCH

Date: 1-28-93 **IRB#:** HES-93-015

Proposal Title: EFFECTS OF NUTRITION EDUCATION PROGRAM ON NUTRITION KNOWLEDGE, DIETARY INTAKE, ATTITUDES AND SELECTED HEALTH PARAMETERS FOR EFNEP AND NATIVE AMERICAN PREGNANT ADOLESCENTS

Principal Investigator(s): Barbara Stoecker, Donna-Jean Hunt

Reviewed and Processed as: Expedited

Approval Status Recommended by Reviewer(s): Approved

APPROVAL STATUS PERIOD VALID FOR ONE CALENDAR YEAR AFTER WHICH A CONTINUATION OR RENEWAL REQUEST IS REQUIRED TO BE SUBMITTED FOR BOARD APPROVAL. ANY MODIFICATIONS TO APPROVED PROJECT MUST ALSO BE SUBMITTED FOR APPROVAL.

Comments, Modifications/Conditions for Approval or Reasons for Deferral or Disapproval are as follows:

Modifications received and approved

Signature: Maria L. Tilley
Chair of Institutional Review Board

Date: January 28, 1993

OKLAHOMA STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD
FOR HUMAN SUBJECTS RESEARCH

Date: 03-15-93 **IRB#:** HES-93-023

Proposal Title: ASSESSMENT OF NUTRITION KNOWLEDGE OF OKLAHOMA COOPERATIVE EXTENSION SERVICE (OCES) EXPANDED FOOD AND NUTRITION EDUCATION PROGRAM (EFNEP) PARAPROFESSIONALS AND FOOD BELIEFS OF THEIR PREGNANT ADOLESCENT CLIENTS (RURAL, URBAN OR NATIVE AMERICAN)

Principal Investigator(s): Barbara Stoecker, Donna-Jean Hunt

Reviewed and Processed as: Exempt

Approval Status Recommended by Reviewer(s): Approved

APPROVAL STATUS SUBJECT TO REVIEW BY FULL INSTITUTIONAL REVIEW BOARD AT NEXT MEETING.
APPROVAL STATUS PERIOD VALID FOR ONE CALENDAR YEAR AFTER WHICH A CONTINUATION OR RENEWAL REQUEST IS REQUIRED TO BE SUBMITTED FOR BOARD APPROVAL. ANY MODIFICATIONS TO APPROVED PROJECT MUST ALSO BE SUBMITTED FOR APPROVAL.

Comments, Modifications/Conditions for Approval or Reasons for Deferral or Disapproval are as follows:

Signature: Maria L. Tilley
Chair of Institutional Review Board

Date: March 17, 1993

APPENDIX C

LETTERS OF PERMISSION

THE UNIVERSITY OF TENNESSEE
KNOXVILLE

College of
Human Ecology

Department of
Nutrition

May 31, 1991

Donna-Jean Hunt
400 Squires Street, K-11
Stillwater, Oklahoma 74075

Dear Ms. Hunt:

I am enclosing a copy of the inventory that was used with the professionals to assess regional differences in beliefs expressed by clients to dietitians. The statements were generated by both adolescents and professionals, and you should be able to use them as long as credit is given to the researchers and the Agricultural Experiment Station which funded the research. The research instruments officially belong to the University of Tennessee and written permission is needed. Therefore, by this letter you may use these statements without alteration or adaptation and credit must be given in cases where the statements are used.

Of course, I want to hear you results. We have a large ongoing study of pregnant adolescents and will be reporting other information related to that groups' beliefs. Good luck.

Sincerely,

Betty Ruth Carruth, PhD, RD
Professor of Nutrition

/jtl

1215 West Cumberland Avenue, Room 229 / Knoxville, Tennessee 37996-1900 / (615) 974-5445, 974-3491 / FAX (615) 974-2617

PURDUE UNIVERSITY

DEPARTMENT OF
FOODS AND NUTRITION

July 10, 1992

Donna-Jean Hunt, M.S., R.D./L.D.
EFNEP Nutritionist
Cooperative Extension Service
Oklahoma State University
Home Economics Programs
Stillwater, Oklahoma 74078

Dear Donna-Jean,

I'm happy to tell you we would be very pleased for you to use our Have A Healthy Baby program in you dissertation research! You may also adapt the material to meet the needs of the Oklahoma Native American Tribes.

All I do ask is to be kept informed of how the study goes and be provided with a copy of your results.

One problem we have recently discovered is how hard it is for our staff to take specific food recalls. If amounts of foods are not listed, you cannot have accurate data. You may wish to give strong thought to getting things in detail. That takes time. Our EFNEP P.A.'s are well trained but regular Home Economists have more trouble.

My associate, Donna Vandergraff has had a lot of experience with these food recalls. If you need to call her, the phone number is (317) 743-1890.

Good luck! We've had very positive feedback from many states using the materials.

Sincerely,

Karen L. Konzelmann
EFNEP Program Coordinator
Extension Specialist

KLK:mlm

cc: Donna Vandergraff

1264 STONE HALL • WEST LAFAYETTE, IN 47907-1264 • (317) 494-8228 • FAX (317) 494-0674

UNIVERSITY OF MINNESOTA

Twin Cities Campus

Division of Epidemiology
School of Public Health

Suite 300
1300 South Second Street
Minneapolis, MN 55454-1015

612-624-1818
Fax: 612-624-0315

September 10, 1992

Donna-Jean Hunt, MS, RD/LD
400 Squires Street, Apt. K-11
Stillwater, Oklahoma 74075

Dear Jean:

I am pleased that you have found my publication "Nutrition Management of the Pregnant Adolescent" helpful. You are more than welcome to use or adapt any instruments in the publication. Your dissertation study sounds most interesting and I would enjoy your sharing the results with me. If I can be of further help please contact me at (612) 626-8801.

Sincerely,

Mary

Mary Story, PhD, RD
Associate Professor
Chair, Public Health Nutrition Major

APPENDIX D

BELIEFS AND KNOWLEDGE INSTRUMENTS FOR

PREGNANT ADOLESCENTS AND PARAPROFESSIONALS

Name: ______________________________

Date: ______________________________

County: ______________________________

Program: ______________________________

Pre / Post (Circle One)

Participant No. ______________________________

OFFICE USE ONLY

BELIEFS AND KNOWLEDGE ABOUT HEALTH AND NUTRITION DURING PREGNANCY (FORM C)

Section I: Belief Statements

Directions: Please read each statement and check (√) what you believe is true about health and nutrition during pregnancy. For example, do you agree with the statement "A pregnant woman will lose a tooth with every baby if she doesn't drink milk." If so, check the column, "agree". After reading each statement select the appropriate response.

Belief Statement	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree
A pregnant woman will lose a tooth with every baby if she doesn't drink milk.					
Pregnant women crave foods they need in their diet.					
Beets build red blood during pregnancy.					
A woman should avoid "excessive" weight gain during pregnancy.					
A pregnant woman craves ice because she is not getting enough of certain nutrients in her diet.					
A father who is a drug addict is more likely to produce birth defects.					
Women will crave pickles and ice cream during pregnancy.					
A woman should not eat fish and milk at the same meal during pregnancy.					

Belief Statement	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree
Pregnant women crave dirt when their diets are low in minerals.					
A father with high cholesterol levels is likely to produce a child with heart disease.					
The child of a mother who dislikes meat during pregnancy will also dislike meat.					
Pregnant women need a balance of hot and cold foods in their diet.					
Food cravings during pregnancy will determine the child's likes and dislikes in later life.					
Pregnant women need a balance of fattening and low calorie foods in their diet.					
Whatever a pregnant woman craves, she should eat.					
A pregnant woman should eat more sodium-rich foods and less meats and high-calorie foods to decrease high blood pressure.					
Women eat better when they become pregnant.					
A woman needs double portions during pregnancy since she is now eating for two.					
Pregnant women who crave sweets will have a girl.					
A woman who eats alot of oranges during pregnancy will have a baby who likes oranges later in life.					

Belief Statement	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree
A pregnant woman who eats lots of ice, lacks iron in her blood.					
The baby gets what he/she needs first, the rest goes to the mother.					
Pregnant women crave non-food items such as laundry starch, clay and dirt.					
It doesn't completely matter how much or how little weight is gained during pregnancy.					
If a woman doesn't eat what she craves during pregnancy, when her baby is born it will smack and lick its' lips until given that food.					
"High blood" (high blood pressure) is caused by excess heat during pregnancy.					
Eating strawberries during pregnancy will cause birthmarks on the baby.					
Pregnant women who crave salty or sour foods will have a boy.					
Birth defects are mostly the fault of the mother.					
A woman who dislikes tomatoes during pregnancy will produce a child who dislikes tomatoes.					
Eating lots of sweets during pregnancy produces a more mild manner child than not eating sweets.					

Belief Statement	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree
A pregnant woman should eat as much as she wants because she is eating for two.					
It doesn't completely matter what a woman eats during pregnancy because the baby will take what it needs from her body.					
Eating chicken legs during pregnancy will cause birthmarks on the baby.					
A woman should avoid animal foods during pregnancy.					
Pregnant women who crave sweets will produce a more hyperactive child.					
Gaining lots of weight during pregnancy makes a healthy baby.					
All pregnant women have cravings.					
A smaller weight gain during pregnancy allows for an easier delivery.					
A pregnant woman should give into her cravings or she will mark the baby.					
Low birth weight babies are mostly the fault of the mother.					
Beets add iron to a pregnant woman's diet.					
If a pregnant woman craves a food, her baby will like that food.					

Section II: Knowledge Statements

<u>Directions</u>: Answer the following true or false knowledge statements by placing a check (√) in the appropriate column.

True	False	Knowledge Statements
______	______	Eating carrots is good for eyesight during pregnancy.
______	______	Young pregnant teens run a greater risk of complications of pregnancy, such as toxemia and prematurity than older girls.
______	______	Pregnancy is a good time to lose weight.
______	______	Pregnant women should follow a strict low salt diet.
______	______	Pregnant women should drink milk to get calcium.
______	______	It's okay for a woman to continue activities that give her exercise while pregnant.
______	______	Dairy products are not tolerated by all subcultural groups and may not be emphasized during pregnancy.
______	______	The most common food aversions during pregnancy are to meat, alcohol and coffee.
______	______	Women should drink plenty of water during pregnancy.
______	______	Pregnant women should restrict use of artificial sweeteners, such as Nutra Sweet.
______	______	Obese women don't need to gain weight during pregnancy.
______	______	Pregnant women should restrict use of foods with caffeine, such as coffee.
______	______	A woman should not follow a low calorie diet during pregnancy.
______	______	If a pregnant woman takes prenatal vitamins, she doesn't have to worry about what she eats.
______	______	After a woman gains eight pounds during pregnancy, the rest she gains is fat.
______	______	It is okay for a pregnant woman to skip meals as long as she takes prenatal vitamins.
______	______	Taking large doses of vitamin C during pregnancy can predispose the infant to infantile scurvy.
______	______	A woman should not gain more than 20 pounds during pregnancy.
______	______	Drinking alcohol during pregnancy can be harmful to the unborn child.
______	______	Pregnant women need vitamin pills to have a healthy baby.
______	______	If a woman breast feeds her baby, she can lose all the weight she gained in pregnancy.
______	______	Smoking during pregnancy can be harmful to the unborn child.

Adapted with permission from Carruth, B and Skinner, J. "Inventory About Food Beliefs During Pregnancy", Dept. of Nutrition, University of Tennessee, Knoxville, TN, 1991.

Name: ______________________________

Date: ______________________________ Paraprofessional No. ______________________________

County: ______________________________ OFFICE USE ONLY

Program: ______________________________

Pre / Post (Circle One)

BELIEFS AND KNOWLEDGE ABOUT HEALTH AND NUTRITION DURING PREGNANCY (FORM B)

Section I: Belief Statements

Directions:
Please read each statement and check (√) what most pregnant teenagers believe is true about health and nutrition during pregnancy. For example, do a large percentage of pregnant teenagers believe the statement "A pregnant woman will lose a tooth with every baby if she doesn't drink milk." If so, check the column, "A Large Percentage". After reading each statement select the appropriate response.

Belief Statement	Majority	A Large Percentage	Very Few	Hardly Any
A pregnant woman will lose a tooth with every baby if she doesn't drink milk.				
Pregnant women crave foods they need in their diet.				
Beets build red blood during pregnancy.				
A woman should avoid "excessive" weight gain during pregnancy.				
A pregnant woman craves ice because she is not getting enough of certain nutrients in her diet.				
A father who is a drug addict is more likely to produce birth defects.				
Women will crave pickles and ice cream during pregnancy.				
A woman should not eat fish and milk at the same meal during pregnancy.				
Pregnant women crave dirt when their diets are low in minerals.				
A father with high cholesterol levels is likely to produce a child with heart disease.				
The child of a mother who dislikes meat during pregnancy will also dislike meat.				
Pregnant women need a balance of hot and cold foods in their diet.				

Belief Statement	Majority	A Large Percentage	Very Few	Hardly Any
Low birth weight babies are mostly the fault of the mother.				
Beets add iron to a pregnant woman's diet.				
If a pregnant woman craves a food, her baby will like that food.				
A pregnant woman who eats lots of ice, lacks iron in her blood.				
The baby gets what he/she needs first, the rest goes to the mother.				
Pregnant women crave non-food items such as laundry starch, clay and dirt.				
It doesn't completely matter how much or how little weight is gained during pregnancy.				
If a woman doesn't eat what she craves during pregnancy, when her baby is born it will smack and lick its' lips until given that food.				
"High blood" (high blood pressure) is caused by excess heat during pregnancy.				
Eating strawberries during pregnancy will cause birthmarks on the baby.				
Pregnant women who crave salty or sour foods will have a boy.				
Birth defects are mostly the fault of the mother.				
A woman who dislikes tomatoes during pregnancy will produce a child who dislikes tomatoes.				
Eating lots of sweets during pregnancy produces a more mild manner child than not eating sweets.				

Belief Statement	Majority	A Large Percentage	Very Few	Hardly Any
Food cravings during pregnancy will determine the child's likes and dislikes in later life.				
Pregnant women need a balance of fattening and low calorie foods in their diet.				
Whatever a pregnant woman craves, she should eat.				
A pregnant woman should eat more sodium-rich foods and less meats and high-calorie foods to decrease high blood pressure.				
Women eat better when they become pregnant.				
A woman needs double portions during pregnancy since she is now eating for two.				
Pregnant women who crave sweets will have a girl.				
A woman who eats alot of oranges during pregnancy will have a baby who likes oranges later in life.				
A pregnant woman should eat as much as she wants because she is eating for two.				
It doesn't completely matter what a woman eats during pregnancy because the baby will take what it needs from her body.				
Eating chicken legs during pregnancy will cause birthmarks on the baby.				
A woman should avoid animal foods during pregnancy.				
Pregnant women who crave sweets will produce a more hyperactive child.				
Gaining lots of weight during pregnancy makes a healthy baby.				
All pregnant women have cravings.				
A smaller weight gain during pregnancy allows for an easier delivery.				
A pregnant woman should give into her cravings or she will mark the baby.				

Section II: Knowledge Statements

Directions: Answer the following true or false knowledge statements by placing a check (√) in the appropriate column. (NOTE: This section is to assess your knowledge about nutrition during pregnancy.)

True	False	Knowledge Statements
_____	_____	Eating carrots is good for eyesight during pregnancy.
_____	_____	Young pregnant teens run a greater risk of complications of pregnancy, such as toxemia and prematurity than older girls.
_____	_____	Pregnancy is a good time to lose weight.
_____	_____	Pregnant women should follow a strict low salt diet.
_____	_____	Pregnant women should drink milk to get calcium.
_____	_____	It's okay for a woman to continue activities that give her exercise while pregnant.
_____	_____	Dairy products are not tolerated by all subcultural groups and may not be emphasized during pregnancy.
_____	_____	The most common food aversions during pregnancy are to meat, alcohol and coffee.
_____	_____	Women should drink plenty of water during pregnancy.
_____	_____	Pregnant women should restrict use of artificial sweeteners, such as Nutra Sweet.
_____	_____	Obese women don't need to gain weight during pregnancy.
_____	_____	Pregnant women should avoid foods with caffeine, such as coffee.
_____	_____	A woman should not follow a low calorie diet during pregnancy.
_____	_____	If a pregnant woman takes prenatal vitamins, she doesn't have to worry about what she eats.
_____	_____	After a woman gains eight pounds during pregnancy, the rest she gains is fat.
_____	_____	It is okay for a pregnant woman to skip meals as long as she takes prenatal vitamins.
_____	_____	Taking large doses of vitamin C during pregnancy can predispose the infant to infantile scurvy.
_____	_____	A woman should not gain more than 20 pounds during pregnancy.
_____	_____	Drinking alcohol during pregnancy can be harmful to the unborn child.
_____	_____	Pregnant women need vitamin pills to have a healthy baby.
_____	_____	If a woman breast feeds her baby, she can lose all the weight she gained in pregnancy.
_____	_____	Smoking during pregnancy can be harmful to the unborn child.

Adapted with permission from Carruth, B and Skinner, J, "Inventory About Food Beliefs During Pregnancy", Dept. of Nutrition, University of Tennessee, Knoxville, TN. 1991.

APPENDIX E

DATA COLLECTION FORM FOR PREGNANT ADOLESCENTS

Name: ______________________________

Date: ______________________	Participant No. ______________
County: ______________________	OFFICE USE ONLY
Program: ______________________	

HAVE A HEALTHY BABY PROJECT-DATA FORM A

Please answer the following questions. This information will help us to provide you with the best nutritional care. All information is confidential.

General Information

1. Name ______________________________
2. Name you would like to be called ______________________________
3. Birthday ____________________ Age: ____________________
4. Ethnic Group ______________________________
5. Are you in school? ______________________________
6. When is your due date? ______________________________
7. Are you enrolled in WIC? Yes ______ No ______
8. What grade are you in? ______________________________
9. Do you have a job? ___ No ___ Yes If so, where? ______________________________
10. Total family income last month was:

    ____ Under $438
    ____ $439-588
    ____ $589-738
    ____ $739-888
    ____ $889-1038
    ____ $1039-1188
    ____ $1189-1338
    ____ $1339 and over
    ____ don't know

11. From which of the following individuals do you receive most of your social support? (CHECK ONE)

    __ mother
    __ father
    __ both parents
    __ one or both grandparents
    __ sister or brother
    __ other relative, (aunt or uncle)
    ____ girlfriend
    ____ boyfriend
    ____ husband
    ____ other person, adult, not related
    ____ social services

12. From which of the following individuals do you receive most of your financial support? (CHECK ONE)

    __ one or both parents
    __ one or both grandparents
    __ self
    __ sister or brother
    __ other relative,
    __ (aunt or uncle)
    ____ girlfriend
    ____ boyfriend
    ____ husband
    ____ other person, adult, not related
    ____ social services

13. In which type of community do you live? (CHECK ONE)

___ rural
___ town under 10,000
___ city 10,000-50,000
_____ suburb of a city over 50,000
_____ metro city over 50,000

14. Where do you receive medical care? (CHECK ONE)

___ health clinic
___ physician
____ no medical care

Health History

1. Do you take any medication daily? (include vitamins)
   Yes __________ No __________
   If yes, explain ____
   ____
2. Have you been pregnant before? Yes___________ No___________
3. Any problems with previous pregnancies? (CHECK ALL THAT APPLY)
   _______ Baby less than 5 1/2 pounds.
   _______ Mom was anemic.
   _______ Baby stayed in hospital after mom was released. If so, why? ________________
   ____
   Other, specify ____
4. When in your current pregnancy did you first see a doctor?___________________________
5. How often do you see a doctor?____
6. Do you have any children? Yes___________ No ___________
7. If you are enrolled in WIC when did you enroll? ___________________________
   What other types of food assistance are you participating in?___________________
   ____
8. Are you:
   _____diabetic
   _____on medication for medical condition

   Do you:
   ____ have high blood pressure
   ____ use drugs? How much? ______________
   ____ use alcohol? How much? ______________
   ____ smoke cigarettes? How much?______________

TO BE COMPLETED AFTER BABY IS BORN

1. Date of birth ____
2. Baby's sex ____
3. Baby's birthweight ____________________________ Length ________________
4. No. of days baby in hospital ____
5. No. of days mom in hospital ____
6. Baby's weight at one month ____
7. Mother's total pregnancy weight gain ____________________________________
8. Mother's current weight ________________ height ________________
9. Mother's blood glucose ________________ hematocrit __________ hemoglobin _________
10. How are you feeding your baby? ____________________________________
11. Are you and your baby enrolled in WIC? ____________________________________

Incomplete Pregnancy

_____ miscarriage _______ stillborn ____ prematures

Adapted with permission from <u>Have A Healthy Baby</u>, part of the Expanded Food and Nutrition Education Program, Purdue University Cooperative Extension Service, West Lafayette, IN, 1991.
Reference: <u>Nutrition Management of the Pregnant Adolescent</u> by Mary Story, 1990, National Clearinghouse, Washington, DC.

APPENDIX F

DIETARY INTAKE FORMS FOR PREGNANT ADOLESCENT

Name: ______________________ Date: ______________________

Date: ______________________
County: ______________
Program: ______________________
Pre/Post (Circle One)

Participant No. ______________
ES/WIC Nutrition Education Initiative 1994-95
____
OFFICE USE ONLY

PREGNANCY DIET INTAKE

"I would like to know what you've eaten within the past 24 hours. Could you please tell me everything you ate or drank, including meals, snacks, beverages, candy and alcohol? Why don't you start with the last thing you've had to eat or drink today and we'll go backwards."

Time:	Place:	Food or Beverage Consumed:	Amount	Milk	Meat	Vegetables	Fruits	Grain Products	Fats and Oils	Sweets
		Minimum Recommended Number of servings/day for adults		4-5	3	3	2	6	2	As needed
		Total Number of Servings								

Is this a typical day? ______________

Nutrients diet may be lacking in: ______________________
____

Nutrients diet may be excessive in: ______________________
____

Adapted with permission. Nutrition Management of the Pregnant Adolescent by Mary Story, Washington DC: National Clearinghouse, 1990, p. 165.

Name: ______________________________

Date: ______________________________ Participant No. ______________________________

County: ______________________________

Program: ______________________________ OFFICE USE ONLY

Pre / Post (Circle One)

EATING HABITS CHECKLIST FORM D

WRITE-IN THE NUMBER OF TIMES YOU USUALLY EAT THE FOLLOWING FOODS DURING A WEEK (7 DAYS)

Milk Group

____ Milk (Kinds: ________)
____ Cheese (Include that used
____ in other foods)
____ Cottage Cheese
____ Yogurt
____ Milkshake
____ Ice Cream
____ Pudding/Custard
____ Creamed Soups

Vegetable Group

____ Spinach/Collards
____ Cabbage, Raw
____ Peppers, Red/Green
____ Kale/Mustard/Turnip Greens
____ Carrots
____ Yellow Squash
____ Sweet Potatoes/Pumpkin
____ Mixed Vegetables
____ Tomatoes
____ Broccoli
____ Other Vegetables

Fruit Group

____ Apricots
____ Cantaloupe
____ Orange/Grapefruit
____ Strawberries
____ WIC Juices:
Orange/Grapefruit/Apple/
____ Pineapple/Grape
____ Other Fruits

Bread/Cereal Group

____ Corn
____ Rice
____ Pizza
____ Cornbread
____ Dry Cereal
____ Cooked Cereal
____ Crackers
____ Bread/Rolls/Buns
____ Biscuits/Muffins
____ Pancakes/Waffles
____ Potatoes (Mashed, baked)
____ Macaroni/Noodles/
Spaghetti

Meat/Protein Group

____ Liver (kind) __________
____ Roast Beef
____ Steak
____ Hamburger
____ Stew Meat
____ Chicken/Turkey
____ Fish/Tuna
____ Eggs
____ Pork (chops/roast/ham)
____ Wild Game
____ Nuts/Seeds
____ Peanut Butter
____ Beans/Peas
____ Sausage/Wieners
____ Bologna/Lunchmeats

Other

____ Soups
____ Bacon or Fat Back
____ Lard/Butter
____ Gravy
____ Chips
____ French Fries
____ Cookies
____ Jam/Jelly
____ Honey/Syrup/Sorghum
____ Cake/Snack Cakes
____ Pastries (Donuts/Sweetrolls)
____ Pies
____ Jello
____ Candy
____ Coffee
____ Tea
____ Beer/Wine
____ Whiskey/Vodka/Etc.
____ Fruit Drinks
____ Punch
____ Lemonade
____ Kool-Aid
____ Soft Drinks
____ Diet Soft Drinks
____ Gatorade
____ Clay/Laundry Starch/Dirt.
Etc.

FOR OFFICE USE ONLY:

Milk Group	Vegetable Group	Fruit Group	Bread/Cereal Group	Meat/Protein Group	Other
☐	☐	☐	☐	☐	☐

Write In Actual Number of Servings

NOTES: ____

Adapted with permission from Chickasaw Nation WIC Program.

Date: ______________________
County: ______________
Town: ______________
Program: ______________________

Participant No. __________
ES/WIC Nutrition Education Initiative 1993-94
OFFICE USE ONLY

NUTRITION QUESTIONNAIRE
Pregnancy

Please answer the following by checking the appropriate box or filling in the blank. Answer only those questions which apply to you. All information is confidential.

1. Before this pregnancy, what was your usual weight?
   ______ lbs. ______ Don't know
   If you have been pregnant before, how much weight did you gain?
   ______ lbs. ______ Don't know
   How much weight do you expect to gain during this pregnancy?
   ______ lbs. ______ Don't know
   Have you ever had any problems with your weight? ☐ Yes ☐ No
   If yes, what? ☐ Underweight
   ☐ Overweight
   ☐ Other

2. How would you describe your appetite?
   ☐ Hearty ☐ Moderate ☐ Poor
   With this pregnancy, have you experienced any of the following?
   ☐ Nausea
   ☐ Vomiting
   ☐ Increased appetite
   ☐ Decreased appetite

3. How would you describe your eating habits?
   ☐ Regular ☐ Irregular

4. Indicate the person who does the following in your household:
   Plans the meals ______________________________
   Buys the food ______________________________
   Prepares the food ______________________________

   How much is spent on food each week for your household?
   $ __________ ☐ Don't know
   How many people does this feed? ______________
   Indicate the types of kitchen equipment you have in your home:
   ☐ Refrigerator ☐ Stove
   ☐ Hot plate ☐ Other ______________

5. Are you taking any vitamin or mineral supplement? ☐ Yes ☐ No
   Do you take any pills to control your weight? ☐ Yes ☐ No
   Do you take diuretic (water) pills? ☐ Yes ☐ No

6. Are you now on a diet to lose weight? ☐ Yes ☐ No

Are you now on a special diet (low salt, diabetic, gallbladder, etc.)? ☐ Yes ☐ No

If yes, what kind of diet? ______________________

If you have been on a special diet in the past, indicate what kind and when. ________

7. Is there any food you can't eat? ☐ Yes ☐ No

   If yes, what food? ______________________

   What happens when you eat this food? ______________________

   ____

   Do you have any cravings for things such as:
   - ☐ Cornstarch
   - ☐ Plaster
   - ☐ Dirt or clay
   - ☐ Ice
   - ☐ Other ______________________

8. Do you have any of the following problems?
   - ☐ Constipation
   - ☐ Diarrhea
   - ☐ Heartburn
   - ☐ Leg Cramps

9. Are you receiving any of the following?
   - ☐ Food stamps
   - ☐ WIC voucher
   - ☐ Free or reduced priced school meals
   - ☐ Food from food shelves
   - ☐ Commodities

10. Are there times during the month when you don't have enough food to eat?

    ☐ Yes ☐ No

11. How do you plan to feed your baby?
    - ☐ Breast feed
    - ☐ Evaporated milk formula
    - ☐ Commercial formula
    - ☐ Undecided

12. Do you have any questions or concerns about nutrition or what you eat?

Sources: Nutrition During Pregnancy and Lactation, 1975, California Dept. of Health and Nutrition for the Pregnant Adolescent by Mary Story, 1990, National Clearinghouse, Washington, DC.

APPENDIX G

PROCEDURES FOR ANTHROPOMETRIC MEASUREMENTS AND PRENATAL WEIGHT GAIN GRID

Procedure To Measure Height

1. Have subject stand erect with weight equally distributed on both feet with the heels together and touching the vertical board.

2. Have subject "look straight ahead" (so that the line of vision is perpendicular to the body), take a deep breath, and hold that position while the horizontal headboard is brought down firmly on top of the head.

3. Measurements will be recorded to the nearest 0.1 cm.

Note. From

Nutritional assessment and support (p. 10), by A. Grant & S. DeHoog, 1991, Seattle,

WA: Grant & DeHoog.

Procedure To Measure Weight

1. Subjects will be weighed early in the morning after a 10 hr fast and voiding on a leveled platform scale with a beam and moveable weights.

2. Subjects will be weighed standing still and looking straight ahead with weight evenly distributed on both feet.

3. Weight will be recorded to the nearest one-quarter pound.

Note. From

Nutritional assessment and support (p. 19), by A. Grant & S. DeHoog 1991, Seattle,

WA: Grant and DeHoog.

Procedure To Calculate Body Mass Index (BMI)

$$BMI = \frac{\text{weight in kg}}{\text{height in meters squared (i.e. } W/S^2)}$$

Note. From

Nutritional assessment and support (p. 38), by A. Grant & S. DeHoog, 1991, Seattle,

WA: Grant and DeHoog.

Procedure To Measure Mid-Arm Circumference

1. Have subject stand with the right arm bent at a 90^{o} angle and the palm up. Clothing should be without sleeves so that the entire arm is exposed.

2. Place the end of a nonstretch tape (Ensure Inser-Tape, Ross Labs) on the lateral tip of the acromial process and extend it along the side of the upper arm below the elbow to the olecranon process. Mark the midpoint on the side of the arm.

3. Next have subject release the arm to hang loosely at the side of the body with the palm forward.

4. Place the tape around the arm at the marked midpoint, parallel to the floor. The tape should touch the skin but not compress the soft tissue. Record to the nearest 0.1 cm.

Note. From

Nutritional assessment and support (pp. 40-41), by A. Grant & S. DeHoog, 1991,

Seattle, WA: Grant and DeHoog.

Procedure To Measure Triceps Skinfold Thickness

1. Have subject stand with the right arm bent at a 90^{o} angle and the palm up. Clothing should be without sleeves so that the entire arm is exposed. Place the end of a nonstretch tape (Ensure Inser-Tape, Ross Labs) on the lateral tip of the acromial process and extend it along the size of the upper arm below the elbow to the olecranon process. Mark the midpoint on the side of the arm. Mark the site on the midline of the back of the arm over the triceps at the same level.

2. Have subject release the arm to hang loosely at the side with the palm forward. Stand behind subject and pick up the skinfold firmly between the thumb and index finger of the left hand (assumes the measurer is right handed) one centimeter above the marked level.

3. Place the Lange calipers (Cambridge Scientific Industries; Cambridge, MD) over the fatfold at the marked level at a point where the sides of the skinfold are approximately parallel (at about one-half the depth of the skinfold). The jaws of the calipers should be parallel to the floor. Release the calipers gently. Do not release the pinch. Wait three to four seconds, and take the reading to the nearest 0.1 mm. Repeat twice and average the values.

Note. From

Nutritional assessment and support (p. 42), by A. Grant & S. DeHoog, 1991, Seattle,

WA: Grant and DeHoog

Procedure To Calculate Mid-Arm Muscle Area (MAMA)

$$\text{MAMA (cm)}^2 = \frac{(\text{MAC (cm)} - (3.14)(\text{Triceps (mm)}))^2}{(4)(3.14)} - 6.5$$

Note. From

Nutrition assessment and support (p. 62), by A. Grant & S. DeHoog, 1991, Seattle,

WA: Grant and DeHoog.

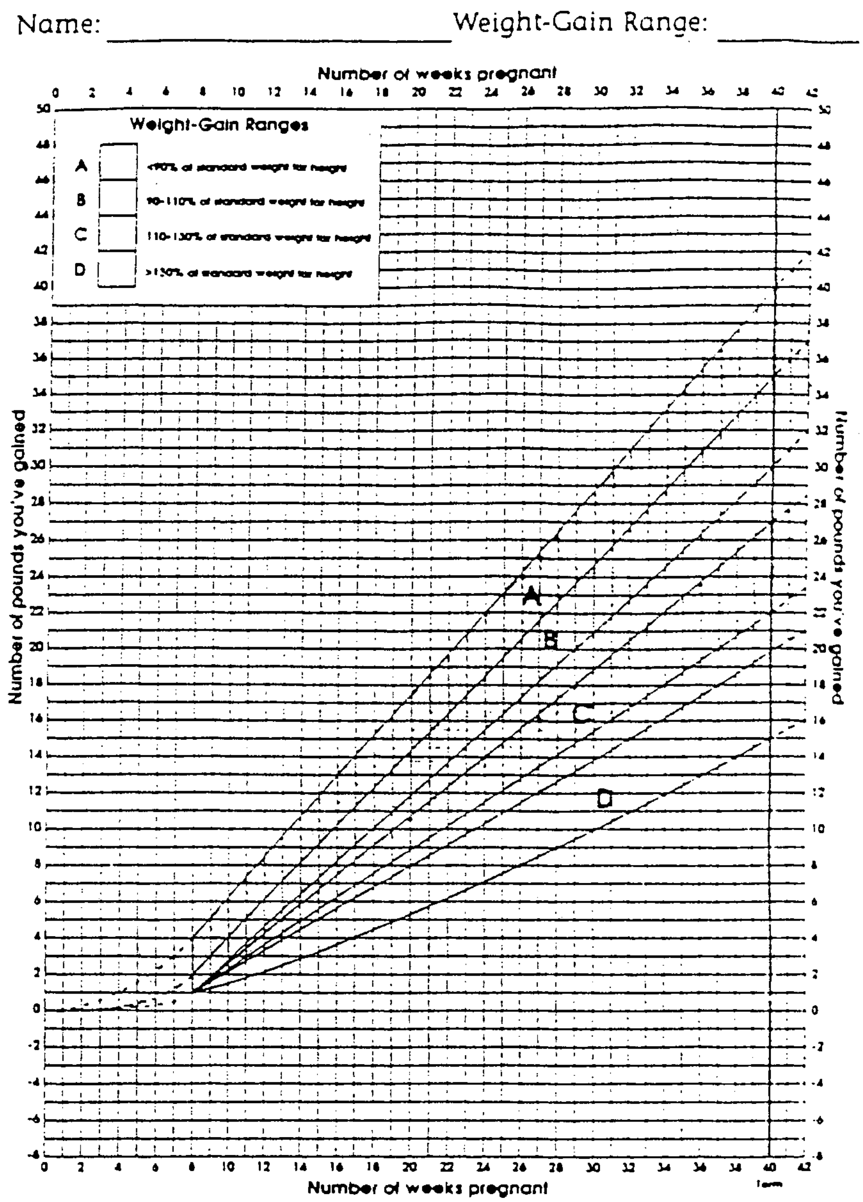
Procedure To Calculate Upper Arm Fat Area (AFA)

$$\text{AFA (cm)}^2 = \frac{(\text{arm circumference (cm)})^2}{(4)(3.14)} - \text{MAMA}$$

Note. From

"Changes in maternal upper arm fat stores are predictors of variation in infant birth weight," by M. Hediger, T. Scholl, J. Scholl, M. Healey and R. Fischer, 1994, Journal of Nutrition, 124, p. 25.

Figure 1
Prenatal Weight Gain Grid



Judith Brown, Healthy Infant Outcome Project, University of Minnesota

Note. From "Weight Issues and Management" by E. Gong. In M. Story (Ed.) Nutrition management of the pregnant adolescent. Washington, D.C.: National Clearinghouse, 1990, p. 59.

APPENDIX H

PROCEDURES FOR BIOCHEMICAL DETERMINATIONS

Procedure To Measure Hemoglobin Concentration

1. Reagents provided

Drabkin's solution is prepared by reconstituting Drabkin's reagent with 1000 mL deionized water. Store in amber bottle at room temperature (18-26°C). It will remain stable for at least 6 months.

Cyanmethemoglobin standard solution is prepared by reconstituting the Hemoglobin Standard with 50.0 mL Drabkin's Solution. Mix well and allow to stand for at least 30 minutes. It will remain stable for at least 6 months when refrigerated (2-6°C).

2. Specimen collection and storage

Venipuncture specimens must be collected in tubes containing solid anticoagulants, such as oxalate, citrate, EDTA or heparin. After thorough mixing with the anticoagulant, blood can be frozen for as long as 2 years or stored for at least a week at 30°C.

3. Procedure
   a. Label two or more test tubes, BLANK, TEST 1, TEST 2, etc.
   b. To all tubes, add 5.0 mL Drabkin's Solution.
   c. To TEST, add 10 uL whole blood, rinsing pipet 3-4 times with reagent. Mix well. Allow to stand at least 15 minutes at room temperature (18-26°C).
   d. Read and record absorbance (A) of TEST vs BLANK as reference at the same wavelength and in the same instrument as used in the preparation of the calibration curve.
   e. Determine total hemoglobin concentration (g/dL) of TEST directly from your calibration curve. Color is stable for several hours.

4. Calibration
   a. Prepare working standards by pipeting and mixing thoroughly the solutions as follows:

1 Tube No.	2 Cyanmethemoglobin Standard Solution (mL)	3 Drabkin's Solution (mL)	4 Blood Hemoglobin (g/dL)
1	0	18	0.0
2	6	12	6.0
3	12	6	12
4	18	0	18

NOTE: Diluted standards are stable for as long as 6 months when stored tightly capped and refrigerated (2-6°C) in the dark.

b. Read absorbance of Tubes 2-4 vs Tube 1 as reference at a wavelength between 530-550 nm.
c. Record absorbance values.
d. Plot a calibration curve of absorbance values vs blood hemoglobin (g/dL) in Column 4. The curve is linear, passing through the origin.

Interpretation of results

a. Results are obtained directly from the calibration curve.
b. The normal range of blood hemoglobin (g/dL) for adult females is 11-16 g/dL.

Note. From

Biochemicals, organic compounds for research and diagnostic reagents, "Total Hemoglobin Procedure No. 525" (p. 2042), by Sigma Diagnostics, 1992, St. Louis, MO: Sigma Diagnostics.

Procedure To Measure Serum Transferrin

1. Specimen collection and preparation

Serum is recommended for this assay to minimize nonspecific turbidity associated with plasma samples. Serum is obtained aseptically by venipuncture according to recommended procedures.

Blood samples may be stored at 2-8°C for up to 14 days. Samples may be stored at -20°C for up to 2 months.

2. Procedure for programming
   a. The SPQ ANTIBODY REAGENT SET II is designed for use in instruments capable of immunoprecipitin analysis. Instrument parameters include the Roche COBAS BIO and COBAS MIRA®.
   b. Reagents and program analyzer should be prepared as directed by the appropriate instrument Parameter section of directions provided.

3. Quality control

SPQ TEST SYSTEM Controls (Low, Normal or High) should be included in each assay performed. Other controls of known concentrations may also be included in the assay. The value determined for the SPQ Control should fall within the stated recovery limits of the value assigned to the Control. The validity of the assay is in question if the value for the Control generated by the assay's calibration curve does not fall within this recovery range. The COBAS BIO needs to be recalibrated if the value determined for the Control falls outside the stated recovery limits.

4. Results

The expected normal range for serum transferrin is 90 to 490 mg/dL with a correlation coefficient of 0.976.

Note: From

"Antibody Reagent Set II for Alpha-1-Antitrypsin, Haptoglobin or Transferrin", SPQ™ Test System by INCSTAR Corporation, 1990, Stillwater, MN: INCSTAR Corporation.

Procedure To Measure Serum Iron

1. Sample preparation for wet ashing

Do all work under a clean air hood until ashing. Pipet 1 or 2 mL serum into acid washed 13 x 100 borosilicate glass tubes. To 1 mL serum sample, add 250 ml of pure concentrated HNO_3. To 2 mL serum sample, add 500 mL of pure concentrated HNO_3. Vortex each sample. For every set of samples, there must be at least 2 blanks. (Blank = tubes without sample with equivalent amount of distilled water and other reagents added to the sample.) Cover each sample tube with parafilm. In addition, cover test tube rack with two layers of parafilm. Let rack of tubes set under the clean air hood for at least 1 to 2 hours.

Note: One set of samples = 45 samples + 2 blanks.

2. Isotemp heating block preparation

Turn on isotemp heating block and set temperature at 85°F for 2 hours. Remove parafilm from samples and set in heating block.

3. Wet ashing procedure

Begin adding 100 mL H_2O_2 every 2 hours until samples are completely ashed to a white powder. Check temperature to make sure samples do not overheat.

Note: If samples become dry before completely ashed e.g., when left overnight, add 100 mL additions each of:

- distilled H_2O
- concentrated HNO_3 and
- H_2O_2

Record time and amounts of additions to each set of samples. Amounts need to be consistent per each set of samples.

4. Storage preparation

Remove samples as they become dry. Cover tubes with plastic caps. Cover rack of tubes with plastic wrap. Store in plastic container in cool, dry area.

Note. From

B. J. Stoecker and B. Adelye, 1995, Stillwater, OK: Oklahoma State University, Dept. of Nutritional Sciences.

Procedure To Measure Glucose

1. Specimen collection and preservation

Serum or plasma may be used. However, the stability of glucose in blood samples is affected by storage temperature, bacterial contamination and glycolysis. Glucose in separated non-hemolyzed serum is generally stable for up to 8 hours at 25°C and up to 72 hours at 4°C.

2. Procedure

   a. Place the vial of reconstituted reagent into the proper position on the reagent rack and place on the instrument. See parameter listings with instructions for specific parameters. See appropriate COBAS Operator's Manual for further details on system programming and operation.

b. To establish the calibration factor, suitable glucose standards must be assayed under the same conditions as the patient sera and controls. See Roche Calibrator Serum, Order No. 44157.

c. It is recommended that two levels of controls be run with the assay at least once every 8 hours and after a reagent lot change. Commercially available control material with established glucose values may be used for quality control. The assigned value of the control material must be confirmed by this method. Failure to obtain the proper range of values in the assay of control material may indicate reagent deterioration, instrument malfunction, or procedural errors.

3. Results

After the assay is completed, the COBAS chemistry instrument calculates a factor using the following formula:

$$F = \frac{1}{2} \quad \frac{CSTD11}{\Delta ASTD11 - \Delta ARB} \quad + \quad \frac{CSTD21}{\Delta ASTD21 - \Delta ARB}$$

Then:

Concentration of the sample (mg/dL) = Dsample - DARB)xF

where:

C	=	Concentration in mg/dL
STD11	=	Standard One (first replicate)
STD21	=	Standard One (second replicate)
DA	=	Absorbance Change
RB	=	Reagent Blank

Note. From

ROCHE® Reagents Reagent for Glucose by Roche Diagnostic Systems, 1993, Nutley,

NJ: Roche Diagnostic Systems.

Procedure To Measure Glycohemoglobins (GHb)

1. Specimen collection and preservation

Blood specimens used in this test should be freshly drawn. If this is not possible, the specimens should be drawn into a blood collection tube with anticoagulant (use heparin or EDTA). Stability of GHb values for blood stored with other anticoagulants cannot be guaranteed.

Store blood at $4^{O}C$, but do not use samples which have been stored for more than a week.

Store samples as whole blood, not as hemolysate or intact red cells.

2. Sample preparation

Use only freshly drawn or carefully preserved (stored at $4^{O}C$) blood specimens to prepare the hemolysate. Use well mixed whole blood-not packed red cells.

Mix 25 uL of blood with 200 uL Sample Preparation Reagent (Bottle #l). Shake gently and let stand for 10 minutes with occasional shaking.

NOTE: If plasma appears cloudy or is lipemic, please prepare sample according to instructions given in the "Interference by Lactescence" section.

3. Column preparation
   a. Stand the closed column upside down until the entire column bed has shifted. Turn right side up 5-10 minutes before use.
   b. Remove first the column's top cap, then the bottom closure. This order of opening is important-otherwise air will enter the column tip interfering with free liquid flow. Use the end of a Pasteur pipette to push the upper disc down until it touches the top of the resin bed. Do not compress the bed.
   c. Allow the column to drain until the liquid reaches the top disc, where flow will automatically stop. The liquid may also be removed by aspirating with a Pasteur pipette.
   d. Add a total of 2.0 mL Column Preparation Solution (Bottle #2) to the top of the column. DISCARD eluate.

4. Nonglycosylated hemoglobin-first fraction
   e. Add 50 uL of the hemolysate prepared in "Sample Preparation" DIRECTLY ONTO THE TOP DISC in the Glyc-Affin column. Allow the liquid to flow completely into the disc. DISCARD eluate. Do not allow the hemolysate to dry on disc.
   f. Add 100 uL First Fraction Elution Agent (Bottle #3) to the top of the disc. Allow the liquid to flow completely into the disc. DISCARD eluate.

NOTE: Allow the sample to sit in the column 10 minutes before proceeding with step 7. For most accurate and reproducible results, use a timer.

   g. Place the column over a clean 16 x 150 mm test tube.

h. Add 3.0 mL First Fraction Elution Agent (Bottle #3) directly onto the top disc. Allow the liquid to flow completely into the disc. Collect the eluate in the test tube. This fraction contains all the nonglycosylated hemoglobins.
i. Add 17.0 mL distilled or deionized water to the test tube. Mix thoroughly by inversion or by pouring into a small Erlenmeyer flask and swirling.

5. Glycohemoglobins-second fraction
   j. Place the column over a clean 12 x 75 mm test tube.
   k. Add 2.0 mL Second Fraction Elution Agent (Bottle #4) to the top of the column.

This 2.0 mL fraction contains the GHb. DO NOT dilute this fraction.

6. Spectrophotometric analysis
   1. Set the spectrophotometer at 415 nm and zero the instrument in accordance with the instruction manual. Use distilled water as a blank.
   m. Mix each solution well before reading absorbance.
   n. Measure the absorbance of each GHb fraction (X) and then its corresponding diluted nonglycosylated hemoglobin fraction (Y). This assures identical treatment conditions for each fraction.

NOTE: For best results, fractions should be read within one hour after collection.

Normal range of absorbance values:

X=.10-1.0

Y=.15-.60

Values outside these ranges may indicate a procedural error or a problem with the spectrophotometer.

7. Calculations

$$\% \text{ GHb} = \frac{100X}{x+10Y}$$

where X=absorbance of the GHb fraction and Y = absorbance of the nonglycosylated Hb fraction

Example: X=.30, Y=.26

$$\% \text{ GHb} = \frac{100(.30)}{.30 + 10(.26)} = 10.34\%$$

8. Interpretation of results

Nondiabetic children and adults will have an average GHb level of 6%. Normal range of values is 4.0-8.0%.

Diabetics will have higher values. The higher above normal the value, the greater the degree of uncontrolled blood glucose levels.

When diabetic patients are carefully controlled and regulated, their GHb levels will begin to drop toward the normal range within 5-6 weeks.

Note. From

Glyc-Affin GHb, "Complete Disposable System For Quantitating Glycohemoglobins (GHb) (100-test kit (Code SG-6200)); 20-test kit (Code SG-6220)-Instructions" 1986, Akron, OH: ISOLAB, Inc.

Procedure To Measure Fructosamine

1. Reagents

The RoTAG™ Fructosamine (Glycated Protein) Assay Kit used in this procedure includes a buffer (200 mM carbonate buffer (pH 10.3)), Nitroblue tetrazolium (NBT)/uricase tablets and lyophilized protein based calibrator.

2. Instructions for reagent handling
   a. The calibrator value indicated on the vial label should be used. Reconstitute the contents of the calibrator vial with 1.0 mL of distilled water one hour prior to use.
   b. Prepare working reagent by adding one tablet of NBT to one 6 mL vial of buffer or by adding five tablets (contents of NBT tablet vial) to one 100 mL vial of buffer. Immediately mix by continual swirling until dissolved and allow to stand for 30 minutes before use.
   c. All reagents should be at room temperature (15-25°C) prior to use.

d. Calibrators may be assayed in each run, or the calibration curve may be stored for one month as long as control values are within range and no change in procedure or reagents occurs.

3. Storage and stability

a. Reconstituted reagent is stable up to 2 weeks at 2-8°C or 3 days at 15-25°C.

b. Store NBT Reagent and Calibrator at 2-8°C and protect from light. Calibrator is stable for 4 weeks after reconstitution when stored at 2-8°C or up to one week at 15-25°C. Some variation in the initial color of the reconstituted reagent may be observed which has no effect on results.

4. Specimen preparation

Nonhemolyzed serum is required for analysis. Sufficient blood should be collected to provide 0.1 mL serum for each test. Samples may be stored up to 4 days at 2-8°C or up to 30 days at -20°C.

5. Instructions for use

a. Pour sufficient working ROTAG™ Reagent into the appropriate disposable container and place on the COBAS system.

b. Assay the calibrator provided with the kit to calibrate the assay as indicated in the instrument parameters.

c. It is recommended that a set of controls in the normal and elevated range be assayed in each run. RoTAG™ Controls should be used. Failure to obtain the proper range of values upon assay of materials may indicate reagent deterioration, instrument malfunction or procedural errors and test results should be considered invalid.

6. Results

After completing the assay, the COBAS Chemistry System calculates a factor using the following formula:

$$F = 1/3 \quad \frac{CSTD11}{\Delta ASTD11-\Delta ARB} \quad + \quad \frac{CSTD21}{\Delta ASTD21-\Delta ARB} \quad + \quad \frac{CSTD31}{\Delta ASTD31-\Delta ARB}$$

Concentration of the sample = (DAsample-DARB) xF where:

C = Concentration (umol/L)

STD11	=	Standard One (first replicate)
STD21	=	Standard One (second replicate)
STD31	=	Standard One (third replicate)
DA	=	Absorbance Change
RB	=	Reagent Blank

Note. From

RoTAG™ Fructosamine (Glycated Protein) Assay (pp. 1-3),by Roche Diagnostic Systems, 1990, Nutley, NJ: Roche Diagnostic Systems.

Procedure To Measure Insulin

1. Specimen collection and preparation

Preserving the chemical integrity of the blood sample is important from the time of collection until it can be assayed.

Samples should be stored at 2-8°C and assayed within 24 hours after collection. If the assay procedure cannot be completed within 24 hours, freezing is recommended. However, repeated freezing and thawing should be avoided. Prior to the assay, samples should be at room temperature and thoroughly mixed by gentle inversion.

2. Reagent preparation

For insulin controls, add 2.0 mL deionized or distilled water to each vial of control. Wait 20 minutes and invert each vial slowly several times to rinse off any particles that may have adhered to the septum. Vials should stand for a few more minutes to be a complete solution. Swirl each vial gently and avoid vigorous mixing.

For the assay procedure, calibrators, control and patient samples should be run in duplicate. With each set of clinical specimens, a calibration curve must be run. The capped reagent vials and bottle need to be at room temperature (20-25°C) before use and returned to recommended storage conditions as soon as possible.

Equate® RIA Double Antibody kit for insulin option I was used:

a. Label tubes as follows: Total counts (TC), tubes 1 and 2; Non-Specific Binding (NSB), tubes 3 and 4; Maximum Binding (B_o), tubes 5 and 6; Calibrators (A to F), tubes 7 through 18. Starting with tube 19, consecutively number two test tubes for each control or patient sample.

b. Pipet 200 ul Assay Buffer into NSB tubes 3 and 4.

c. Pipet 100 ul Assay Buffer into B_0 tubes 5 and 6.

d. Pipet 100 ul Calibrators (A to F), controls and patient samples as follows:

Tube No.	Sample**	uU/mL*	mU/L*
7, 8	Calibrator A	5	5
9,10	Calibrator B	15	15
11,12	Calibrator C	35	35
13,14	Calibrator D	75	75
15,16	Calibrator E	150	150
17,18	Calibrator F	300	300
19,20	Unknowns (Control or Patient Samples)		

*Approximate concentrations. Refer to labels on vials for exact values.
**Samples reading greater than the highest calibrator should be diluted with Assay Buffer and reassayed.

e. Pipet 100 uL Insulin Tracer into all tubes.

f. Pipet 100 uL Insulin Antiserum into all tubes except TC and NSB tubes.

g. Vortex all tubes gently, cover and incubate for 90 minutes at room temperature.

h. Centrifuge at 1500 x g for 10 minutes at 2-8°C using a refrigerated centrifuge.

i. Decant the supernatant of each tube (except TC tubes) into a suitable radioactive waste container. Decanting must be done smoothly and carefully to avoid dislodging any of the pellet. Blot the rim of each tube on absorbent paper.

j. Count radioactivity in all tubes for one minute, or a time sufficient to remove counting statistics as an important source of variability.

Note: Gamma counters suitable for detecting ^{125}I, either manual or automatic, are acceptable for use in measuring the radioactivity of this assay.

3. To determine final reaction stability after the tubes have been decanted, measurements should be completed as soon as possible after the reaction is complete. The counting period must be the same for all tubes that are counted.

Note. From

Equate® RIA INSULIN, "Equate® RIA INSULIN Double Antibody 100 test kit" by

BINAX, 1993, Portland, ME: BINAX.

APPENDIX I

SELECTED NUTRITION EDUCATION PROGRAM MATERIALS FOR PREGNANT ADOLESCENTS

Teen Age Parents

Home Economics Programs • Cooperative Extension Service • Oklahoma State University

Pregnancy

Daily Food Choices

Do you know what foods to eat and how much to eat every day until the baby is born? The Daily Food Guide helps you make healthy food choices. The food you eat provides the nutrients your baby needs for proper growth and development and your growth. Eat the recommended number of servings from each of the food groups and foods low in fat.

 = **Variety & Moderation**

Breads & Cereals Group

Eat 6 servings daily. One serving is:
- 1 slice of bread, biscuit or tortilla
- 1/2 hamburger bun or English muffin
- 3 to 4 small crackers
- 1/2 cup cooked cereal, rice or pasta
- 1 ounce of ready-to-eat breakfast cereal

Fruits

Eat 2 servings daily. One serving is:
- 1 apple, banana or orange
- 3/4 cup fruit juice
- 1/2 cup canned fruit

Vegetables

Eat 3 servings daily. One serving is:
- 1/2 cup cooked vegetable
- 1 bowl of green salad
- 1 cup raw vegetable such as carrot sticks

Include one food rich in Vitamin C such as: grapefruit, oranges, tomatoes, or their juice, broccoli, melons and strawberries.
Include one food rich in Vitamin A such as: broccoli, cantaloupe, carrots, winter squash and sweet potatoes.

Meat & Other Protein Foods

Eat 3 servings daily. One serving is:
- 2-3 ounces of cooked, lean meat, poultry or fish
- 2 eggs
- 1 cup dried beans or peas, cooked
- 2 tablespoons peanut butter

Milk & Dairy Products

Eat 4 to 5 servings daily. One serving is:
- 1 cup milk (try low-fat)
- 1 cup yogurt
- 1 1/2 ounces natural cheese
- 2 ounces process cheese

> Drink 8 to 10 glasses of liquid each day. Milk, fruit juice, and water are good choices.

Your doctor may recommend a daily vitamin and mineral supplement.

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Suggested Readings:

Dairy Council of California (1990). Pregnancy: A special time for nutrition and good health. Sacramento, CA: Author.

March of Dimes (1991). Eating for two: Nutrition during pregnancy. White Plains, NY: Author.

March of Dimes (1991). Public health education information sheet: Eating for two: Nutrition during pregnancy. White Plains, NY: Author.

U.S. Department of Agriculture, U.S. Dept. of Health & Human Services (1990). Dietary Guidelines for Americans, 3rd edition. Washington, D.C.: Author.

Reference List:

McCoy, H., Kenney, M., Kirby, A., Disney, G., Ercanli, E., Glover, E., Korslund, M., Lewis, H., Liebman, M., Livant, E., Moak, S., Stallings, S., Wakefield, T., Schilling, P., and Ritchey, S. (1984). Nutrient intake of female adolescents from eight southern states. Journal of the American Dietetic Association, 84, 1453-1460.

Schneck, M., Sideras, K., Fox, R., and Dupuis, L. (1990). Low-income pregnant adolescents and their infants: Dietary findings and health outcomes. Journal of the American Dietetic Association, 90, 555-558.

Story, M. (1990). Nutrient needs during adolescence and pregnancy. In M. Story (Ed.). Nutrition management of the pregnant adolescent (pp. 21-28). Washington, DC: National Clearinghouse.

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APPENDIX J

ADDITIONAL DATA TABLES NOT INCLUDED IN RESEARCH REPORT ARTICLES CHAPTERS IV, V OR VI

Table 1. Demographic and health history summary of pregnant adolescent participants prior to the nutrition education programs.[a]

Demographic/Health History Variables	Eating Right Is Basic (ERIB) Nutrition Education	Have A Healthy Baby (HAHB) Nutrition Education
Pregnant adolescents (n)	15	28
Paraprofessionals (n)	5	5
EFNEP counties in Oklahoma (n)	4	5
Age		
14-15 (y) (n) (%)	4 (27%)	6 (21%)
16-17 (y) (n) (%)	4 (27%)	12 (43%)
18-19 (y) (n) (%)	7 (47%)	10 (36%)
Ethnic group		
White (n) (%)	5 (33%)	18 (64%)
Black (n) (%)	3 (20%)	2 (7%)
Native American (n) (%)	7 (47%)	8 (29%)
WIC enrollment [b]		
Yes (n) (%)	14 (93%)	22 (79%)
No (n) (%)	1 (7%)	6 (21%)
Grade in school		
7-10th Grade (n) (%)	4 (33%)	11 (48%)
11-12th Grade (n) (%)	8 (67%)	10 (44%)
Dropped out of school (n) (%)	0 (0%)	0 (0%)
High school graduate (n) (%)	0 (0%)	3 (11%)
Attending college (n) (%)	0 (0%)	2 (9%)
Job		
Yes (n) (%)	5 (33%)	7 (25%)
No (n) (%)	10 (67%)	21 (75%)
Family monthly income		
Under $438 (n) (%)	3 (21%)	2 (7%)
$439 - 888 (n) (%)	1 (7%)	4 (15%)
$889 - 1338 (n) (%)	1 (7%)	4 (15%)
$1339 and over (n) (%)	1 (7%)	2 (7%)
Don't know (n) (%)	8 (57%)	15 (56%)
Social support		
Parents (n) (%)	7 (47%)	18 (67%)
Grandparents (n) (%)	1 (7%)	0 (0%)
Other relatives (n) (%)	2 (14%)	0 (0%)
Boyfriend or husband (n) (%)	3 (20%)	3 (11%)
Other friends (n) (%)	1 (7%)	3 (11%)
Social services (n) (%)	1 (7%)	0 (0%)
Financial support		
Self (n) (%)	2 (13%)	1 (4%)
Parents (n) (%)	11 (73%)	16 (57%)
Grandparents (n) (%)	0 (0%)	0 (0%)
Other relatives (n) (%)	0 (0%)	1 (4%)
Boyfriend or husband (n) (%)	2 (13%)	7 (25%)
Other friends (n) (%)	0 (0%)	0 (0%)
Social services (n) (%)	0 (0%)	3 (11%)

Community of residence		
Rural (n) (%)	4 (27%)	9 (32%)
Town under 10,000 (n) (%)	2 (13%)	11 (39%)
City 10,000 - 50,000 (n) (%)	7 (47%)	8 (29%)
Suburb of a city over 50,000 (n) (%)	2 (14%)	0 (0%)
Type of medical care		
Health clinic (n) (%)	7 (47%)	5 (18%)
Physician (n) (%)	5 (33%)	20 (71%)
No medical care (n) (%)	3 (20%)	3 (11%)
Month of first doctor's visit		
0 (n) (%)	2 (14%)	2 (8%)
1 (n) (%)	4 (29%)	4 (15%)
2 (n) (%)	5 (36%)	10 (39%)
3 (n) (%)	3 (21%)	8 (31%)
4-5 (n) (%)	0 (0%)	2 (8%)
Frequency of doctor's visit		
Once a month (n) (%)	12 (100%)	21 (84%)
Every two weeks (n) (%)	0 (0%)	3 (12%)
Once a week (n) (%)	0 (0%)	1 (4%)
Health history		
Diabetes		
Yes (n) (%)	0 (0%)	4 (50%)
No (n) (%)	5 (100%)	4 (50%)
High blood pressure		
Yes (n) (%)	0 (0%)	4 (50%)
No (n) (%)	6 (100%)	4 (50%)
Medication for medical condition		
Yes (n) (%)	2 (33%)	2 (20%)
No (n) (%)	4 (67%)	8 (80%)
Drug use		
Yes (n) (%)	1 (17%)	1 (11%)
No (n) (%)	5 (83%)	8 (89%)
Alcohol use		
Yes (n) (%)	1 (14%)	1 (13%)
No (n) (%)	6 (86%)	7 (88%)
Cigarette use		
Yes (n) (%)	1 (17%)	2 (17%)
No (n) (%)	5 (83%)	10 (83%)
Previous pregnancy		
Yes (n) (%)	2 (13%)	6 (21%)
No (n) (%)	13 (87%)	22 (79%)
Other children		
Yes (n) (%)	1 (7%)	4 (15%)
No (n) (%)	14 (93%)	23 (85%)

[a] N = number of participants with percent (%) frequency.

[b] Special Supplemental Food Program for Women, Infants, and Children.

Table 2. Factors identified from initial responses to 43 belief statements of pregnant adolescent participants by nutrition education program.

Pregnant Adolescent Participants/Education Program	Factors/Belief Statements	Factor Loadings[a]
"Have a healthy baby" (HAHB) nutrition education program	*Factor 1: Prenatal Weight Gain*	
	Women will crave pickles and ice cream during pregnancy.	0.58
	A pregnant woman should eat as much as she wants because she is eating for two.	0.68
	It doesn't completely matter how much or how little weight is gained during pregnancy.	0.71
	It doesn't completely matter what a woman eats during pregnancy because the baby will take what it needs from her body.	0.75
	Gaining lots of weight during pregnancy makes a healthy baby.	0.83
	Factor 2: Food Cravings - Likes and Dislikes	
	Eating lots of sweets during pregnancy produces a more mild manner child than not eating sweets.	0.54
	Food cravings during pregnancy will determine the child's likes and dislikes in later life.	0.66
	A woman who dislikes tomatoes during pregnancy will produce a child who dislikes tomatoes.	0.78
	Pregnant women who crave salty or sour foods will have a boy.	0.91
	Factor 3: Cravings and Baby's Needs	
	A woman who eats alot of oranges during pregnancy will have a baby who likes oranges later in life.	0.53
	Pregnant women crave foods they need in their diet.	0.70
	A woman needs double portions during pregnancy since she is now eating for two.	0.71
	The baby gets what he/she needs first, the rest goes to the mother.	0.83
	Factor 4: Health	
	A father who is a drug addict is more likely to produce birth defects.	0.56
	A father with high cholesterol levels is likely to produce a child with heart disease.	0.57
	Pregnant women crave nonfood items such as laundry starch, clay and dirt.	0.70
	Pregnant women crave dirt when their diets are low in minerals.	0.75
"Eating right is basic" (ERIB) nutrition education program	*Factor 1: Food Cravings*	
	Pregnant women who crave sweets will produce a more hyperactive child.	0.61
	Women eat better when they become pregnant.	0.63
	Food cravings during pregnancy will determine the child's likes and dislikes in later life.	0.74
	If a pregnant woman craves a food, her baby will like that food.	0.87
	A woman who eats alot of oranges during pregnancy will have a baby who likes oranges later in life.	0.89

A woman who dislikes tomatoes during pregnancy will produce a child who dislikes tomatoes.	0.94
Factor 2: Cravings - Baby and Pica	
A pregnant woman who eats lots of ice, lacks iron in her blood.	0.64
If a woman doesn't eat what she craves during pregnancy, when her baby is born it will smack and lick it's lips until given that food.	0.70
Eating lots of sweets during pregnancy produces a more mild manner child than not eating sweets.	0.77
Pregnant women crave dirt when their diets are low in minerals.	0.77
Pregnant women crave nonfood items such as laundry starch, clay and dirt.	0.80
Factor 3: Cravings - Sex of the Child and Nutrient Needs	
Pregnant women who crave sweets will have a girl.	0.60
Women will crave pickles and ice cream during pregnancy.	0.67
Pregnant women who crave salty or sour foods will have a boy.	0.83
A pregnant woman craves ice because she is not getting enough of certain nutrients in her diet.	0.83
A pregnant woman should eat more sodium rich foods and less meats and high-calorie foods to decrease high blood pressure.	0.94
Factor 4: Folklore	
Beets build red blood during pregnancy.	0.50
Beets add iron to a pregnant woman's diet.	0.68
A pregnant woman will lose a tooth with every baby if she doesn't drink milk.	0.70
A woman should not eat fish and milk at the same meal during pregnancy.	0.81
Factor 5: Nutrient Needs	
Pregnant women crave foods they need in their diet.	0.50
The child of a mother who dislikes meat during pregnancy will also dislike meat.	0.63
It doesn't completely matter how much or how little weight is gained during pregnancy.	0.70
It doesn't completely matter what a woman eats during pregnancy because the baby will take what it needs from her body.	0.88

[a]Each factor includes statements that loaded $\geq$ 0.50 and is named for the dominant concept. Not all 43 belief statements fall into one of the identified factors, only those with the greatest internal consistency (Cronbach's Coefficient Alpha at least 0.79).

Table 3. Factors identified from post responses to 43 belief statements of all pregnant adolescent participants.

Pregnant Adolescent Participants/Education Program	Factors/Belief Statements	Factor Loadings[a]
Pregnant adolescent participants in both nutrition education programs	*Factor 1: Food Cravings - Likes and Dislikes*	
	Food cravings during pregnancy will determine the child's likes and dislikes in later life.	0.51
	A woman should not eat fish and milk at the same meal during pregnancy.	0.54
	The child of a mother who dislikes meat during pregnancy will also dislike meat.	0.58
	All pregnant women have cravings.	0.62
	"High blood" (high blood pressure) is caused by excess heat during pregnancy.	0.70
	A woman who eats alot of oranges during pregnancy will have a baby who likes oranges later in life.	0.72
	A woman who dislikes tomatoes during pregnancy will produce a child who dislikes tomatoes.	0.81
	If a pregnant woman craves a food, her baby will like that food.	0 81
	Factor 2: Health and Folklore	
	Birth defects are mostly the fault of the mother.	0.53
	Pregnant women who crave salty or sour foods will have a boy.	0.62
	Pregnant women who crave sweets will have a girl.	0.70
	A pregnant woman should give into her cravings or she will mark the baby.	0.74
	Eating chicken legs during pregnancy will cause birthmarks on the baby.	0.81
	Eating strawberries during pregnancy will cause birthmarks on the baby.	0.88
	Factor 3: Prenatal Weight Gain	
	Gaining lots of weight during pregnancy makes a healthy baby.	0.50
	Whatever a pregnant woman craves, she should eat.	0.54
	Women will crave pickles and ice cream during pregnancy.	0.69
	A woman needs double portions during pregnancy since she is eating for two.	0.78
	A pregnant woman should eat as much as she wants because she is eating for two.	0.87
	Factor 4: Health	
	A father with high cholesterol levels is likely to produce a child with heart disease.	0.50
	Pregnant women crave nonfood items such as laundry starch, clay and dirt.	0.50
	Pregnant women crave dirt when their diets are low in minerals.	0.57
	A father who is a drug addict is more likely to produce birth defects.	0.78

[a]Each factor includes statements that loaded $\geq$ 0.50 and is named for the dominant concept. Not all 43 belief statements fall into one of the identified factors, only those with the greatest internal consistency (Cronbach's Coefficient Alpha at least 0.79).

Table 4
Demographic and health history summary of pregnant adolescent participants prior to the nutrition education programs[a]

Demographic/Health history variables	Eating right is basic (ERIB) nutrition education	Have a healthy baby (HAHB) nutrition education
Pregnant adolescents (n)	14	18
Paraprofessionals (n)	6	6
EFNEP counties in Oklahoma (n)	4	5
Age		
14-15 (y) (n) (%)	1 (7%)	4 (22%)
16-17 (y) (n) (%)	5 (36%)	6 (33%)
18-19 (y) (n) (%)	8 (57%)	8 (44%)
Ethnic group		
White (n) (%)	6 (43%)	13 (72%)
Black (n) (%)	3 (21%)	1 (6%)
Native American (n) (%)	5 (36%)	4 (22%)
WIC enrollment [b]		
Yes (n) (%)	13 (93%)	14 (78%)
No (n) (%)	1 (7%)	4 (22%)
Grade in school		
8-10th Grade (n) (%)	1 (8%)	7 (47%)
11-12th Grade (n) (%)	11 (92%)	6 (40%)
Dropped out of school (n) (%)	0 (0%)	0 (0%)
High school graduate (n) (%)	0 (0%)	0 (0%)
Attending college (n) (%)	0 (0%)	2 (13%)
Job		
Yes (n) (%)	4 (29%)	4 (22%)
No (n) (%)	10 (71%)	14 (78%)
Family monthly income		
Under $438 (n) (%)	3 (23%)	2 (12%)
$439 - 888 (n) (%)	1 (8%)	3 (18%)
$889 - 1338 (n) (%)	2 (15%)	1 (6%)
$1339 and over (n) (%)	1 (8%)	1 (6%)
Don't know (n) (%)	6 (46%)	10 (59%)
Social support		
Parents (n) (%)	7 (50%)	13 (77%)
Grandparents (n) (%)	0 (0%)	0 (0%)
Other relatives (n) (%)	1 (7%)	0 (0%)
Boyfriend or husband (n) (%)	4 (29%)	3 (18%)
Other friends (n) (%)	1 (7%)	1 (6%)
Social services (n) (%)	1 (7%)	0 (0%)
Financial support		
Self (n) (%)	1 (7%)	0 (0%)
Parents (n) (%)	10 (71%)	12 (67%)
Grandparents (n) (%)	0 (0%)	0 (0%)
Other relatives (n) (%)	1 (7%)	0 (0%)
Boyfriend or husband (n) (%)	2 (14%)	4 (23%)
Other friends (n) (%)	0 (0%)	0 (0%)
Social services (n) (%)	0 (0%)	2 (11%)

Community of residence		
Rural (n) (%)	3 (21%)	6 (33%)
Town under 10,000 (n) (%)	3 (21%)	8 (44%)
City 10,000 - 50,000 (n) (%)	6 (43%)	4 (22%)
Suburb of a city over 50,000 (n) (%)	2 (14%)	0 (0%)
Type of medical care		
Health clinic (n) (%)	6 (43%)	2 (11%)
Physician (n) (%)	6 (43%)	14 (78%)
No medical care (n) (%)	2 (14%)	2 (11%)
Month of first doctor's visit		
0 (n) (%)	1 (8%)	1 (6%)
1 (n) (%)	5 (39%)	3 (18%)
2 (n) (%)	4 (31%)	7 (41%)
3 (n) (%)	3 (23%)	5 (29%)
4-5 (n) (%)	0 (0%)	1 (6%)
Frequency of doctor's visit		
Once a month (n) (%)	11 (92%)	15 (94%)
Every two weeks (n) (%)	1 (8%)	1 (6%)
Once a week (n) (%)	0 (0%)	0 (0%)
Health history		
Diabetes		
Yes (n) (%)	0 (0%)	2 (50%)
No (n) (%)	4 (100%)	2 (50%)
High blood pressure		
Yes (n) (%)	0 (0%)	2 (50%)
No (n) (%)	8 (100%)	2 (50%)
Medication for medical condition		
Yes (n) (%)	4 (57%)	2 (50%)
No (n) (%)	3 (43%)	2 (50%)
Drug use		
Yes (n) (%)	0 (0%)	1 (20%)
No (n) (%)	8 (100%)	4 (80%)
Alcohol use		
Yes (n) (%)	1 (11%)	1 (20%)
No (n) (%)	8 (89%)	4 (80%)
Cigarette use		
Yes (n) (%)	1 (13%)	2 (25%)
No (n) (%)	7 (88%)	6 (75%)
Previous pregnancy		
Yes (n) (%)	4 (29%)	3 (18%)
No (n) (%)	10 (71%)	15 (83%)
Other children		
Yes (n) (%)	1 (7%)	2 (11%)
No (n) (%)	13 (93%)	16 (89%)

[a] N = number of participants with percent (%) frequency.
[b] Special Supplemental Food Program for Women, Infants, and Children.

Table 5
Mean anthropometric measurements of pregnant adolescent participants of two eight-week nutrition education programs at pre, post and one month after birth [a]

Anthropometric variables	Eating right is basic (ERIB) nutrition education (n =14)	P [b]	Have a healthy baby (HAHB) nutrition education (n=18)	P [c]
Prepregnancy weight [d]				
Underweight (n) (%)	1 (7%)		4 (22%)	
Normal weight (n) (%)	9 (64%)		10 (56%)	
Overweight (n) (%)	3 (21%)		1 (5%)	
Obese (n) (%)	1 (7%)		3 (17%)	
Height (cm)				
Pre nutrition education	162.1 ± 7.9		163.0 ± 10.1	
Post nutrition education	162.6 ± 7.9	0.15	163.4 ± 10.2	0.09
Post delivery	162.4 ± 7.9	0.24	163.8 ± 10.2	0.13
Weight (kg)				
Pre nutrition education	69.0 ± 16.7		66.6 ± 14.0	
Post nutrition education	76.5 ± 20.4	0.002	73.4 ± 15.4	0.0001
Post delivery	69.0 ± 16.7	0.003	68.2 ± 16.5	0.0003
Body mass index (kg/m^2)				
Prepregnancy	23.8 ± 4.3		23.2 ± 4.3	
Pre nutrition education	26.2 ± 5.6		25.0 ± 4.7	
Post nutrition education	28.8 ± 6.6	0.003	27.4 ± 4.9	0.0001
Post delivery	26.0 ± 5.1	0.006	25.3 ± 5.2	0.0003
Mid-arm circumference (cm)				
Pre nutrition education	28.5 ± 4.0		27.8 ± 3.5	
Post nutrition education	29.0 ± 4.2	0.26	27.8 ± 3.4	0.91
Post delivery	28.7 ± 4.5	0.43	28.2 ± 3.5	0.39
Triceps skinfold thickness (mm)[e]				
Pre nutrition education	31.4 ± 8.3		29.9 ± 6.1	
Post nutrition education	32.1 ± 10.9	0.71	31.5 ± 6.1	0.09
Post delivery	30.2 ± 9.0	0.37	31.4 ± 8.0	0.88
Mid-arm muscle area (cm^2)				
Pre nutrition education	21.5 ± 8.7		20.8 ± 7.0	
Post nutrition education	22.3 ± 6.9	0.74	19.4 ± 7.0	0.24
Post delivery	23.4 ± 7.9	0.63	20.7 ± 5.9	0.39
Arm fat area (cm^2)				
Pre nutrition education	44.1 ± 13.5		41.4 ± 10.4	
Post nutrition education	45.8 ± 17.1	0.37	43.0 ± 10.1	0.20
Post delivery	43.5 ± 15.1	0.30	43.7 ± 12.7	0.63
Blood Pressure				
Pre nutrition education	111 ± 9/74 ± 8		108 ± 7/66 ± 7	
Post nutrition education	111 ± 6/69 ± 10	0.93/0.11	111 ± 6/69 ± 8	0.05/0.13
Post delivery	109 ± 7/70 ± 6	0.29/0.83	109 ± 5/69 ± 7	0.06/0.98

[a] All means are ± standard error unless otherwise noted.
[b] P value as determined by a two sample t test is associated with the null hypothesis that mean anthropometric measurement values are not significantly different between pre and post, or post and follow-up data for the "Eating Right Is Basic" group.
[c] P value as determined by a two sample t test is associated with the null hypothesis that mean anthropometric measurement values are not significantly different between pre and post, or post and follow-up for the "Have A Healthy Baby" group.
[d] N = number of participants with percent (%) frequency.
[e] Mean of three measurements.

Table 6
Follow-up data of pregnant adolescent participants collected one month post delivery [a]

Follow-up variables	Eating right is basic (ERIB) nutrition education (n=14)[b]	Have a healthy baby (HAHB) nutrition education (n=18)	P[c]
Prenatal weight gain (kg)	16.6 ± 8.4	14.8 ± 5.3	0.45
Sex			
Boys (n) (%)	10 (67%)	11 (61%)	
Girls (n)(%)	5 (33%)	7 (39%)	
Birth weight			
Mean (kg)	3.2 ± 0.5	3.5 ± 0.6	.45
Length mean (cm)	49.8 ± 2.5	50.7 ± 3.3	.41
No. of days in hospital			
Mother (mean)	3.1 ± 1.1	2.3 ± 1.3	.05
Infant (mean)	3.1 ± 1.1	5.2 ± 12.7	.53
Babys' weight at one month			
Mean (kg)	4.3 ± 0.8	4.4 ± 0.8	.81
Method of feeding			
Breast (n) (%)	2 (13%)	5 (28%)	
Bottle (n) (%)	12 (80%)	13 (72%)	
Combination (n) (%)	1 (7%)	0 (0%)	.20
WIC Enrollment [b]			
Yes (n) (%)	14 (100%)	17 (94%)	
No (n) (%)	0 (0%)	1 (6%)	.37
Length of gestation			
Premature birth (n) (%)	1 (7%)	1 (6%)	
Full term birth (n) (%)	14 (93%)	17 (94%)	

[a] N = number of participants with percent (%) frequency unless otherwise noted.
[b] One participant delivered twins.
[c] P value as determined by a two sample t test is associated with the null hypothesis that mean follow-up values are not significantly different between the "ERIB" and "HAHB" groups.

Table 7
Pre, post and follow-up dietary intake data (% RDA) summarized from the 24 - hour dietary recall form[a]

Nutrient	Eating right is basic (ERIB) nutrition education (n = 14) % RDA	P[b]	Have a healthy baby (HAHB) nutrition education (n = 18)[d] % RDA	P[c]
Calories				
Pre nutrition education	66.9		79.6	
Post nutrition education	61.1	0.55	77.2	0.61
Post delivery	64.1	0.78	80.9	0.56
Protein				
Pre nutrition education	115.6		136.7	
Post nutrition education	106.2	0.67	139.5	0.87
Post delivery	83.0	0.06	164.4	0.30
Carbohydrate				
Pre nutrition education	60.0		68.7	
Post nutrition education	47.1	0.15	63.8	0.18
Post delivery	60.3	0.30	61.7	0.88
Fat				
Pre nutrition education	74.0		93.8	
Post nutrition education	79.8	0.71	94.2	0.96
Post delivery	75.8	0.79	106.9	0.35
Saturated Fat				
Pre nutrition education	75.8		111.1	
Post nutrition education	86.6	0.54	115.5	0.75
Post delivery	81.5	0.75	118.3	0.68
Monounsaturated Fat				
Pre nutrition education	86.8		95.8	
Post nutrition education	94.3	0.70	97.5	0.88
Post delivery	86.0	0.65	124.9	0.16
Polyunsaturated Fat				
Pre nutrition education	39.9		52.5	
Post nutrition education	41.9	0.82	43.3	0.14
Post delivery	42.1	0.98	53.6	0.38
Cholesterol				
Pre nutrition education	77.4		101.9	
Post nutrition education	96.9	0.45	93.7	0.64
Post delivery	46.5	0.008	136.7	0.11
Fiber				
Pre nutrition education	59.2		61.2	
Post nutrition education	47.3	0.45	62.3	0.92
Post delivery	36.8	0.44	53.2	0.63
Vitamin A				
Pre nutrition education	73.8		123.8	
Post nutrition education	79.1	0.85	159.6	0.14
Post delivery	39.4	0.01	93.8	0.01

Thiamin				
Pre nutrition education	82.4		110.7	
Post nutrition education	84.8	0.88	114.5	0.70
Post delivery	102.7	0.15	115.6	0.67
Riboflavin				
Pre nutrition education	89.1		145.5	
Post nutrition education	87.6	0.93	139.2	0.63
Post delivery	82.3	0.72	131.9	0.79
Niacin				
Pre nutrition education	102.5		125.6	
Post nutrition education	102.2	0.98	136.8	0.44
Post delivery	77.9	0.02	147.5	0.60
Niacin equivalents				
Pre nutrition education	97.4		123.2	
Post nutrition education	102.3	0.73	136.1	0.38
Post delivery	72.1	0.002	137.9	0.85
Vitamin B_6				
Pre nutrition education	62.1		91.8	
Post nutrition education	55.4	0.53	99.9	0.31
Post delivery	63.7	0.28	104.3	0.43
Vitamin B_{12}				
Pre nutrition education	158.6		230.1	
Post nutrition education	167.1	0.84	283.3	0.15
Post delivery	106.1	0.04	197.7	0.05
Folate				
Pre nutrition education	59.9		75.2	
Post nutrition education	49.9	0.35	69.2	0.67
Post delivery	78.7	0.06	115.2	0.02
Pantothenic acid				
Pre nutrition education	59.6		73.6	
Post nutrition education	49.1	0.49	68.8	0.62
Post delivery	32.7	0.10	66.6	0.99
Vitamin C				
Pre nutrition education	79.6		171.4	
Post nutrition education	118.4	0.16	143.0	0.45
Post delivery	86.6	0.44	135.1	0.96
Vitamin D				
Pre nutrition education	47.1		73.0	
Post nutrition education	33.1	0.65	65.1	0.66
Post delivery	15.7	0.03	39.8	0.02
Vitamin E				
Pre nutrition education	55.4		68.1	
Post nutrition education	58.4	0.81	56.2	0.28
Post delivery	46.2	0.40	70.3	0.36
Calcium				
Pre nutrition education	47.5		91.1	
Post nutrition education	58.9	0.39	93.6	0.85
Post delivery	36.0	0.05	68.2	0.10

Copper				
Pre nutrition education	39.3		48.4	
Post nutrition education	37.6	0.84	52.2	0.40
Post delivery	26.9	0.14	46.9	0.76
Iron				
Pre nutrition education	51.0		52.1	
Post nutrition education	38.7	0.13	67.3	0.07
Post delivery	61.6	0.08	97.8	0.02
Magnesium				
Pre nutrition education	72.9		86.6	
Post nutrition education	63.0	0.39	97.1	0.31
Post delivery	45.8	0.0001	79.3	0.0001
Manganese				
Pre nutrition education	77.3		68.0	
Post nutrition education	51.9	0.17	77.0	0.43
Post delivery	64.4	0.71	66.9	0.72
Phosphorus				
Pre nutrition education	93.1		123.6	
Post nutrition education	98.0	0.80	132.2	0.56
Post delivery	65.6	0.03	108.8	0.26
Potassium				
Pre nutrition education	119.9		145.9	
Post nutrition education	108.6	0.55	156.4	0.55
Post delivery	76.5	0.05	115.9	0.06
Selenium				
Pre nutrition education	59.7		83.3	
Post nutrition education	77.4	0.49	81.9	0.93
Post delivery	56.9	0.12	97.1	0.43
Sodium				
Pre nutrition education	134.7		152.9	
Post nutrition education	134.7	1.00	156.7	0.83
Post delivery	101.5	0.19	128.9	0.33
Zinc				
Pre nutrition education	69.7		67.5	
Post nutrition education	65.3	0.75	84.4	0.08
Post delivery	48.8	0.06	83.3	0.99

[a] N = Mean percent of Recommended Dietary Allowances (RDA) or Estimated Safe and Adequate Daily Dietary Intake Range (ESADDI).
[b] P value as determined by a two sample τ test is associated with the null hypothesis that mean nutrient intakes are not significantly different between pre and post, or post and follow-up data for the "Eating Right Is Basic" group.
[c] P value as determined by a two sample τ test is associated with the null hypothesis that mean nutrient intakes are not significantly different between pre and post, or post and follow-up for the "Have A Healthy Baby" group.
[d] Pre and post nutrient intake data based on 17 dietary recalls.

Table 8
Pre, post and follow-up dietary intake data (% RDA distribution) summarized from the 24-hour dietary recall form[a]

Nutrient	Eating right is basic (ERIB) nutrition education (n = 14) % RDA distribution (< 67% or ≥ 67%)	Have a healthy baby (HAHB) nutrition education (n = 18) % RDA distribution (< 67% or ≥ 67%)
Calories		
Pre nutrition education	7 (50%) 7 (50%)	4 (24%) 13 (77%)
Post nutrition education	8 (57%) 6 (43%)	4 (24%) 13 (77%)
Post delivery	12 (86%) 2 (14%)	10 (56%) 8 (44%)
Protein		
Pre nutrition education	2 (14%) 12 (86%)	1 (6%) 16 (94%)
Post nutrition education	2 (14%) 12 (86%)	0 (0%) 17 (100%)
Post delivery	7 (50%) 7 (50%)	0 (0%) 18 (100%)
Carbohydrate		
Pre nutrition education	8 (57%) 6(43%)	9 (53%) 8 (47%)
Post nutrition education	13 (93%) 1 (7%)	10 (59%) 7 (41%)
Post delivery	8 (57%) 6 (43%)	9 (50%) 9 (50%)
Fat		
Pre nutrition education	8 (57%) 6 (43%)	4 (24%) 13 (77%)
Post nutrition education	5 (36%) 9 (64%)	5 (29%) 12 (71%)
Post delivery	0 (0%) 14 (100%)	0 (0%) 18 (100%)
Saturated fat		
Pre nutrition education	8 (57%) 6 (43%)	3 (18%) 14 (82%)
Post nutrition education	4 (29%) 10 (71%)	2 (12%) 15 (88%)
Post delivery	7 (50%) 7 (50%)	1 (6%) 17 (94%)
Monounsaturated fat		
Pre nutrition education	6 (43%) 8 (57%)	3 (18%) 14 (82%)
Post nutrition education	3 (21%) 11 (79%)	4 (24%) 13 (77%)
Post delivery	7 (50%) 7 (50%)	4 (22%) 14 (78%)
Polyunsaturated fat		
Pre nutrition education	13 (93%) 1 (7%)	12 (71%) 5 (29%)
Post nutrition education	12 (86%) 2 (14%)	16 (94%) 1 (6%)
Post delivery	12 (86%) 2 (14%)	15 (83%) 3 (17%)
Cholesterol		
Pre nutrition education	9 (64%) 5 (36%)	5 (29%) 12 (71%)
Post nutrition education	4 (29%) 10 (71%)	5 (29%) 12 (71%)
Post delivery	0 (0%) 14 (100%)	0 (0%) 18 (100%)
Fiber		
Pre nutrition education	8 (57%) 6 (43%)	13 (77%) 4 (24%)
Post nutrition education	10 (71%) 4 (29%)	11 (65%) 6 (35%)
Post delivery	12 (86%) 2 (14%)	13 (72%) 5 (28%)

Vitamin A		
Pre nutrition education	9 (64%) 5 (36%)	1 (6%) 16 (94%)
Post nutrition education	7 (50%) 7 (50%)	2 (12%) 15 (88%)
Post delivery	11 (79%) 3 (21%)	7 (39%) 11 (61%)
Thiamin		
Pre nutrition education	6 (43%) 8 (57%)	0 (0%) 17 (100%)
Post nutrition education	5 (36%) 9 (64%)	2 (12%) 15 (88%)
Post delivery	4 (29%) 10 (71%)	2 (11%) 16 (89%)
Riboflavin		
Pre nutrition education	3 (21%) 11 (79%)	0 (0%) 17 (100%)
Post nutrition education	4 (29%) 10 (71%)	1 (6%) 16 (94%)
Post delivery	7 (50%) 7 (50%)	1 (6%) 17 (94%)
Niacin		
Pre nutrition education	2 (14%) 12 (86%)	1 (6%) 16 (94%)
Post nutrition education	4 (29%) 10 (71%)	1 (6%) 16 (94%)
Post delivery	5 (36%) 9 (64%)	0 (0%) 18 (100%)
Niacin equivalents		
Pre nutrition education	3 (21%) 11 (79%)	1 (6%) 16 (94%)
Post nutrition education	4 (29%) 10 (71%)	1 (6%) 16 (94%)
Post delivery	7 (50%) 7 (50%)	0 (0%) 18 (100%)
Vitamin B_6		
Pre nutrition education	10 (71%) 4 (29%)	4 (24%) 13 (77%)
Post nutrition education	12 (86%) 2 (14%)	2 (12%) 15 (88%)
Post delivery	7 (50%) 7 (50%)	3 (17%) 15 (83%)
Vitamin B_{12}		
Pre nutrition education	2 (14%) 12 (86%)	1 (6%) 16 (94%)
Post nutrition education	0 (0%) 14 (100%)	0 (0%) 17 (100%)
Post delivery	5 (36%) 9 (64%)	1 (6%) 17 (94%)
Folate		
Pre nutrition education	10 (71%) 4 (29%)	9 (53%) 8 (47%)
Post nutrition education	10 (71%) 4 (29%)	9 (53%) 8 (47%)
Post delivery	7 (50%) 7 (50%)	9 (50%) 9 (50%)
Pantothenic acid		
Pre nutrition education	10 (71%) 4 (29%)	6 (35%) 11 (65%)
Post nutrition education	13 (93%) 1 (7%)	16 (94%) 1 (6%)
Post delivery	13 (93%) 1 (7%)	11 (61%) 7 (39%)
Vitamin C		
Pre nutrition education	9 (64%) 5 (36%)	2 (12%) 15 (88%)
Post nutrition education	6 (43%) 8 (57%)	5 (29%) 12 (71%)
Post delivery	10 (71%) 4 (29%)	8 (44%) 10 (56%)
Vitamin D		
Pre nutrition education	13 (93%) 1 (7%)	9 (53%) 8 (47%)
Post nutrition education	12 (86%) 2 (14%)	10 (59%) 7 (41%)
Post delivery	14 (100%) 0 (0%)	15 (83%) 3 (17%)

Vitamin E		
Pre nutrition education	10 (71%) 4 (29%)	12 (71%) 5 (29%)
Post nutrition education	10 (71%) 4 (29%)	13 (77%) 4 (24%)
Post delivery	12 (86%) 2 (14%)	10 (56%) 8 (44%)
Calcium		
Pre nutrition education	12 (86%) 2 (14%)	3 (18%) 14 (82%)
Post nutrition education	8 (57%) 6 (43%)	4 (24%) 13 (77%)
Post delivery	12 (86%) 2 (14%)	10 (56%) 8 (44%)
Copper		
Pre nutrition education	13 (93%) 1 (7%)	14 (82%) 3 (18%)
Post nutrition education	13 (93%) 1 (7%)	0 (0%) 17 (100%)
Post delivery	14 (100%) 0 (0%)	15 (83%) 3 (17%)
Iron		
Pre nutrition education	11 (79%) 3 (21%)	12 (71%) 5 (29%)
Post nutrition education	12 (86%) 2 (14%)	9 (53%) 8 (47%)
Post delivery	9 (64%) 5 (36%)	5 (28%) 13 (72%)
Magnesium		
Pre nutrition education	9 (64%) 5 (36%)	4 (24%) 13 (77%)
Post nutrition education	7 (50%) 7 (50%)	2 (12%) 15 (88%)
Post delivery	11 (79%) 3 (21%)	9 (50%) 9 (50%)
Manganese		
Pre nutrition education	7 (50%) 7 (50%)	9 (53%) 8 (47%)
Post nutrition education	10 (71%) 4 (29%)	7 (41%) 12 (59%)
Post delivery	12 (86%) 2 (14%)	11 (61%) 7 (39%)
Phosphorus		
Pre nutrition education	3 (21%) 11 (79%)	1 (6%) 16 (94%)
Post nutrition education	1 (7%) 13 (93%)	1 (6%) 16 (94%)
Post delivery	8 (57%) 6 (43%)	4 (22%) 14 (78%)
Potassium		
Pre nutrition education	1 (7%) 13 (93%)	1 (6%) 16 (94%)
Post nutrition education	1 (7%) 13 (93%)	0 (0%) 17 (100%)
Post delivery	8 (57%) 6 (43%)	3 (17%) 15 (83%)
Selenium		
Pre nutrition education	9 (64%) 5 (36%)	8 (47%) 9 (53%)
Post nutrition education	6 (43%) 8 (57%)	6 (35%) 11 (65%)
Post delivery	11 (79%) 3 (21%)	7 (39%) 11 (61%)
Sodium		
Pre nutrition education	2 (14%) 12 (86%)	1 (6%) 16 (94%)
Post nutrition education	2 (14%) 12 (86%)	2 (12%) 15 (88%)
Post delivery	0 (0%) 14 (100%)	0 (0%) 18 (100%)
Zinc		
Pre nutrition education	8 (57%) 6 (43%)	9 (53%) 8 (47%)
Post nutrition education	8 (57%) 6 (43%)	4 (24%) 13 (77%)
Post delivery	12 (86%) 2 (14%)	8 (44%) 10 (56%)

[a] Percent distribution of $<$ or $\geq$ 67% of Recommended Dietary Allowances (RDA) or the mid-point of the Estimated Safe and Adeuqate Daily Dietary Intake Range (ESADDI).

Table 9
Eating habits summary of pregnant adolescent participants prior to the nutrition education programs [a]

Eating habit variables	Eating right is basic (ERIB) nutrition education (n=14)	Have a healthy baby (HAHB) nutrition education (n=18)
Prepregnancy weight (kg)	58.6	60.8
Previous prenatal weight gain (kg)	9.1	20.5
Expected weight gain (kg)	12.3	14.4
Weight problem identified		
Yes (n) (%)	4 (29%)	3 (17%)
No (n) (%)	10 (71%)	15 (83%)
Underweight (n) (%)	1 (7%)	1 (6%)
Overweight (n) (%)	3 (21%)	3 (17%)
Appetite		
Hearty (n) (%)	2 (14%)	9 (50%)
Moderate (n) (%)	10 (71%)	9 (50%)
Poor (n) (%)	2 (14%)	0 (0%)
Nausea (n) (%)	11 (79%)	10 (56%
Vomiting (n) (%)	11 (79%)	7 (39%)
Increased appetite (n) (%)	11 (79%)	11 (61%)
Decreased appetite (n) (%)	3 (21%)	6 (33%)
Regular eating habits		
Regular (n) (%)	7 (50%)	15 (83%)
Irregular (n) (%)	7 (50%)	3 (17%)
Vitamin mineral supplements		
Yes (n) (%)	11 (79%)	15 (83%)
No (n) (%)	3 (21%)	3 (17%)
Pills for weight loss		
Yes (n) (%)	1 (7%)	0 (0%)
No (n) (%)	13 (93%)	18 (100%)
Use of diuretic (water) pills		
Yes (n) (%)	0 (0%)	0 (0%)
No (n) (%)	14 (100%)	18 (100%)
Following a diet for weight loss		
Yes (n) (%)	0 (0%)	1 (6%)
No (n) (%)	14 (100%)	17 (94%)
Following a special diet		
Yes (n) (%)	0 (0%)	1 (6%)
No (n) (%)	14 (100%)	16 (89%)

Foods not tolerated		
Yes (n) (%)	3 (21%)	4 (22%)
No (n) (%)	10 (71%)	14 (78%)
Cravings		
Cornstarch (n) (%)	0 (0%)	0 (0%)
Plaster (n) (%)	0 (0%)	0 (0%)
Dirt or clay (n) (%)	0 (0%)	0 (0%)
Ice (n) (%)	4 (29%)	3 (17%)
Other (n) (%)	3 (21%)	3 (17%)
Problems		
Constipation (n) (%)	5 (36%)	2 (11%)
Diarrhea (n) (%)	0 (0%)	2 (11%)
Heartburn (n) (%)	4 (29%)	8 (44%)
Leg cramps (n) (%)	5 (36%)	11 (61%)
Food assistance		
Food stamps (n) (%)	1 (7%)	3 (17%)
WIC voucher (n) (%)	13 (93%)	15 (83%)
School lunch (n) (%)	5 (36%)	4 (22%)
Food shelves (n) (%)	0 (0%)	0 (0%)
Commodities (n) (%)	0 (0%)	1 (6%)
Not enough food during the month		
Yes (n) (%)	3 (21%)	1 (6%)
No (n) (%)	11 (79%)	17 (94%)
Plans to feed baby		
Breast-feed (n) (%)	4 (29%)	4 (22%)
Evaporated milk formula (n) (%)	0 (0%)	0 (0%)
Commercial formula (n) (%)	2 (14%)	7 (39%)
Undecided (n) (%)	8 (57%)	7 (39%)

[a] Means are reported for the first three variables related to prenatal weight gain.
[b] N = number of participants with percent (%) frequency for all variables except the first three related to prenatal weight gain.

VITA

Donna-Jean Hunt

Candidate for the Degree of

Doctor of Philosophy

Thesis: EFFECTS OF NUTRITION EDUCATION PROGRAMS ON NUTRITION KNOWLEDGE, DIETARY INTAKE, BELIEFS AND SELECTED HEALTH PARAMETERS OF PREGNANT ADOLESCENTS

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