ASSOCIATION OF RISK FACTORS IN COLLEGE FRESHMEN WITH CORONARY-PRONE BEHAVIOR PATTERN

By

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CHAPTER I

INTRODUCTION

Significance of the Study

Since approximately 55% of all the deaths occurring annually in the United States are due to coronary heart disease or diseases directly related to the arteriosclerotic process, it is appropriate to consider the risk of coronary heart disease as a major emphasis in determining the total well-being of university students. At Oral Roberts University a prime concern is that students establish a lifestyle with an education, not merely an education. This lifestyle provides many interesting facets which may be studied in relation to behavior and physical fitness.

During the past 15 years, there has been increasing interest in certain social and psychological factors suspected of playing a role in coronary atherosclerosis. Among the more promising approaches has been the work of Friedman and Rosenman (7) of the Mount Zion Hospital and Medical Center San Francisco, California. These men in the late 1950's began studies of a specific manifest personality type, "the coronary-prone bahavior pattern or Behavior Pattern Type A". This pattern is characterized by attributes such as hard-driving effort, competitiveness, aggressiveness, impatience, restlessness, feelings of being under pressure of time, the challenge of responsibility, striving for achievement and an intense dedication to one's job. Also, persons with this pattern tend to exhibit the physical attributes of hyperalertness; explosiveness of speech and tenseness of facial muscles. The classification of men proposed by Friedman and Rosenman is such that individuals at increased risk to coronary heart disease (CHD) are labeled as Type A and those at lower risk as Type B. To date four different research groups have shown this overt behavior pattern to be associated with increased prevalence of CHD (9)(13)(18)(23). Therefore, association between certain social-psychological factors with clinical coronary heart disease has been predominately assumed.

For the purposes of this study the computer-scored questionnaire entitled "The Jenkins Activity Survey for Health Prediction" (JAS) was used. It is a more quantitative and less expensive procedure to judge Type A personalities than the extensive interview method. It was developed by Jenkins in collaboration with Friedman and Rosenman (14). However, those attributes of the personality pattern that relate to one's style of physical response cannot be tested by the JAS. An individually administered test bases its assessment on the content of the responses. However, the JAS has been subjected to repeated revisions since the initial 1965 edition in order to increase its reliability in replicating the standardized interview as used in the three-study classification schemes mentioned earlier. A detailed description of its development and validity as a measure of the coronary prone personality pattern has been reported (15)(16).

Identification of individuals who are susceptible to premature development of coronary heart disease has been heavily stressed in the past for the adult population. This has led to the development and use of "CHD risk factors", such as hypertension, elevated blood lipids (serum cholesterol and triglycerides), cigarette smoking, obesity, family history of heart disease, diabetes, and inadequate physical activity. The data of Wilmore and McNamara (25), and earlier studies by Drash (4) and Friedman (6) show the prevalence of risk factors and suggest that CHD risk factors may be and can be identified during adolescence or early childhood. Other data are available (for example, see Kamel and Dawber) (15), identifying one or possibly two risk factors in children. In addition, data collected at the 7th European Cardiology Congress, held in June, 1976, in Amsterdam provided a significant amount of research supporting identifiable risk variables occuring in adolescence (11).

It is upon this foundation of risk factors' association with psychosocial variable through overt behavior practices and internal psychophysiologic mechanisms probability of influencing clinical coronary artery disease

(CAD), the identification of possible trends of CHD risk factors in college freshmen has been pursued.

Statement of the Problem

The purpose of this study was to investigate the relationship between behavioral patterns and CAD risk factors in college freshmen.

Hypothesis

The Type A college freshman is more coronary prone because of the influences of overt behavior practices and internal psychophysiologic mechanisms. This increased risk of CHD in later years is manifested by:

1. Undesirable body composition i.e. too much fat.
2. Less aerobic physical activity.
3. Higher plasma lipids and lipoproteins.
4. Lower treadmill performance times.
5. Tendency for higher blood pressure and lower forced vital capacity.

Delimitations

1. Six hundred freshmen students under the age of twenty at Oral Roberts University (O.R.U.) were administered the Jenkins Activity Survey (JAS).

2. All subjects were to be tested on all parameters.

Limitations

1. Of the six hundred freshman students administered the JAS, one hundred ninety-one were classified as either Type A or Type B, representing 33% of the total freshmen populatiion.

2. Of the one hundred ninety students classified as Type A or Type B, one hundred fifty were tested on all parameters.

Assumptions

1. The students answered the Jenkins Activity Survey honestly and accurately.

2. A voluntary maximal effort was given by each student during the forced vital capacity and treadmill testings.

3. Mileage and aerobic points were reported and recorded honestly and accurately.

4. The students adhered to the procedures required concerning the fasting and exercise.

5. All technicians were qualified to collect the physical data.

Definition of Terms

<u>Form N of the Jenkins Activity Survey</u>--several forms of the JAS were written especially for employed persons. This meant that a number of questions were not appropriate for students, housewives and certain self-employed workers

not on salary or wages. To overcome this limitation and also to build in the results of item analyses resulting from research done in the past year, a new form of the Jenkins Activity Survey specifically aimed at persons not adequately covered by earlier forms was created. At present, to score the activity survey for the Type A scale, three factor scores have been added: speed and impatience, hard-driving competitive, and a third factor which, for employed persons, measures job involvement. For students and non-employed persons, this factor takes on a different form, but still remains independent of the other factors. Researchers are working to clarify the meaning of this third factor. At present, it seems to be an index of activation and social involvement. The Form N of the Jenkins Activity Survey is a more quantitative, less expensive and quicker procedure for judging Type A personalities in students.

Total Skin Fold--the total sum of the skinfold sites used to determine body fat.

Percent Body Fat--the ratio of body fat-tissue to lean muscle tissue, which is compatible with optimal health fitness status.

Forced Vital Capacity--the maximum amount of air that can forcibly be exhaled in a single breath and is measured in liters.

Systolic Blood Pressure--measured when the heart contracts in systole, pumping the blood out through the artery. The blood pressure rises, heard as the first sound with a stethoscope when placed over the brachial artery. It is measured in millimeters of mercury.

Diastolic Blood Pressure--measured when the heart relaxes and expands in diastole, refilling. Blood pressure falls and is heard as a muffling sound, indicating that the cuff is no longer occluding the artery. It is measured in millimeters of mercury.

Resting heart Rate--number of contractions per minute the heart must beat to supply the blood demanded by the body while at rest.

Voluntary Maximum Heart Rate--the maximum heart rate voluntarily obtained safely during an excercise stress test.

Stress Test--exercise (walk, jog, run) done on a treadmill with an increase in elevation and speed at prescribed intervals. The test is terminated when the subject "feels" he can not go any longer without collapsing.

Treadmill Time--amount of time an individual can endure a stress test; the longer the time, the greater the aerobic capacity.

Aerobic Capacity--maximum amount of oxygen that can be delivered to the cells in any given minute, synonomous terms are maximum oxygen intake, uptake and consumption. It is considered to be the best single indicator of cardiorespiratory fitness.

Cardiorespiratory Fitness--functioning capabilities of the lungs, the blood, and the blood vessels, and the heart.

CHAPTER II

REVIEW OF LITERATURE

The search of the related literature was concerned with reviewing studies related to the risk of coronary artery disease in groups and individuals with coronary-prone behavior patterns. The review provided information of other data collected specifically in the area of CAD precursory risk factors which are determinable in adolescence. It also provided information about design and procedure for completing this study and aided in the analysis and interpretation of the results.

A quote from the pioneers in the subject of coronary-prone behavior pattern, Friedman and Rosenman (8) from their book Type A Behavior and Your Heart, states

> We believe that the major cause of coronary artery and heart disease is a complex of emotional reactions which we have designated Type A behavior pattern. Such being our conviction, and also, because less than a handful of medical investigators have concerned themselves with the possible relationship of your brain to your heart and its nourishing arteries . . . (p. 56).

They defined Type A as

> . . . an excessive competitive drive, aggressiveness, impatience, and a harrying sense of time urgency. Individuals displaying this pattern seem to be engaged in a chronic, ceaseless and often

> fruitless struggle--with themselves, with others, with circumstances . . . They frequently exhibit a free floating, but well rationalized form of hostility, and almost always a deep seated insecurity (pp. 56-58).

The Western Collaborative Group Study (WCGS) demonstrated in its research group that this overt behavior pattern was associated in incidence of coronary heart disease (23). Three additional research groups have shown this same associatiion to be evident (2) (15) (22). Therefore, association between certain social-psychological factors with clinical coronary heart disease has been assumed.

In the past, designation of "CAD risk factors", such as hypertension, elevated blood lipids (serum cholestrol and triglycerides)., cigarette smoking, obesity, family history of heart disease, diabetes, and inadequate physical activity was developed from identification of susceptible individuals in the adult population. Allied medical professions have recently begun to identify these same variables during adolescence. The data of Wilmore and McNamara (25) show the prevalence of risk factors, such as obesity (25% fat), low physical work capacity (42 ml/kg min.) and elevated serum cholesterol (200 mg%) and triglyceride (100 mg%) levels in boys 8-12 years of age. Lauer and his associates (19) also investigating CAD risk factors in 4,829 school children, reported that twenty-four percent had elevated cholesterol levels and fifteen percent had abnormal triglyceride levels. In addition, they reported that twenty percent of the children, 6-9 years of age, had excess body weight as determined by deviation from the median body weight at a given height. Earlier studies by Drash and Friedman (16) also suggested that CAD risk factors may be identified during early childhood. Kannel and Dawber (17) identified one or possibly two risk factors in children in their studies.

Strong (24) provided much information in aiding the analysis and interpretatiion of results. In his study the major coronary risk factors: hyperlipidemia, hypertension, and smoking are discussed, accompanied by the seemingly lesser influencing factors of sedentary living habits, obesity, and a positive family history of a premature atherosclerotic event. Strong suggests, also, that this multifactorial hypothesis tends to imply that many of these factors act simultaneously or in sequence for the necessary development of some coronary artery diseases. In addition, it may be necessary for the factors to occur during a critical or vulnerable time, e.g., a high cholestrol intake during the second and third decade of life, which may be more injurious than during the first or fifth decade.

At the 7th European Cardiology Congress, held in June 1976, several European countries participated in a collaboration of information (11). The recorded exhibition discussed several different approaches to epidemiological and multifactorial studies.

The data of these studies substantiated the prevalence of coronary heart disease risk factors in children. More importantly, much of the data give evidence to the development of multiple risk factors at an early age. The research collected presented a challenge for the need to know more about epidemiology and features of so-called indicators in children and its consequences in adulthood. The purpose of this paper then, was to investigate the relationship between behavior patterns and CAD risk factors in an age group previously not researched, that of college freshmen.

CHAPTER III

METHODS AND PROCEDURES

The purpose of this study was to investigate the relationship between behavior patterns and coronary artery disease risk factors in college freshmen. This chapter presents the methods and procedures used to complete the study.

Source of Data

Approximately 600 freshmen students (age 20 years) at Oral Roberts University were used as subjects in this study. They were given Form N of the Jenkins Activity Survey (JAS), and they were divided into two groups on the basis of scoring one standard deviation above or below the mean: (1) Type A, JAS score $\leq \pm 10$; (2) Type B, JAS score $\geq \pm 10$. Of the 600, 191 were classified either Type A or Type B. Risk factor data were available only on 13 Type A and 47 Type B males and 33 Type A and 57 Type B females.

Organization of the Study

The testing was completed over the fall school semester beginning in September of 1976 and finishing in December of 1976. There were two phases of testing. Phase I consisted of anthropometric measurements, lipid analysis, and cardiorespiratory variable measurements. Returning upon a later date, Phase II included the student's performance level as evaluated by a treadmill stress test and maximum heart rate recordings. The mileage and cumulative aerobic points accumulated for the two semesters of 1976-77 were recorded weekly by computer cards on an honor basis for each student.

Collection of Data

In order to investigate any significant relationship between behavior patterns and CAD risk factors in college freshmen, the following variables were compared. Height, weight, total-skin-fold (TSF), and body-fat (%Fat) were determined as comparative measurements of the human body. Plasma glucose, uric acid, cholestrol (chl) with HDL-LDL differentiation, and triglyceride (Tri) concentrations were analysized for any indication of upper limit abnormalities. Forced vital capacity (FVC), systolic (SBP) and diastolic blood pressure (DBP) and resting heart rate (RHR) were measured to record fitness of the oxygen-forwarding capacity of the heart and cardiorespiratory system. Treadmill time (TTime) and maximum heart rate (MHR) were measurements of the maximum performance possible at maximum physical effort of the individual. Mileage and cumulative points were recorded as an indication of aerobic physical activity.

<u>Measurement of Anthropometric Variables</u>

These variables deal with the comparative measurements of the human body. The height of each student was measured in centimeters while the weight was determined in pounds. The total skinfold was derived from the sum of six (in females) and seven (in males) cites:

(1) (only on males) Chest, diagonal fold one third of the distance between the anterior axillary line and nipple.

(2) Axilla, vertical fold on the mid axillary line at approximately the level of the nipple.

(3) Triceps, vertical fold on the posterior mid-line of the upper arm (over triceps), halfway between the acromion and olecranon processes with the elbow extended and relaxed.

(4) Subscapular, fold taken on a diagonal line coming from the vertebral border 1 cm. from the inferior angle of the scapula.

(5) Abdominal, vertical fold adjacent to and approximately 2 cm. laterally from the umbilicus.

(6) Suprailiac, diagonal fold on the crest of the ilium at the mid axillary line.

(7) Thigh, vertical fold on the anterior aspect of the thigh midway between the hip and knee joints. These site recommendations are derived from Pollock (21). The log of the sum of the skinfold thicknesses was then calculated into a regression equation compiled by Durnin (5). A corresponding table from this equation was developed by

Oral Roberts University to easily determine percentages of fat. This, then, is a determinatin of the percentage of fat tissue in the body's composition (Appendix).

Lipid Analysis

Samples of blood were collected and separated into serum and plasma. Samples were separated, sent to Hillcrest Medical Center, Tulsa, Oklahoma, and then analyzed for uric acid and glucose. Other samples of the plasma were sent to Oklahoma City for lipid analysis.

Measurement of Cardio-Respiratory Variables

These measurements consisted of the individual's forced vital capacity (FVC) and blood pressure. The FVC was measured after a forced inhalation and exhalation was blown for 15 seconds into a spirometer. This capacity represents the maximum amount of air that can be expired after a maximum inspiration.

Systolic and diastolic blood pressures were taken after the subject had been sitting quietly five minutes. Measurement was determined with the use of a sphygmomanometer.

Measurement of Performance and Physical Activity

During Phase I, each student after sitting quietly at least five minutes, was administered a 12 lead electrocardiogram. He laid supine and motionless. The resting heart rate was then determined.

During Phase II of the testing, voluntary maximum cardio-respiratory (CR) efficiency was measured. The motor driven treadmill was used, as it is universally recognized by exercise physiologists as presentlly being the most efficient in measuring fitness (1). The treadmill's use of walking is a more familar activity and measurements are more accurately derived on the general public. The subjects received a thorough explanation of the procedures and protocol of the exercise test as described by the Bruce test (1). The treadmill was placed at 10 percent grade and 1.7 miles per hour. The subject began walking. The treadmill speed and elevation were increased every three minutes according to the Bruce protocol. The treadmill speed and grade were consistently increased for each subject until his voluntary maximum and, consequently, a good measurement of his CR efficiency.

Throughout the walking and jogging on the treadmill test, the heart rate was continuously recorded by use of a single channel ECG recorder.

During the performance, the students were monitored every minute for heart rate increase and abnormalities. Recordings were also taken at peak heart-rate and repeatedly at the one, three, and five minute recovery periods.

Mileage and cumulative aerobic points were recorded on an honor basis, with each student keeping a count of his/her aerobic activities by means of a computer card turned in following each bout. Cards were evaluated weekly and points assigned.

Procedure for Collecting Data

All testing was completed in the Human Performance Laboratory at Oral Roberts University. Plasma lipid values were determined at Oklahoma City in the Lipid Research Clinic. Subjects were acquainted with the proper procedure before the actual testing began. The testing dates were arranged with each subject to allow for his/her convenience. Testing occurred primarily between the hours of 9:30 a.m. and 5:15 p.m. The subjects were instructed not to eat two hours prior to the exercise test (in the case of the lipids' test, 12 hours fasting was required), light exercise was permitted within 12 hours of the exercise test, and no exercise was allowed within 4 hours of the exercise test. For testing purposes, the subject wore gym shoes, shorts and a T-shirt. The complete testing was accomplished in the two phases.

Statistical Analysis of Data

The independent "t" test was the primary statistical procedure which was applied to these data. The purpose of this analysis was to see if the mean scores between Type A and Type B persons in the various measurements were significantly different.

To facilitate speed and accuracy, the electronic computer terminal in the Human Performance Laboratory was used for data analysis.

CHAPTER IV

ANALYSIS AND DISCUSSION OF RESULTS

Organization of the Data for Analysis

The purpose of this study was to investigate the relationship between behavior patterns and coronary artery disease risk factors in college freshmen. The parameters that were measured and analyzed were various anthropometric variables, plasma lipids, plasma glucose and uric acid, cardio-pulmonary variables, performance and physical activity.

Analysis and Discussion of Results

The significant results were as follows:

Type A males had lower DBP (66.7 vs. 74.2 mmHg., P.<05), and more aerobic physical activity (60 vs. 43 pts/wk., P.<05).

Type A. females had more aerobic physical activity (39 vs. 29 pts/wk., P.<01).

Type A freshmen had higher cholesterol than Type Bs (161.5 vs. 148.2 mglml., P.<002) as well as higher HDL (53.9 vs. 49.7 mglml., P.<05).

No significant differences existed between the two types in either sex in FVC, SBP, Bruce Treadmill time, body weight, or % fat.

Data presented in Table I and Table II are of those physiological parameters that were found to be significant.

TABLE I

DIASTOLIC BLOOD PRESSURE AND PHYSICAL ACTIVITY DATA

		Type A			Type B				
	Subjects	N	$\bar{x}$	S.D.	N	$\bar{x}$	S.D.	t	p
DBP mm/tlg	Males	9	66.7	± 9.85	47	74.23	± 8.83	2.31	.05
Aerob Pts 2 Sems	Males	16	1437.5	±1037.5	55	1041.6	±485.4	2.16	.05
	Females	43	941.8	± 510.9	77	695.4	±262.2	3.49	.01
Aerob Pts Per Week	Males	16	60.0		55	43.0			.05

TABLE II

LIPID DATA

		Type A			Type B				
Lipid	Subjects	N	$\bar{x}$	S.D.	N	$\bar{x}$	S.D.	t	p
Chol. mg %	Males	13	156.4	± 19.2	47	141.5	± 21.9	2.22	.05
	Females	33	163.6	± 27.2	57	153.9	± 23.5	1.78	.10
	Both	46	161.5	± 25.2	104	148.2	± 23.6	3.17	.002
HDL mg %	Males	13	45.1	± 10.1	47	43.8	± 7.4	.50	NS
	Females	33	57.3	± 11.3	57	54.5	± 9.4	1.27	NS
	Both	46	53.9	± 12.2	104	49.7	± 10.1	2.20	.05
Try. mg %	Males	13	79.5	± 29.0	47	81.0	± 24.3	.19	NS
	Females	33	74.0	± 29.4	57	78.6	± 28.1	.74	NS
	Both	46	75.6	± 29.0	104	79.6	± 26.1	.85	NS

The mass of available statistical data found indicates a questionable association between <u>obesity</u> per se and CAD risk. The long-term epidemiologic studies have shown that the risk is largely attributable to the natural inclination of the obese individual to hyperlipidemia, hypertension, and carbohydrate intolerance. These associations, however, do make obesity an attractive characteristic regardless of the statistics (9).

Hersch and Knittle (11) showed that infantile obesity was associated with adipose-cell hyperplasia. In infantile-onset obesity, there is relatively little difference in the average size of the adipose cell in comparison to individuals of normal weight, but the total number of fat cells is two to five times greater. In addition, once a weight range is firmly established, ideal or other-wise, long-term studies have shown it is very difficult to permanently disrupt the established equilibrium. Thus, early infancy may be the most important period for weight control on a permanent basis. Because the obese infant has larger and more fat cells than the lean infant, he apparently is more prone to be an obese adolescent and an obese adult. Repeatedly in "<u>The Heart In Europe</u>" data pointedly regarded overweight and obesity as high risk factors (11).

In this study, weight, total-skin-fold, and body fat presented no significant difference between the two groups.

This may have been caused by the small number of subjects tested and the distribution of Type A subjects versus Type B subjects (Table III).

TABLE III

ANTHROPOMETRIC DATA

		Type A			Type B				
		N	$\bar{x}$	S.D.	N	$\bar{x}$	S.D.	"t"	P
Height cm.	Male	11	70.7	± 2.8	54	79.5	± 3.9	.15	NS
	Female	39	64.6	± 2.8	76	70.5	± 3.9	1.70	.10
Weight lbs.	Male	9	164.8	±18.0	53	159.9	±25.7	.58	NS
	Female	40	17.4	±18.0	71	127.1	±18.2	.06	NS
TSF mm.	Male	11	81.7	±32.5	52	94.9	±56.9	.74	NS
	Female	39	107.1	±33.6	75	112.9	±35.0	.87	NS
%FAT	Male	10	16.2	± 4.4	53	17.5	± 5.8	.68	NS
	Female	40	29.1	± 4.9	75	30.0	± 4.7	.98	NS
FVC liters	Male	11	5.4	± .87	55	5.5	± .71	.463	NS
	Female	40	3.8	± .46	76	3.8	± .55	.250	NS
SBP mm/hg	Male	9	130.4	±16.1	47	124.5	±11.34	1.34	NS
	Female	32	110.3	± 9.9	62	110.0	± 9.7	.13	NS
TTime min.	Male	10	13.5	± 2.0	53	13.1	± 1.6	.74	NS
	Female	40	10.0	± 1.7	74	9.6	± 1.2	1.5	NS
MHR bts/ min.	Male	9	193.7	± 8.5	53	197.9	± 9.2	1.33	NS
	Female	40	190.0	± 9.5	73	101.4	± 9.2	.75	NS

The second major risk factor associated with coronary heart disease is hypertension. There does not appear to be a simple critical level, but the risk is continuous, i.e., the greater the blood pressure, the greater the risk of a CAD event.

Blood pressure elevation occurs in family aggregates suggesting a genetic basis, but extrinsic factors (sodium ingestion, diet and obesity) also play a significant role. Zinner (26) and his associates have shown familial aggregation in children between two and fourteen years of age.

New cases of hypertension evolving after the age of thirty in previously normotensive persons are uncommon. This strongly suggests the origin of hypertension to be in early life. The studies of Londe (20) and colleagues of blood pressure in children using the 95th percentile for age, rather than adult criteria, showed that 74 of 1,600 children (three to eighteen years of age) had elevated systolic and/or diastolic blood pressures. Only five of the 74 were found to have a primary etiology. It would be expected then to find elevated blood pressures in the Type A individuals. However, the results of this study reported lower means for both SBP and DBP than what most studies reported as high risk variables.

Type A males 130/67 mm/HG Type B males 134/74 mm/Hg
Type A females 110/70 mm/Hg Type B females 110/69

Hypertension is a possibility if the diastolic blood pressure rises even occasionally to 90 mm. Hg. There was a significant difference between the Type A and Type B male diastolic blood pressures at the $P < .05$ level. It would seem that Type A would be higher, if indeed it was coronary-prone. However, perhaps either the significant increase in aerobic exercise lowered this pressure or more likely the small number of subjects caused this significance.

Norms for Forced Vital Capacity:

Males	20-30 years	4.8 liters/minute
Females	20-30 years	3.2 liters/minute

This study's results:

Males	5.5 liters/minute
Females	3.8 liters/minute

Compared to accepted norms, O.R.U. students in general display increased FVC, however, Type A compared sexually-differentiated with Type B students reveal no significant difference. This is probably due to the small number tested. It is interesting to note a significant difference in total Type A students compared to total Type B students (4.5 l/min. vs. 4.53 l/min., $p. < 02$). This might be a related trend, however, FVC is a sex-related variable causing this relation to be insignificant.

Hyperlipidemia is the first major risk factor associated with coronary heart disease. As with hypertension, the serum cholesterol concentration has an almost linear relationship to the risk of developing CAD i.e., the risk is continuous, the greater the cholesterol level, the greater the risk of CAD. Additional information comes from three major sources: The International Atherosclerosis

Project (IAP), the Korean and Vietnam War casualties, and animal studies (24). The Appendix shows "normal" cholestrol values for different age groups. These values are average values, not necessarily normal values. They were obtained from a population known to be at high risk of an atherosclerotic event. A value no higher than 165 mg/ml is probably more likely to be an upper limit "normal" value than a value of 190 mg/ml in a preadolescent.

Elevation of serum cholestrol may be genetic or acquired. Fredrickson (24) has classified the genetic disorders into five types, however, the elevation of serum cholestrol of most Americans is felt to be most likely acquired from excessive intake.

In comparison with the results of this study, O.R.U. figures were lower. Nonetheless, Type A freshmen had higher total cholestrol than Type B's ($P.<002$). This was considered an undesirable trend, as well as higher HDL ($P<.05$) considered a desirable trend. No statistically significant difference existed between Type A and Type B in triglyceride concentration, as would have been otherwise expected (Table II).

The standards for elevated triglycerides and cholestrol have been established previously (10) (19) (25). Elevated triglycerides and Type IV hyperlipoproteinemia rank second in the predominance of risk factors in Gilliam's study (9). Eighteen percent of the children had elevated triglycerides which is considerably higher than reported by

Wilmore (25). Ten percent of the children had elevated cholestrol levels which is about one-half the magnitude reported by Wilmore and Lauer (19). Two of the children had both elevated triglycerides and cholestrol.

Seemingly then, there is an alarmingly significant percent of young individuals with elevated cholesterol levels. This was also significant in this study (Table II).

Uric acid is usually consideredd a risk factor at the 6 mg/100ml. level (normal 3 to 5 mg.). Overproduction of uric acid is largely responsible for the pathologic increase in gout, which usually appears about middle-age. The ratio of males to females being about 19:1, who portray this gout.

Oral Roberts University's men did have higher uric acid values than O.R.U. females (6.50 vs. 4.78 mg.). Both male and female Type A uric acid values tended to be higher than Type Bs'; however, there was no statistically significant difference. More subjects would be necessary.

The Merck Manual states if the fasting value is 110 mg/100 ml., diabetes mellitus is the presumptive diagnosis. Diabetes should never be diagnosed from a single determination of blood sugar, since a laboratory error or some unrecognized cause of temporary hyperglycemia may be present. Both males and females means were near 95.5 mg/100ml. There were no significant differences between any of the figures. The figures were not close enough to be concerned.

Astrand (1) provided the equation (220 - subject's age) as a determination of maximum heart rate. Under this criteria the students' means were slightly low. However, some interesting trends occured in their physical performance.

Type A individuals tend to have lower resting heart rate.

Type A individuals tend to have longer treadmill times.

Type A individuals tend to have lower maximum heart rate.

Type A individuals tend to have accumulated more mileage.
(105.8 miles/week vs. 99.2 miles/week)

Type A individuals tend to have accumulated more aerobic points.
(1076 vs. 839 points/2 sem.)

These last two statements were statistically significantly different at the p.∠01 level.

By using O.R.U. students this data tends to support the view that persons with Type A behavior patterns tend to engage in more regular aerobic activity. Such activity could offset to a certain extent the harmful effects of the coronary-prone bahavior pattern.

From the amount of conflicting data in the literature concerning the effects of exercise upon the heart, it seems that if the author enjoys exercise, his research endeavors to support his attitude. On the other hand, if the author does not enjoy physical activity, he can find no evidence to support its beneficial effects in preventing or decreasing the incidence of CAD.

In a recent review of animal studies, Froelicher (9) summarized that the effect of chronic exercise causes metabolic and morphologic changes that make the cardiovascular system better able to withstand any stress. The favorable adaptions are more marked in young animals than in the older animals, and the beneficial effects on the already developed atherosclerotic process are at best questionable. Vigorous exercise begun in youth may play a role in preventing the development of CAD.

Kannel (17) has shown that an inverse relationship of physical activity to increased coronary mortality exists in adults. Whether or not this relationship exists in children is unknown. Kannel believes that physical activity may not protect against having coronary attacks but rather against lethal attacks. Minimum standards for exercise capabilities for healthy adults have been recorded in terms of the maximal oxygen uptake (1). It is felt by most exercise physiologists that the voluntary maximum oxygen uptake best represents an individual's physiological exercise capacity. Unfortunately, no accepted standard norms exist for pre-pubescent children at this time.

Results of this study do indicate a few differences exist between Type A and Type B college freshmen in certain CAD risk factors.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary of the Study

In summary, the significant results of this study's investigation to demonstrate a relationship between behavioral patterns and CAD risk factors in college freshmen are:

Type A males had lower diastolic blood pressure (P.<05) and more aerobic physical activity (P.<05).

Type A females had more aerobic physical activity (P.<01).

Type A freshmen had higher total cholesterol than Type Bs (P.<002) as well as higher HDL (P.<05).

No statistically significant differences existed between the two types in FVC., SBP., Bruce Treadmill time, body weight, % fat, plasma glucose, uric acid, triglycerides, HDL or LDL cholesterol.

Conclusions

Results of this study indicate that a few differences exist between Type A and Type B college freshmen in certain CAD risk factors, which may have implications regarding future disease. The results also indicated that behavior pattern may influence plasma lipids and lipoproteins which supports previous research on middle-age adults. The results support the view that persons with Type A behavior patterns tend to engage in more regular aerobic activity. Such activity could offset to a certain extent the harmful effects of the coronary-prone behavior pattern.

Recommendations for Further Study

Recommendations for further study as an outflow of this paper are manifold. Research concerning differences existing between Type A and Type B college freshman regarding CAD risk factors which may have implications toward future disease is vital and necessary. Longitudinal studies are needed on the individuals for coronary heart event rates and mortality rates. "Safe" level norms for college age individuals need to be developed. Educative programs need to be developed to begin life-style modification in youth where the habit patterns are established and the disease process seems to begin.

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APPENDIX

Upper Limit Values for Serum Cholesterol

Age	mg/100 ml
Cord blood	83
1-6 yr	190
Preadolescent and adolescent	195
20-29 yr	240
30-39 yr	270
40-49 yr	310
50-59 yr	330

REGRESSION EQUATIONS

Regression equations for the predictions of body density (y) from the log of the sum of skinfold thicknesses at all skinfold sites in mm(x).

Subjects	Equations	SEL of Estimate
Men	y=1.1610-0.0632x	± 0.0069
Women	y=1.1581-0.0720x	± 0.0096
Boys	y=1.1533-0.0643x	± 0.0083
Girls	y=1.1369-0.0598x	± 0.0081

SKINFOLD ESTIMATE OF PERCENT FAT

Percent Fat--Male	Sum of SF	Percent Fat--Male	Percent Fat--Male	Sum of SF	Percent Fat--Female
0.9	10	5.8	19.6	49	27.6
2.0	11	7.0	19.8	50	27.9
3.0	12	8.2	20.0	51	28.2
3.9	13	9.2	20.3	52	28.5
4.7	14	10.2	20.5	53	28.7
5.5	15	11.1	20.8	54	29.0
6.3	16	12.0	21.0	55	29.3
7.0	17	12.8	21.2	56	29.5
7.6	18	13.6	21.4	57	29.8
8.3	19	14.3	21.6	58	30.1
8.9	20	15.0	21.8	59	30.3
9.4	21	15.7	22.0	60	30.5
10.0	22	16.3	22.3	61	30.8
10.5	23	17.0	22.5	62	31.0
11.0	24	17.5	22.7	63	31.3
11.5	25	18.1	22.8	64	31.5
11.9	26	18.7	23.0	65	31.7
12.4	27	19.2	23.2	66	31.9
12.8	28	19.7	23.4	67	32.2
13.2	29	20.2	23.6	68	32.4
13.6	30	20.6	23.8	69	32.6
14.0	31	21.1	24.0	70	32.8
14.4	32	21.6	24.1	71	33.0
14.8	33	22.0	24.3	72	33.2
15.1	34	22.4	24.5	73	33.4
15.5	35	22.8	24.7	74	33.6
15.8	36	23.2	24.8	75	33.8
16.2	37	23.6	25.0	76	34.0
16.5	38	24.0	25.2	77	34.2
16.8	39	24.3	25.3	78	34.4
17.1	40	24.7	25.5	79	34.6
17.4	41	25.1	25.6	80	34.8
17.7	42	25.4	25.8	81	35.0
18.0	43	25.7	25.9	82	35.1
18.2	44	26.1	26.1	83	35.3
18.5	45	26.4	26.2	84	35.5
18.8	46	26.7	26.4	85	36.7
19.1	47	27.0	26.5	86	35.9
19.3	48	27.3	26.7	87	36.0
26.8	88	36.2	31.5	127	41.7
27.0	89	36.4	31.6	128	41.9
27.1	90	36.5	31.7	129	42.0
27.3	91	36.7	31.8	130	42.1
27.4	92	36.9	31.9	131	42.2
27.5	93	37.0	32.0	132	42.3

SKINFOLD ESTIMATE OF
PERCENT FAT

Percent Fat--Male	Sum of SF	Percent Fat--Male	Percent Fat--Male	Sum of SF	Percent Fat--Female
27.7	94	37.2	32.1	133	42.4
27.8	95	37.3	32.2	134	42.6
27.9	96	37.5	32.3	135	42.7
28.1	97	37.7	32.4	136	42.8
28.2	98	37.8	32.5	137	42.9
28.3	99	38.0	32.6	138	43.0
28.4	100	38.1	32.7	139	43.1
28.6	101	38.3	32.8	140	43.2
28.7	102	38.4	32.8	141	43.3
28.8	103	38.6	32.9	142	43.5
28.9	104	38.7	33.0	143	43.6
29.1	105	38.9	33.1	144	43.7
29.2	106	39.0	33.2	145	43.8
29.3	107	39.1	33.3	146	43.9
29.4	108	39.3	33.4	147	44.0
29.5	109	39.4	33.5	148	44.2
29.7	110	39.6	33.6	149	44.2
29.8	111	39.7	33.6	150	44.3
29.9	112	39.8	33.7	151	44.4
30.0	113	40.0	33.8	152	44.5
30.1	114	40.1	33.9	153	44.6
30.2	115	40.2	34.0	154	44.7
30.3	116	40.4	34.1	155	44.8
30.4	117	40.5	34.2	156	44.9
30.6	118	40.6	34.2	157	45.0
30.7	119	40.8	34.3	158	45.1
30.8	120	40.9	34.4	159	45.2
30.9	121	41.0	34.5	160	45.3
31.0	122	41.1	34.6	161	45.4
31.1	123	41.3	34.6	162	45.5
31.2	124	41.4	34.7	163	45.6
31.3	125	41.5	34.8	164	45.7
31.4	126	41.6	34.9	165	45.8
35.0	166	45.9	36.3	184	47.5
35.0	167	46.0	36.4	185	47.6
35.1	168	46.1	36.5	186	47.6
35.2	169	46.1	36.5	187	47.7
35.3	170	46.2	36.6	188	47.8
35.4	171	46.3	36.7	189	47.9
35.4	172	46.4	36.7	190	48.0
35.5	173	46.5	36.8	191	48.1
35.6	174	46.6	36.9	192	48.1
35.7	175	46.7	36.9	193	48.2
35.7	176	46.8	37.0	194	48.3
35.8	177	46.9	37.1	195	48.4

SKINFOLD ESTIMATE OF
PERCENT FAT

Percent Fat--Male	Sum of SF	Percent Fat--Male	Percent Fat--Male	Sum of SF	Percent Fat--Female
35.9	178	47.0	37.1	196	48.5
36.0	179	47.0	37.2	197	48.5
36.0	180	47.1	37.3	198	48.6
36.1	181	47.2	37.3	199	48.7
36.2	182	47.3	37.4	200	48.8
36.2	183	47.4			

VITA

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