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PARENTS' AND GUARDIANS' KNOWLEDGE OF HEALTH IMPLICATIONS OF PROCESSED MEAT AND ASSOCIATIONS WITH FEEDING PRACTICES OF SCHOOL-AGED CHILDREN

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PARENTS' AND GUARDIANS' KNOWLEDGE OF HEALTH IMPLICATIONS OF PROCESSED MEAT AND ASSOCIATIONS WITH FEEDING PRACTICES OF SCHOOL-AGED CHILDREN

A THESIS APPROVED FOR THE
DEPARTMENT OF HEALTH AND EXERCISE SCIENCE

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Abstract

Introduction: Processed meat is labeled as a Group1A carcinogen according to the World Health Organization due to the certainty that processed meat causes colorectal cancer. In addition to colorectal cancer, processed meat has also been linked to heart disease and diabetes. There is evidence that one's diet and processed meat consumption in childhood effects their risk of disease into adulthood. **Objectives:** The goal of this study is to assess whether a relationship exists between parent/guardian processed meat nutrition knowledge and feeding frequency of processed meat to school-aged children. **Methods**: This study used convenience sampling to survey parents/guardians of school-aged children. The study created and utilized a processed meat nutrition knowledge questionnaire and a feeding frequency questionnaire regarding processed meat. **Results:** The results indicated no significant relationships between processed meat nutrition knowledge and feeding frequency of processed meat. No significant relationships existed between feeding frequency and gender or education. A significant relationship was found regarding feeding frequency and income, with the finding showing those with a total combined family income at or above $50,000 a year more likely to serve seven or more servings of processed meat per week. **Conclusion:** Results found that parents'/guardians' knowledge about the health implications of processed meat does not have a significant association with feeding practices of processed meat to school-aged children.

Chapter 1

Introduction

Introduction

The World Health Organization (WHO) states that 34,000 deaths globally each year are linked to high processed meat consumption (2016). Processed meat is defined as any meat that has undergone "salting, curing, fermentation, smoking, or other processes to enhance flavor or improve preservation" (WHO, 2016). Processed meat includes items such as bacon, sausage, deli meat, jerky, ham, and hot dogs. After sufficient evidence in epidemiological studies was found in humans exposed to processed meat, the WHO labeled processed meat as a Group 1A carcinogen (WHO, 2016). This group is the same category as tobacco smoking and signifies the level of confidence that processed meat is carcinogenic to humans.

The WHO states that eating a 50-gram serving of processed meat daily results in an 18% increase in risk of colorectal cancer (WHO, 2016). For reference, one serving of Hillshire Farm sliced turkey deli meat is 56 grams (Hillshire Farm, 2018). Colorectal cancer is responsible for the second most cancer-related deaths in both men and women in the United States. In 2014, 139,992 people were diagnosed with colorectal cancer and 51,651 people died from the disease (CDC, 2018). The disease can be caused by a number of factors, including excess weight as well as a diet low in fiber and high in animal fat (CDC, 2016). Studies have found that certain compounds found in processed meat, namely polycyclic aromatic hydrocarbons (PAHs), heterocyclic amines (HCAs), heme iron, and N-nitroso compounds (NOCs) contribute to DNA mutations that cause colorectal cancer, in addition to an inflamed gut also caused by consuming processed meat (Cascella et. Al, 2018). Due to these carcinogenic compounds, the International Agency for Research on Cancer (IARC) and the WHO stated that processed meat consumption

causes colorectal cancer (WHO, 2016). The American Cancer Society recommends limiting processed meat consumption in response to the IARC findings in regard to the carcinogenicity of processed meat (American Cancer Society, 2016).

However, cancer is not the only negative health outcome associated with eating processed meat. Heart disease and cancer are the top two causes of death in the United States, and both are linked to the consumption of processed foods (Hales, Carroll, Fryar, & Ogden, 2017). Heart disease claims the lives of around 630,000 people each year and costs the United States approximately $200 billion dollars in medication, health care, and lost productivity costs. Possible causes for developing heart disease include excess weight, diabetes, and a poor diet (CDC, 2017). The American Heart Association suggests one limits daily sodium intake to 1,500 milligrams (mg) and saturated fat intake to 13 grams for a 2,000-calorie diet in order to decrease blood pressure and risk of cardiovascular disease (American Heart Association, 2018). When applying these numbers in practical terms, one Ballpark brand beef hot dog, a processed meat product, contains six grams of saturated fat, almost half of the daily recommended amount, and 510 milligrams of sodium, over one-third the daily recommended amount (BallPark Brand, 2018). In addition, a meta-analysis concluded that processed meat consumption is associated with higher rates of coronary heart disease as well as diabetes (Micha, Wallace, Mozaffarian, 2010).

Despite the evidence showing the dangers of consuming processed meat, it is still commonly consumed. According to the National Health and Nutrition Examination Survey (NHANES) from 2003-2004, processed meat makes up 22% of total meat consumption in the United States (Daniel et.al, 2011). NHANES data from 2003-2010 showed that processed meat consumption was one of the top ten sources of energy, or calories, for those aged 2 to18 years

old, and processed meat consumption accounted for slightly more than unprocessed meat consumption in total energy intake (Slining et. Al, 2013).

While colorectal cancer and heart disease are often thought of solely as concerns for adults, there is evidence that these diseases can develop in childhood (Ruder et.al, 2011, Daniels et.al, 2011). Although colorectal cancer is most prominent in men and women over the age of 30 (CDC, 2015), there is evidence that consumption of processed meat during one's lifespan could play a role in colon cancer development (Ruder et.al, 2011). In addition, there is evidence that low risk of cardiovascular disease in childhood leads to very low risk of cardiovascular disease in adulthood (Daniels et.al, 2011). This could be due to the development of taste preferences that are established in infancy and continued through adolescence and early adulthood (Aisbitt, 2008). Prior to adulthood, however, children still see effects of poor diet and lifestyle choices. According to the NHANES survey in 2015-2016, 18.5% of children in the United States ages 6 to 11 were obese (Hales, Carroll, Fryar, & Ogden, 2017). Obesity can not only affect a child's self-esteem, but also lead to the development of further health conditions in childhood such as sleep apnea, high blood pressure, asthma, and diabetes (CDC, 2018). The National Institutes of Health reported that the incidence of Type 2 diabetes rose 4.8% each year from 2002 to 2012 for those under 20 years old (NIH, 2017). Primary prevention, including limiting processed meat intake, of both cardiovascular disease and colon cancer decrease likelihood of disease development later in life.

In order to properly assess and modify a child's diet, researchers often look to the parent or guardian of the child. Studies have found that the foods parents consume predicts the types of food children consume (Ventura & Worobey, 2013). Parents modeling eating behavior around types of food encourages or discourages a child to eat the food (Ventura & Worobey, 2013). In

addition, the food that a parent makes available at home is significantly associated with the types of food that a child consumes. The types of foods that parents chose to have available is strongly associated with the parent's nutrition knowledge (Campbell, et.al, 2013). When parents have higher nutritional knowledge as well as better attitudes towards healthy eating, their children often have better nutritional status (Al-Shookri, et al., 2011). Because of the influence parents have on children's diets and the role that their nutritional knowledge plays in food choices, parents have the ability to encourage children to consume foods that may help to reduce cancer and heart disease risk.

This study analyzed associations between nutrition knowledge of processed meat consumption and parents/guardians serving processed meat to their children. Parents'/guardians' health knowledge was assessed in order to find associations between parents'/guardians' knowledge about processed meats and serving their children recommended amounts of processed meat.

Purpose

The purpose of this study was to analyze associations between parents' or guardians' nutritional knowledge regarding processed meat consumption and serving processed meat to their school-aged children. Previous research has not explored the relationship between nutritional knowledge and processed meat feeding practices, so this research filled this gap in the current literature. The study was useful for future interventions and research because it gave researchers baseline information about the status of nutritional knowledge regarding processed meat among parents and guardians as well as baseline information about the average intake of processed meat is a sample of school-aged children, as well as data about if a relationship exists between the two variables .

Research Questions:

The study attempted to answer the following questions:

- Research Question 1: Do associations between frequency of feeding children processed meats differ by parent/guardian gender?
- Research Question 2: What is the level of knowledge regarding processed meats among parents/guardians of school-aged children participating in a community after school program in central Oklahoma?
- Research Question 3: How frequently do parents/guardians feed their children processed meats each week?
- Research Question 4: What is the relationship between parent /guardian processed meats knowledge level score regarding processed meats and feeding children a high-risk level of processed meats each week?

Hypotheses:

After reviewing the previous literature regarding the relationship between parental nutrition knowledge and child's dietary intake, the following research hypotheses were developed based on research questions one and four. Research questions two and three were reported as descriptive statistics.

- Hypothesis 1: Female guardians will have a higher level of nutrition knowledge of processed meat than male guardians.
- Alternative Hypothesis 1: Women will not have a higher level of nutrition knowledge of processed meat than men.
- Null Hypothesis 1: There will be no significant differences in nutrition knowledge of processed meat between genders.

- Hypothesis 2: Increased guardian knowledge regarding the health implications of processed meat will be associated with feeding lower than recommended amounts of processed meat to a school-aged child.
- Alternative Hypothesis 2: Increased guardian knowledge regarding the health implications of processed meat will be associated with feeding higher than recommended amounts of processed meat to a school-aged child.
- Null Hypothesis 2: There will be no significant difference between guardian knowledge regarding the health implications of processed meat and feeding processed meat to a school-aged child.

Significance:

Processed meat consumption is linked to multiple diseases including colorectal cancer, coronary heart disease, and diabetes. These diseases take years to develop and are worsened by poor dietary choices, including processed meat consumption. For school-aged children, guardians are the decision makers as to what food the child will eat. Previous studies report that home availability of types of food is strongly associated with the types of food the child consumes (Campbell et al., 2013). However, parents/guardians must first be aware of the risks and recommendations of processed meat in order to make an informed decision as to whether or not to purchase the food for their children. Studies have shown that when a mother has greater nutrition knowledge, the child's diet reflects that in healthier food consumption (Vereecken & Maes, 2010). Despite previous studies regarding parents'/guardians' nutrition knowledge and child's dietary intake, no previous studies were found regarding processed meat nutritional knowledge and child's processed meat intake.

Delimitations

- At least 100 guardians of children aged 6-12 years old in Norman Public Schools.
- Survey is in the English language.

Limitations of the Study

- Community After School Program holds a weekly nutrition education lesson for school-aged children to familiarize the children about making healthy food choices as well as fruit and vegetable consumption. Parents are informed of the health topic each week. Because of this, parents/guardians may have been more conscious about food choices and more familiar with dietary guidelines.
- Sample was limited to Central Oklahoma.
- Many children consume a lunch provided by their school, and therefore, the parent/guardian was not responsible for their dietary consumption at this time.
- Data was self-reported and therefore was dependent upon the participant's honesty and understanding when answering questions.
- Dietary recall is subject to error based upon memory, accuracy of measurement and honesty.

Assumptions

- The survey created was both valid and reliable in measuring parents'/guardians' nutrition knowledge regarding processed meats as well as feeding practice of processed meat for children's consumption
- The survey was in English, so it was well understood and comprehensible by English-speaking participants.
- The participants answered to the best of their ability and honestly.

- The parent/guardian was one of the primary caregivers of the child and was responsible for the child's diet when under the parent's/guardian's care.

Operational definitions

- Processed meat: Meat that has undergone smoking, fermenting, salting, curing or another process for preservation and flavor enhancement (World Health Organization, 2016).
- School-Aged child: A child within the age range of 6-12 years old (MedlinePlus, n.d.).
- Nutrition Knowledge: Knowledge of concepts and processes related to nutrition and health including knowledge of diet and health, diet and disease, foods representing major sources of nutrients (Miller, Cassady, 2015).
- Guardian: mainly provides meals for child (Asakura, Todoriki, Sasaki, 2017).

Chapter 2

Literature Review

The purpose of this study was to analyze the relationship between health knowledge regarding processed meat consumption and children's processed meat consumption. This study examined how knowledge regarding negative health effects of processed meat consumption affect a guardian's decision to provide processed meat for his or her child. This chapter provides a review of the literature on producing processed meat, processed meat's effect on cancer, processed meat's effect on heart disease, processed meat's effect on diabetes, parental nutritional knowledge and food choices, and parental influence on a child's diet.

Literature searches were conducted using CINAHL, Psychinfo, Google Scholar, and PubMed and were filtered to include either information regarding processed meat or articles relating to nutritional knowledge and a child's diet. Key terms included "processed meat," "cancer," "heart disease," "parents' nutrition knowledge," "guardians' nutritional knowledge", "home availability," "child's consumption," and "dietary intake." Searches were limited to peer-reviewed, English language articles posted after the year 2000.

Processed Meat and Cancer- Colorectal

The IARC and WHO classify processed meat as a Group 1 carcinogen, meaning that it is carcinogenic to humans and that there is sufficient evidence that processed meat consumption causes colorectal cancer in humans (WHO, 2016). The Group 1 carcinogen label is given to an agent that is found to cause cancer in epidemiological studies or testing conducted on animals that is believed to have the same effect in humans (IARC, 2015). The studies found that one serving of processed meat increases daily risk of colorectal cancer by 18% (WHO, 2016).

Processed meat has been suggested to cause colorectal cancer due to compounds created in the cooking processes of processed meat or in the meat itself (Cascella et al, 2018; Tuan, Chen, 2015). The compounds that are created from the cooking process include Heterocyclic Amines (HCAs) and Polycyclic Aromatic Hydrocarbons (PAHs). The PAHs and HCAs form DNA adducts in epithelial cells, which can lead to colorectal cancer. Compounds found in the meat that are known to cause cancer include N-Nitroso compounds and heme (Cascella et al, 2018; Tuan, Chen, 2015). When heme leads to lipid peroxidation and the formation of N-Nitroso compounds, DNA mutations, along with resulting inflammation, lead to an increase in colorectal cancer development (Cascella et al, 2018; Tuan, Chen, 2015).

Several countries outside of the United States have found that processed meat contributes to a large portion of the colorectal cancer risk in the given country. A study in Australia calculated that 12% of colorectal cancer cases were attributable to both red and processed meat consumption (Grundy et al, 2016), while a study in Columbia concluded that 14% of colorectal cancer cases were attributable to processed meat alone (De Vries, Quintero, Henríquez-Mendoza & Herrán, 2015). A systematic review of articles conducted in 20 countries, including the United States, found that processed meat is associated with an increased risk of colorectal cancer (Zhao et al, 2017).

Along with the evidence present that processed meat consumption in adulthood contributes to colorectal cancer, there is evidence that processed meat consumption in childhood may also contribute to colorectal cancer risk and development (Ruder et al., 2011). A study in the United States found that the amount of processed meat consumed over one's lifetime affects their risk of colorectal cancer into adulthood. The study stated that exposure to foods during the ages of 12-13 are associated with colorectal cancer in adulthood just as exposure to foods during

the ages of 41-61 are associated with colorectal cancer later in life. This finding demonstrates the need to reduce processed meat consumption in children in order to prevent risk of colorectal cancer in the future (Ruder et al., 2011).

Processed Meat and Cancer- Other Cancers

While the WHO states that processed meat causes colorectal cancer, processed meat has also been associated with multiple other types of cancer (WHO, 2016). This suggests that the evidence regarding colorectal cancer and processed meat is conclusive; however, evidence regarding processed meat and other types of cancer is not conclusive. Correlation is the "size and direction of a relationship between two or more variables" while causation "indicates that one event is the result of the occurrence of the other event" (Australian Bureau of Statistics, 2013). It is for this reason that the WHO states that processed meat causes colorectal cancer but is associated with stomach cancer (WHO, 2016).

In addition to stomach cancer identified by the WHO, a meta-analysis found that there is a significantly increased risk (22%) of bladder cancer with high processed meat consumption (Cascella et al, 2018). Another meta-analysis stated that bladder cancer and processed meat consumption were positively associated, likely due to the nitrosamines which have shown evidence of inducing bladder cancer (Crippa, et al, 2016). Upper digestive and respiratory tract neoplasms, or abnormal cell growths that could result in cancer (NCI Dictionary of Cancer Terms, n.d.), are strongly associated with the consumption of processed meats (Levi et.al, 2014). Data from case-controlled hospital studies found a moderate excess risk of breast, endometrial, and ovarian cancers in women with a higher processed meat intake (Rosato et al., 2018).

Processed Meat and Cardiovascular Disease

According to the Center of Disease Control (CDC), heart disease kills more than 600,000 people each year. High blood pressure, high cholesterol, obesity, and diabetes are all risk factors for heart disease as well as well as diets high in saturated fat, trans fat, cholesterol, and sodium (CDC, 2015). There is a strong association between processed meat intake and coronary heart disease (Micha, Wallace, & Mozaffarian, 2010). Processed meat consumption has a significant positive association with heart failure risk as well (Kaluza, Åkesson, & Wolk, 2014).

Processed meats contain a significant amount of saturated fat and cholesterol as well as a large amount of sodium, all of which contribute to heart disease (Kouvari et al, 2016; Renata, 2010). Sodium is said to be the main difference that contributes to processed meat's high effect on cardiovascular disease when compared to the effect of red meat (Micha, Wallace & Mozaffarian, 2010). This is believed to be due to increased blood pressure and arterial stiffness as a result of a diet high in sodium (Micha, Wallace & Mozaffarian, 2010). The heme iron and nitrous preservatives contribute to the cardiovascular effects of processed meat as well (Kouvari, et al, 2016). Nitrates have experimentally shown an increase in atherosclerosis and endothelial dysfunction, both of which contribute to coronary heart disease (Micha, Wallace & Mozaffarian, 2010).

Processed Meat and Diabetes

Multiple studies have examined the link between diabetes mellitus and processed meat consumption (Kouvari et al, 2016; Micha, Wallace & Mozaffarian, 2010; Fretts, et al, 2013; Malik et al, 2011, Micha et al, 2012). These studies found increased risk (Fretts, et al, 2013), prevalence (Fretts, et al, 2013), and incidence (Micha, Wallace & Mozaffarian, 2010) of diabetes with processed meat consumption. A dose-response study found that one 50 gram serving of

processed meat per day increased diabetes risk by 51% (Kouvari et al, 2016). This information is pertinent to school-aged children because there is evidence that one's diet and consumption of processed meat prior to adulthood increases diabetes mellitus risk in middle-aged women (Malik et al, 2011).

While the association between processed meat and diabetes is believed to be in part due to the high sodium, there is also evidence that the nitrates found in processed meat contributes to its effect on diabetes (Micha, Wallace & Mozaffarian, 2010). Experimental research has found that nitrates reduce insulin secretion and hinder glucose tolerance, both of which contribute to the promotion of diabetes (Micha, Wallace & Mozaffarian, 2010). Additional observational studies have found that nitrates are associated with Type 1 diabetes in children. In adults, nitrate concentrations are a biomarker for poor insulin response and endothelial dysfunction (Micha, Wallace & Mozaffarian, 2010).

While it is clear that there is evidence stating that processed meat consumption is harmful for human health, it is important to understand how knowledge of nutrition information affects dietary intake. Although there are no previous studies examining guardian nutrition knowledge and child's dietary intake in regard to processed meat consumption, there are studies that have been conducted investigating the relationship between parents' general nutrition knowledge and children's dietary intake.

Guardian Knowledge and Child's Dietary Intake

Previous studies have used varying terms such as "parent" (Hardcastle, Blake, 2016; Vereecken & Maes, 2010), "guardian" (Asakura, Todoriki, Sasaki, 2017), "caretaker" (Marshall, Golley, Hendrie, 2011), and "mother" (Campbell, et al, 2013) to signify the relationship between the adult caretaker and the child. Guardian was defined as someone who mainly provides meals

for the children (Asakura, Todoriki, Sasaki, 2017). When the term parent or guardian was used in methodology, the results often only included mothers' responses due to difference in responses and the low response rate of fathers (Hardcastle, Blake, 2016; Vereecken & Maes, 2010; Asakura, Todoriki, Sasaki, 2017).

Almost all of the studies conducted pertaining to guardians' nutrition knowledge and the nutritional intake of children found that guardians' nutritional knowledge was positively associated with a child's nutritional intake. This positive relationship is especially found to be true in regard to nutritional knowledge and a child's consumption of fruits and vegetables (Campbell, et al, 2013; Asakura, Todoriki, Sasaki, 2017). One study examined the relationship between mothers' nutritional knowledge, home availability, and a child's diet and found that increased nutrition knowledge was related to increased consumption and home availability of fruits and vegetables and decreased consumption and home availability of salty snacks and soft drinks (Campbell, et al, 2013).

Similar studies have found comparable evidence that nutrition knowledge and home availability of fruit, vegetables, and snacks is related to a child's food consumption and energy density (Fernando, et al, 2018). In some low-income communities, nutrition knowledge and nutrition intake did not have a strong positive association (Babington, Patel, 2008; Hardcastle, Blake, 2016). The studies done in these communities found that either time constraints (Babington, Patel, 2008) or cost of healthy food (Hardcastle, Blake, 2016) prevented mothers from making healthy meals, despite their nutritional knowledge.

Gender Differences in Parental Feeding Practices

Previous studies have focused primarily on mothers' nutrition knowledge. One reason for this includes building upon previously established data that mothers' nutrition knowledge and a

child's diet are positively associated (Campbell, et al, 2013). Other studies that include fathers' nutrition knowledge have resulted in limited feedback. In one study of 316 guardians, 92.1% of the respondents were female (Asakura, Todoriki, Sasaki, 2017), and another study excluded their data of fathers' due to the differences in knowledge (Vereecken & Maes, 2010). There is a gap in the literature about gender differences in parental nutrition knowledge and if there is a difference in the relationship between a mothers' and fathers' nutrition knowledge and a child's diet.

Measuring Nutrition Knowledge

In order to assess general nutrition knowledge, the majority of studies relied on a nutrition knowledge questionnaire. The questionnaires were aimed at discovering general nutrition knowledge rather than knowledge about a particular type of food. These questionnaires varied in length with the number of items ranging from as low as eight to as high as 84 (Al-Shookri, et al, 2011; Asakura, Todoriki, Sasaki, 2017; Campbell, et al, 2013; Rezaei et al, 2014). While all of the articles examined were in English, some of the questionnaires used in other countries had been developed in English and translated to the region's native language (Asakura, Todoriki, Sasaki, 2017; Poh, 2012).

Questionnaires varied in focus and development. One study developed a survey to assess common misconceptions about children's diets in an attempt to keep the survey concise (Vereecken, Maes, 2010). These questions were listed as statements to which the guardian responded: "Right!" "I think it is right," "I think it is wrong," "Wrong," and "I do not know." An example of a statement from this survey is "Fruit juice contains as much sugar as cola" (Vereecken, Maes, 2010). Other studies adapted their questionnaires from a previous questionnaire by Parmenter and Wardle (1994) that has been tested for validity and reliability (Asakura, Todoriki, Sasaki, 2017; Campbell, et al, 2013). This questionnaire included 5 sections:

"a) the understanding of terms; b) awareness of dietary recommendations; c) which foods contain which nutrients; d) using the information to make dietary choices; and e) awareness of diet/disease associations (Asakura, Todoriki, Sasaki, 2017)."An example of a question adapted from Parmenter and Wardle includes "In your view, which one of the following would be the best choice for a low fat, high fibre snack?" and given the options: (1) diet strawberry yoghurt, (2) raisins, (3) a muesli bar, (4) wholemeal biscuits with cheddar cheese, and (5) I do not know (Campbell, et al, 2013)." One study highlighted knowledge on a specific nutrient, iron (Rezaei, Moodi, Moazam 2014). No surveys were found that specifically examined knowledge regarding processed meat or children's processed meat consumption.

Measuring Dietary Intake

In the studies examined for this literature review, children's dietary intake were most often measured using Food Frequency Questionnaires (FFQ) in which the guardian recalled the dietary intake of the child (Al-Shookri, et al, 2011; Campbell, et al, 2013; Vereecken, Maes, 2010). In the reviewed studies, a FFQ originally developed for preschoolers in Belgium was commonly modified and used to better fit the population being assessed (Al-Shookri, et al, 2011; Vereecken, Maes, 2010). In the modified questionnaires, parents were given a specific food group and were asked the frequency of a child's consumption as "never or less than 1 day per month," "1–3 days per month," "1 day per week," "2 days per week," "3–4 days per week," "5–6 days per week," and "every day." Given a specific type of food, they were then asked a range of portion sizes and asked to select which portion size the child eats in the day (Vereecken, Maes, 2010). Most often, the parents were asked to recall their child's diet within the past month (Al-Shookri, et al, 2011; Campbell, et al, 2013; Asakura, Todoriki, Sasaki, 2017). Aside from a few outliers, questionnaires included a range of 46 to 77 items (Al-Shookri, et al, 2011; Asakura,

Todoriki, Sasaki, 2017; Vereecken, Maes, 2010). The responses of dietary intake were then compared to the standard dietary guidelines of the country (Al-Shookri, et al, 2011; Asakura, Todoriki, Sasaki, 2017; Vereecken, Maes, 2010).

The Effect of Demographic Variables

It is important to note the effects that demographic variables have on nutrition knowledge and feeding practices. One study found that mothers' nutrition knowledge was positively related to their child's dietary intake. However, when controlling for socio-demographics, the knowledge score did not significantly predict dietary excess. They noted that this is likely due to the significant differences between nutrition knowledge and health attitudes among sociodemographic groups. The sociodemographic factors included: gender, child's age, mother's age, family structure, number of children, mother's education and mother's education. All of those included were female so the gender was constant. This study also noted this effect when controlling for education alone. (Vereecken, Maes, 2010).

Chapter 3

Methodology

Introduction

Parents and guardians who are responsible for their children's dietary choices have the task of deciding which foods should be eaten and how often foods that are less healthy should be consumed. This role is critical as nutrition is a key influence in chronic diseases. Processed meat including hot dogs, salami, lunch meat, and bacon are foods that are commonly fed to children despite the evidence that processed meats cause cancer (World Health Organization, 2016). Consuming these meats increases one's likelihood of developing colorectal cancer as well as other cancers (World Health Organization, 2016). In addition, processed meat consumption has been linked to diabetes and heart disease (Kouvari et al, 2016; Micha, Wallace & Mozaffarian, 2010; Fretts, et al, 2013; Malik et al, 2011, Micha et al, 2012). It is theorized that increased knowledge regarding these negative health effects of processed meat would lead to the parent feeding a child less of these processed meat products.

In order to assess parental feeding practices by gender and relationships between nutrition knowledge regarding processed meat and feeding practices of processed meat to school aged children, a survey was conducted among parents/guardians of school-aged children in Norman, Oklahoma.

Sample

The sample was drawn from parents/guardians who have a child that participates in the Community After School Program (CASP). The sample included both male and females. CASP is an after-school program available in all 17 public elementary schools in Norman, Oklahoma. The cost of the program ranges from $165 to $300 per month per child depending on days the

child attends and family income level (CASP, n.d.). Children in elementary school are between the grades of Kindergarten to fifth grade and are generally between the ages of 5-10 years old (State Department of Education, 2017).

Recruitment

Parents/guardians were emailed a link to the survey as well as a consent form. The recruitment email was sent by the by the Program Director at CASP. The email referenced CASP and the University of Oklahoma in order to familiarize the responder with the nature and intent of the study. The email was sent twice; the first time was December 5, 2019 and the second January 7, 2019. This study used convenience sampling method with voluntary participation. This method of sampling has been used in the past to assess parents' nutrition knowledge and its relationship between dietary intake **(**Hardcastle & Blake, 2016). The Institutional Review Board at the University of Oklahoma approved all study procedures before data collection.

Inclusion Criteria

Parents/guardians must have had at least one child aged 6-12 enrolled in CASP in Fall of 2018 in order to be eligible to participate in the study. The parents/guardians were asked if they are responsible or somewhat responsible for their child's diet while in the parents'/guardians' care and must have responded yes in order to participate. Parents/guardians must have been able to read English. Participants were not restricted due to race, gender, or income level. Aside from the previously noted criteria, no parents/guardians were excluded.

Instrumentation

Nutrition knowledge questionnaires have been the primary method of gathering data in previous studies and were adapted for use in this study to assess parents'/guardians' knowledge regarding processed meat (Asakura, Todoriki & Sasaki, 2017). Food Frequency Questionnaires

were modified and used to assess how often parents/guardians feed their children processed meat. This adaptation was necessary because currently there is not a Food Frequency Questionnaire developed specifically for processed meats.

Nutrition Knowledge

In order to measure nutritional knowledge regarding processed meat consumption, a survey was developed to test parent/guardian recognition of what qualifies as processed meat and awareness of the warnings and health implications associated with consuming processed meat. No previously developed knowledge questionnaires specifically address processed meat, so the survey was adapted from Parmenter and Wardle's General Nutrition Knowledge Questionnaire due to its frequent use in similar studies and its adaptability (Asakura, Todoriki, Sasaki, 2017; Campbell, et al, 2013). The questionnaire includes 5 main criteria which are explained in further detail in regard to processed meat:

Understanding of terms. These questions assessed understanding what is classified as a processed meat. This included a question that asks the user to choose from a list of 19 meats and one meat alternative (i.e. tofu) and identify which options were processed meats. The respondent received one point for correctly tallying a processed meat or for correctly leaving the tally blank for a non-processed meat or meat alternative. They received zero points for an incorrect answer.

Awareness of dietary recommendations. These questions addressed current recommendations from health experts as to what foods should be consumed modestly or in large amounts. An example question includes "Health organizations in the United States have found processed meat to be associated with cancer." Respondents answered true or false. Correct responses received one point, and incorrect responses resulted in no points. There are two questions regarding this criterion.

Which foods contain which nutrients. These questions addressed nutrients that cause processed meat to be problematic. For example, "Hot dogs do not contain a significant amount of sodium." Respondents answered true or false. Correct responses received one point, and incorrect responses resulted in no points. Two questions addressed this criterion.

Using the information to make dietary choices. These questions addressed parents'/guardians' knowledge about making food choices for their children based of nutrition quality of the food. An example question includes "The food my child eats now will affect their risk of disease later in life." Respondents answered true or false. Correct response resulted in one point, and incorrect response resulted in no points. Two questions addressed this criterion.

Awareness of diet/ disease associations. These questions evaluated the respondents' knowledge on potential disease risks that result from eating processed meat. This type of question includes "Saturated fat contributes to heart disease risk." Respondents answered true or false. Correct responses received one point, and incorrect responses resulted in no points. There were eight questions regarding this criterion.

Answers were coded as 1=Correct, 0= Incorrect. A score of 70% or higher was considered acceptable nutrition knowledge (Feren, Torheim, Lillegard, 2011).

Feeding Practices

In addition to the nutrition knowledge items, a FFQ assessed parent's feeding practices regarding processed meat. This FFQ was adapted from a survey used by Vereecken and Maes (2010). The FFQ asked guardians to recall the frequency and amount of processed meat they fed their child within the past week. The responses were coded as discrete variables. Because previous studies have found that one 50 gram serving of processed meat per day increases the risk of diabetes by 51% (Kouvari et al, 2016) and colorectal cancer by 18%, participants were

also grouped into a high and optimal category of feeding practice where seven or more 50 gram servings per week were considered high, and less than seven 50 gram servings per week were considered optimal. (WHO, 2016).

The FFQ asked guardians to recall feeding practices of hot dogs, bacon, deli turkey, ham, roast beef, deli chicken, sausage, pepperoni, salami, canned meat, and jerky. Parents/guardians were asked to recall the number of days in a week they feed their children that processed meat ("Never," "1," "2," "3," "4," "5," "6," "7") and how many servings the parent/guardian fed the child that day ("Less than 1," "1," "2," "3," "More than 3"). Respondents were given an appropriate example of a serving. For example, when asked about deli turkey, they were told that a serving size is approximately 2 slices that are about the size of CDs. Number of days served processed meat was coded 0-7. Servings of processed meat were coded ("Less than 1," =0 "1"=1 "2,"=2 "3,"=3 "More than 3"=3). Results were then calculated to find the total number of servings a child gets in one week as well as whether or not that number was greater than seven servings.

The FFQ was analyzed by a nutrition expert and piloted with over 200 parents/guardians in Oklahoma. Pilot study participants were asked to provide feedback and any necessary changes were made to the survey. Once finalized, the survey was tested for readability. The Flesch Reading Ease score was 67.6, which is average according to the US Department of Health and Human Services (USDHHS) and the Flesch-Kincaid Grade Level was 5.9, within the 6.9 or less recommended by the USDHHS for wide-understanding (Kher, Johnson, Griffith, 2017).

Research Design

The research design allowed researchers to quantitatively measure if parents'/guardians' nutritional knowledge regarding processed meat consumption is associated with processed meat

feeding practices for children as well as if gender differences exist in parental feeding practices. This study was cross-sectional. Parents'/guardians' nutrition knowledge and gender were the independent variables and feeding their child more or less than the recommended amounts of processed meats was the dependent variable. Previous studies that assess the relationship between parents'/guardians' nutrition knowledge and children's dietary intake have used similar research designs (Al-Shookri, et al, 2011; Campbell, et al, 2013; Vereecken, Maes, 2010). Threats to external validity included population validity because the population selected is a small subset of the parent population in the United States and cannot necessarily be generalized to all guardians.

Data Collection Procedures

Approval for data collection was obtained from the Institutional Review Board (IRB) of the University of Oklahoma, Norman Campus, before conducting this study. The survey was available online December 5, 2018 through January 15, 2019. The responses were gathered via email that parents/guardians involved in CASP received. A recruitment email was sent December 5, 2018 as well as January 7, 2019. The study was administered using Qualtrics online survey software. A link to the survey was emailed to the parents/guardians along with a reference to The University of Oklahoma and CASP. Before starting the survey, the participant was informed of the purpose, design, measurement procedures, length of participation, and expected risks and benefits of the survey. The participant was also informed that the study is voluntary and confidential. Participants were then asked to click if they agreed to participate. If they did not click that they agreed, the participants were not asked any further questions. Data was kept on a password-protected computer and participants' responses were anonymous.

Data Management and Analysis

Data were recorded using Qualtrics online survey software. The data were then exported and analyzed using the Statistical Package for Social Sciences (SPSS) Version 23.0. The analysis included descriptive tests for means and frequencies. Chi- square and independent *t*-tests assessed the relationship between guardian knowledge score and feeding children a high-risk level of processed meat (categorized as 7 or more servings per week). Chi-square tests were also used to test relationships between demographic variables and feeding children a high-risk level of processed meat. Chi-square tests also tested for differences in feeding of processed meats based on gender of the guardian. Multivariate analyses included logistic regression. Logistic regression was used to examine associations between participant knowledge scores and categorized high-risk or low-risk feeding frequency of processed meats while controlling for demographic variables.

Recoding of Variables

Variables were recoded in order to analyze the dataset. First, the nutrition knowledge questionnaire consisted of 34 questions and was recoded as a continuous variable to reflect the total knowledge score (KnowledgeScore). An additional categorical variable (PassFail) was created to indicate scores above and below 70%. Next, a variable was created in order to calculate the total number of servings of processed meat each child was served in a week (Child1Week, Child2Week, Child3Week). This score was calculated by multiplying the number of days a child was served a particular processed meat by the number of servings the child was served per day. The scores for each type of meat were then added together in order to calculate a total number of servings for the week. With that, a new categorical variable (FamilyRecommended) was created. This variable was categorized as “over” or “under” based

on having at least one child served more than 7 servings of processed meat in a week. Finally, total combined family income (Income) was used to create a new categorical variable (HighLowincome). Those categorized as High Income noted a total combined family income as equal to or greater than $50,000, and those categorized as Low Income reported less than $50,000 total combined family income. This distinction has been used in previous research based on Federal Poverty Levels (Ilowite, et al., 2018).

Chapter 4

Results

The present study sought to gain understanding about the relationship between parents'/ guardians' nutrition knowledge regarding processed meat and feeding practices of processed meat to their school-aged children. To do this, parents and guardians from the Community After-School Program in Norman, Oklahoma were asked to participate in a survey distributed via email. The survey included a processed meat FFQ as well as a NKQ regarding processed meat. Additional questions gathered demographic and background data.

This section will address the findings of the study. This includes: how missing data was handled, demographics, and results of statistical analyses.

Missing Data

Participants with missing data were identified as those who did not answer every question in the NKQ and therefore had an incomplete Knowledge Score. Of the 104 respondents, 13 were categorized as incomplete. Of those, 9 respondents answered the question regarding sex and all 9 responded female. The majority of those respondents (n=8) were white and had a total combined household income of $50,000 or above (n=8). Chi-Square tests were run between participants with complete and incomplete surveys to test for differences based on gender, race, marital status, education and income. No significant differences ($p > .05$) were found between the two groups, and participants with incomplete knowledge sores were excluded from the analysis.

Demographics

There were 91 participants with complete data included in the analysis. The participants were 91.2% (n=83) female and 8.8% (n=8) male. The ages of the participants ranged from 22 to 65, with the mean being 37.92(SD=6.603). Most participants had a graduate degree (47.3%),

30.8% had a bachelor's degree, 7.7% had an associate's degree, 12.1% had some college but no degree, and 2.2% had a high school degree or equivalent. The total percentage of those with less than a four-year degree was 22%. Total combined income was at least $50,000 for 70% of respondents. Table 1.1 consists of the complete frequencies and percentages of the income variable.

Table 1.1 Total Combined Household Income (N=91)

Variables	Frequency	Percentage
$0 to $9,999	0	0
$10,000 to $24,999	4	4.4
$25,000 to $49,999	10	11.1
$50,000 to $74,999	19	21.1
$75,000 to $99,999	17	18.9
$100,000 to $124,999	13	14.4
$125,000 to $149,999	7	7.8
$150,000 to $174,999	6	6.7
$175,000 to $199,999	7	7.8
$200,000 and up	6	6.7
Don't know	1	1.1

Respondents were able to choose more than one race. The majority of respondents identified as white (85.7%). Table 1.2 summarizes the race demographic variable by frequency and percentage.

Table 1.2 Race- Choose all that apply

Variables	Frequency	Percentage
White	78	85.7
Black or African-American	1	1.1
American Indian or Alaskan Native	11	12.1
Asian	6	6.6
Native Hawaiian or Other Pacific Islander	1	1.1
Other	5	5.5

Of the respondents, 71.4% (n=65) were married, 17.6% (n=16) were divorced, 8.8%(n=8) were single, and 2.2% (n=2) were widowed. Most of the respondents, 70.3% (n=64),

had one child between the ages of 6-12, 25.3% (n=23) had two children between the ages of 6-12, and 4.4% (n=4) had three children between the ages of 6-12.

Level of Parental Nutrition Knowledge and Feeding Practices

A small percentage of participants (8.8%, n=8) answered less than 70% of the nutrition knowledge questions correctly and 91.2% (n=83) answered at least 70% of the questions correctly. The majority of parents (68.1% n=62) fed at least one child seven or more servings of processed meat each week.

Relationship between Feeding Recommended Servings and Gender

A Chi-Square test of independence was performed to examine the relationship between gender and having at least one child fed over the recommended servings of processed meat per week. The relationship between these variables was not significant $\chi^2(1, N=91) = .128$, $p = .720$. Findings are listed in Table 2.1.

Relationship between Feeding Recommended Servings and Demographic Variables of Marital Status, Education and Nutrition Knowledge

Next, a Chi-Square test of independence was performed to examine the relationship between marital status and at least one child being served over the recommended amount of servings per week. There was no significant relationship found $\chi^2(3, n=91) = 4.604$, $p = .203$. Then, a Chi-Square test of independence was performed to examine the relationship between at least one child being served over the recommended amount of servings per week and parent's education level. There was no significant relationship found $\chi^2(4, N=91) = 2.946$, $p = .567$.

Finally, a Chi-Square test of independence was performed to examine the relationship between at least one child being served over the recommended amount of servings per week and passing or failing the nutrition knowledge questionnaire. There was no significant relationship

found $\chi^2(1, n=91) = 3.790$, $p=.052$. Because of this, we can accept the null hypothesis which states that there are no significant differences between the groups. The complete findings of the Chi-Square test are found in the table below.

Table 2.1 Chi Square test of independence between feeding frequency and gender, marital status, education, and knowledge test.

	Not Over Recommended Frequency	**Over Recommended Frequency**	**P value**
	N (%)	N (%)	
Gender			.720
Male	5 (5.5%)	3(3.3%)	
Female	57 (62.6%)	26(28.6)	
Marital Status			.203
Single (Never Married)	5 (5.5%)	3(3.3%)	
Married	46(50.5%)	19(20.9%)	
Divorced	11(12.1%)	5(5.5%)	
Widowed	0 (0%)	2 (2.2%)	
Highest Education			.567
Less than high school degree	0 (0%)	0(0%)	
High school degree or equivalent (e.g., GED)	2 (2.2%)	0(0%)	
Some college but no degree	8(8.8%)	3(3.3%)	
Associates degree	5(5.5%)	2 (2.2%)	
Bachelor's degree	16(17.6%)	12 (13.2%)	
Graduate degree	31(34.1%)	12 (13.2%)	
Knowledge Test Pass/Fail			.052
Fail	3 (3.3%)	5 (5.5%)	
Pass	59 (64.8%)	24 (26.4%)	

Note. *p<0.05

Relationship between Knowledge Score and Feeding Recommended Servings

An independent-samples *t*-test was conducted to compare at least one child being served over the recommended amount of servings per week with the total knowledge score. There was no significant difference in the scores for those who served their children under the recommended amount and the raw knowledge score (*M*=28.40, *SD*= 2.87) or for those who served their children over the recommended amount and raw knowledge score (*M*=28.13, *SD*=3.99); equal variance assumed, *t*(89)=.387, *p*=.699.

Logistic Regression of associations between Feeding Practices and Knowledge Score with Control Variables

A logistic regression was calculated to predict at least one child being served over the recommended amount of servings per week based on participant knowledge score, controlling for gender, high or low income, and highest education received. The education variable was assigned to three categories: less than a four-year degree, four year degree, more than a four year degree. This was done to accumulate the 22% of respondents with less than a four-year degree into one category. The results of the multiple logistic regression indicated that there was no significant association when controlling for these variables (OR =.942, 95% CI [.796,1.115], *p*=.486). A significant relationship was found in the model between feeding practices and income (OR 9.881, 95% CI [1.035, 94.317]), *p*=.047), indicating that higher income is associated with serving over the recommended amount of processed meat per week. Findings are listed below.

Table 2.2: Logistic Regression of associations between feeding practices and knowledge scores with control variables

Variable	Referent Group	Odds Ratio	95% CI	*p*-value
Female	Male	.731	.140-3.810	.710
High Income	Low Income	9.881	1.035-94.317	.047*
Bachelor's degree	Less than Bachelor's	1.005	.233-4.328	.995
Graduate/Professional degree	Less than Bachelor's	.642	.156-2.636	.430
Knowledge Score	-	.942	.796-1.115	.486
Constant	-	.524	-	.796

Note. *p<0.05; Control variables are education, income, and gender; The dependent variable in this analysis is parental feeding practice coded so that 0 = serving under the recommended servings of processed meat per week and 1 = serving over the recommended servings of processed meat per week.

Chapter 5

Discussion

This study was novel in investigating the relationship between parents'/guardians' nutrition knowledge regarding processed meat and feeding practices of processed meat to school-aged children. While hypotheses were created based upon previous research regarding nutrition knowledge and feeding practices, researchers were unable to formulate hypotheses based on previous research regarding processed meat due to sparse research in this area. The discussion further explains the findings from the data analysis as it pertains to the hypotheses of the study. This chapter will also discuss limitations of the research along with suggestions for future research about processed meat knowledge and feeding practices.

The demographics of the participants in this research study were consistent with the expected population. Similar to previous research, the majority of respondents of this study were female (91.2%; Asakura, Todoriki, Sasaki, 2017; Campbell, et al, 2013; Vereecken & Maes, 2010). Participants' self-identified race and ethnicities are consistent with the population of Norman, Oklahoma, with white being the most prevalent race both in the present study (85.7%) and in Norman (81.1%) and those who identify as Hispanic or Latino in the present study (6.6%) and in Norman (5.4%) (City of Norman, 2010). The median income of the research population was between $75,000-$99,000 while the median income in the population of Norman is $48,248(City of Norman, 2010).

The study found that hypothesis 1 for research question 1 was not supported. No significant relationship between parent's/guardian's gender and feeding practices of processed meat was found. However, the sample size was small with only 8.8% of male participants. Previous research also has limited or no data regarding differences between feeding practices

based on gender due to the small sample size of male participants (Asakura, Todoriki, Sasaki, 2017; Vereecken & Maes, 2010). Future research needs to be done with a larger sample size in order to make inferences about the role of gender in feeding practices.

Findings for research question 2 assessing parent/guardian nutrition knowledge found that the majority of people (91.2%) had a high nutrition knowledge related to processed meat consumption. This finding suggest that the target population has an acceptable basis of nutrition knowledge regarding processed meat and therefore, nutrition education may not be necessary or recommended for future research and interventions targeted towards discouraging excess consumption of processed meat. A similar study regarding nutrition knowledge and dietary intake found guardian's mean nutrition knowledge to be at least 70% (Asakura, Todoriki, Sasaki, 2017). This similar study expanded knowledge score into sections and subcategories in order to get a more comprehensive view of guardians' knowledge in various categories of nutrition information. Future research about processed meat with a larger nutrition knowledge questionnaire should consider assessing subcategories of processed meat nutrition knowledge. For instance, participants may be aware of the health effects of processed meat, however, they may not be aware that a particular meat is categorized as a processed meat. For example, 33% of respondents said they feed their children processed meat (Table 3.2) only 54.9% of respondents correctly identified ham as a processed meat. Percentages and frequencies of correct responses when asked "Which of the following meats are considered processed meats?" are found in Table 3.1.

Table 3.1 "Which of the following meats are considered processed meats?"

Variables	Frequency	Percentage
Hotdog		
Correct	88	96.7
Ham		
Correct	50	54.9
Tofu		
Correct	76	83.5
Deli (lunchmeat) turkey		
Correct	81	89.0
Bone-in steak		
Correct	87	95.6
Bacon		
Correct	61	67.0
Sausage		
Correct	72	79.1
Jerky		
Correct	73	80.2
Chicken breast		
Correct	85	93.4
Spam		
Correct	86	94.5
Reduced sodium bacon		
Correct	67	73.6
Turkey breast		
Correct	77	84.6
Low-fat hotdog		
Correct	87	95.6
Filet steak		
Correct	85	93.4
Ground turkey		
Correct	59	64.8
Meat that has been braised		
Correct	73	80.2
Meats with nitrates		
Correct	76	83.5
Meats that are salted		
Correct	47	51.6
Meats that are baked		
Correct	77	84.6
Meats that are cured		
Correct	61	67.0

Because of this lack of awareness, parents/guardians might feed their children a significant amount of the processed meat, despite high nutrition knowledge about the dangers of processed meat. Further research into these subcategories could help researchers better understand why nutrition knowledge and feeding practices of processed meat were not associated.

Findings for research question 3 assessing feeding frequency of processed meat found that over half (68.1%) of the parents/guardians fed over the recommended amount of processed meat each week. This finding suggests that processed meat is a common food for most of the participants' children. While this is not entirely surprising based on previous findings of increasing incidence of diabetes in those less than 20 years old (NIH, 2017), it does cause concern not only because of health complications associated with diabetes, but also due to evidence that both colorectal cancer and cardiovascular disease risk can be effected by one's diet prior to adulthood (Daniels et.al, 2011, Ruder et.al, 2011). While there are no previous studies regarding feeding practices of processed meat, similar studies have found that a majority of children do not meet dietary guidelines for items such as water, fruit, and milk (Al-Shookri, et al, 2011; Vereecken & Maes, 2010). Future interventions should focus on decreasing school-aged children's processed meat consumption while increasing consumption of these more nutrient-dense foods.

The study found that hypothesis 2 for research question 4 was not supported. No significant relationship was found between parent's/guardian's nutrition knowledge and feeding practices to a school-aged child. This trend was consistent even when controlling for gender, income, and education. While previous studies found that higher parental nutrition knowledge was associated with higher home availability or consumption of fruits and vegetables for their children (Campbell, et al, 2013; Asakura, Todoriki, Sasaki, 2017), one study found that higher nutrition

knowledge was associated with increased consumption of cakes (Campbell, et al, 2013). The researchers believe that the association could be due to mothers thinking that homemade cakes are a healthier alternative to other snacks (Campbell, et al, 2013). Therefore, those with a higher nutrition knowledge would feed their children more cakes in an effort to feed them less of something the mothers viewed as unhealthier. It is possible that participants in this research study believed the same thing to be true with some of the processed meats, especially when considering that the most popular processed meat choice was lunchmeat turkey (34.1% of participants). Table 3.2 provides a complete view of the meats parents/guardians fed to children in a week.

Table 3.2 "In a typical week, I feed my child (click all that apply)"

Variable	Frequency	Percentage
Hotdogs	19	20.9
Bacon	24	26.6
Lunchmeat Turkey	31	34.1
Ham	30	33
Roast Beef	7	**7.7**
Lunchmeat Chicken	6	6.6
Sausage (Including turkey, beef and pork)	26	28.6
Pepperoni (Including turkey, beef and pork)	27	29.7
Salami	6	6.6
Bologna	0	0
Canned Meat	3	3.3
Jerky	8	8.8
None of the above	14	15.4

The finding that no relationship existed between nutrition knowledge and feeding practices of processed meat suggests that the health warnings about processed meat are may not be enough to change a parent's feeding practices. Future studies need to be done to investigate other reasons parents feed their children processed meat despite the warnings. Use of the Health Belief Model could provide researchers with useful information about parents' beliefs about processed meat

and its association with disease risk (Conner, Mcmillan, 2004). Other research could investigate children's influence on parents' food purchases.

This study did reveal an interesting finding that those in the high-income category were more likely to serve over the recommended amount of processed meat to at least one child. This finding was not expected. It is possible that trend was observed because those with a higher income had the ability to serve their child a sandwich with lunchmeat, for example, rather than a peanut-butter and jelly sandwich or they were able to prepare a homemade breakfast with bacon rather than a bowl of cereal. Some processed meats, such as these, could be viewed as foods that those with more money or time could prepare to serve their child. This is especially a possibility considering that only three respondents fed their children canned meat, a very inexpensive form of processed meat. Previous research has found that there was not a significant positive relationship between nutrition knowledge and nutrient intake in low-income communities' association (Babington, Patel, 2008; Hardcastle, Blake, 2016). It is important further study income to recognize these associations in order to better guide future research. While researchers may have viewed processed meat as an item that people with lower incomes consume due to the low cost of some types of processed meat and those with higher income do not consume due to the ability to get better quality meat or meat alternatives, this research suggests that people with both low and high-incomes should be considered when forming future interventions and studies. However, in the present study, the low-income group was a small sample size with only 14 participants. A larger sample size is needed to make clearer conclusions.

Limitations

The study had limitations that should be addressed. This study used convenience sampling and therefore may not be generalizable to parents/guardians who do not participate in CASP. Also, due to the limited number of respondents, results may have been impacted. This is also true for the number of male respondents. The small sample size made it difficult to make meaningful inferences.

When analyzing data, a few limitations arose. First, there was an error in wording that resulted in the data regarding frequency of feeding of canned meat to be removed from the analysis. While only three of the 91 participants noted that they feed their children canned meat, it is still important to note the necessary removal of that data. Also, as previously noted, incomplete data was removed from analysis. Next, the use of discrete variables did not allow participants to give an exact amount of processed meat consumed and instead had to round up or down. When participants chose the option "Less than one," responses were recorded as zero and when they chose "More than three," responses were recorded as three in order to be conservative with estimates. Because of this, it is possible that participants fed their children much more than the survey accounted for. In addition, the use of self-report and dietary recall allows for error based upon participant's accuracy with measurements and recall as well as their truthfulness in reporting.

Recommendations for future research

Further research needs to be done regarding nutrition knowledge and feeding practices of processed meat. It would be helpful to have more research about the amount of processed meat school-aged children eat both at home and at school. Research needs to be done about motivation to purchase processed meat as well as the influence of price and convenience of processed meat

in order to better understand how future interventions can work to reduce the amount of processed meat parents/guardians feed their school-aged children. Based off of the findings of our study, it does not appear that knowledge about processed meat is a significant deterrent to significantly limit feeding processed meat to school-aged children. These research findings can be used to guide future health promotion programs regarding processed meat intake and related diseases. Future programs can use alternative strategies in addition to nutrition education to reduce feeding practices of processed meat to school-aged children. Researchers can use the findings of the most frequently served processed meat to suggest healthier alternatives to the commonly consumed meats.

It would be interesting to duplicate this study in another population, possibly a larger population that is located in a different region, or nationally representative. It is possible that regional differences in preferences for processed meat exist and that the feeding practices or nutritional knowledge could vary throughout the United States. Since previous studies found different effects of knowledge and feeding practices in varying populations, it is possible that this could be true for knowledge and feeding practices of processed meat. Finally, it would be interesting to ask parents about their processed meat consumption to see if there is a correlation between their consumption and their child's consumption in order to investigate a relationship between the two.

Conclusion

Although previous research has identified a relationship between parents'/guardians' nutrition knowledge and feeding practices to children, this study uniquely examined nutrition knowledge regarding processed meat and feeding practices of processed meat to school-aged children. Over half on the parents/guardians fed a child over the recommended servings of

processed meat despite over 91% having a high nutrition knowledge regarding processed meat. This study suggests that, in regard to processed meat, there is not a relationship between nutrition knowledge and feeding practices. While this is contrary to some previous data investigating general nutrition knowledge and parent/guardian feeding practices (Campbell, et al, 2013; Asakura, Todoriki, Sasaki, 2017), it is consistent with other data which found that while nutrition knowledge increased serving frequency of fruits and vegetables, it also increased frequency of certain unhealthy foods (Campbell, et al, 2013). These findings suggest that certain foods are fed to children despite knowledge of health effects and recommendations. Thus, programs outside of nutrition education should be considered when attempting to decrease the amount of processed meat served to school-aged children.

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Appendix A Instrument

Consent Form

Would you like to be involved in research at the University of Oklahoma?
I am Riley Uhl from the Health and Exercise Science Department and I invite you to participate in my research project entitled "Guardian Knowledge of Health Implications of Processed Meat and Associations with Feeding Practices of School-Aged Children." This research is being conducted at The University of Oklahoma You were selected as a possible participant because you are a parent/guardian of a school-aged child or children aged 6-12 years, enrolled in an after-school program in Oklahoma. You must be at least 18 years of age to participate in this study. Please read this document and contact me to ask any questions that you may have BEFORE agreeing to take part in my research.

What is the purpose of this research? The purpose of this research is to analyze associations between parent/guardian nutritional knowledge regarding processed meat consumption and feeding practices of processed meat for school-aged children.
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4/8/2019 Qualtrics Survey Software

How many participants will be in this research? About 200 people will take part in this research.

What will I be asked to do? If you agree to be in this research, you will respond to a survey. The survey will take approximately 15 minutes. This survey can be taken via a mobile phone or on a computer. The survey will ask you questions about your health knowledge and the foods you feed your child/children.

How long will this take? Your participation will take approximately 15 minutes.

What are the risks and/or benefits if I participate? There are no identified risks from participating in this research. While there are no direct benefits to participating in the study, you will contribute to the nutrition knowledge base.

Will I be compensated for participating? There will be no compensation for participating.

Who will see my information? Data are collected via an online survey system that has its own privacy and security policies for keeping your information confidential. No assurance can be made as to their use of the data you provide. No identifying information will be provided. Research records will be stored on a password protected computer and only approved researchers and the OU Institutional Review Board will have access to the records.

Do I have to participate? No. If you do not participate, you will not be penalized or lose benefits or services unrelated to the research. If you decide to participate, you do not have to answer
https://ousurvey.ca1.qualtrics.com/Q/EditSection/Blocks/Ajax/GetSurveyPrintPreview 2/24

any question that you choose not to and can stop participating at any time.

Who do I contact with questions, concerns or complaints? If you have questions, concerns or complaints about the research or have experienced a research-related injury, contact Riley Uhl at 214-415-6905, rileyuhl@ou.edu or Dr. Sarah Maness at (405) 325-4984, smaness@ou.edu
You can also contact the University of Oklahoma – Norman Campus Institutional Review Board (OU-NC IRB) at 405-325-8110 or irb@ou.edu if you have questions about your rights as a research participant, concerns, or complaints about the research and wish to talk to someone other than the researcher(s) or if you cannot reach the researcher(s).
Please print this document for your records. By providing information to the researcher(s), I am agreeing to participate in this research.

- o I agree to participate
- o I do not agree to participate [Thank you for your participation]

Section I: Demographics and Other

Do you have children between the ages of 6-12?

- ○ Yes
- ○ No

How many children do you have between the ages of 6-12?

- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ 7

How many children do you have total?

_____

What is your gender?

- ○ Male
- ○ Female
- ○ Other _____

What is your marital status?

- ○ Single (Never Married)
- ○ Married
- ○ Divorced
- ○ Separated
- ○ Widowed

What is your race? (Click all that apply)

- ☐ White
- ☐ Black or African-American
- ☐ American Indian or Alaskan Native
- ☐ Asian
- ☐ Native Hawaiian or other Pacific Islander
- ☐ Some other race (please specify)

_____

Are you Hispanic or Latino?

- ○ Yes
- ○ No

What is your age?

_____

What is the highest level of education you have received?

- ○ Less than high school degree
- ○ High school degree or equivalent (e.g., GED)
- ○ Some college but no degree
- ○ Associate's degree
- ○ Bachelor's degree
- ○ Graduate degree (e.g., Master's, PhD, MD, JD)

How much total combined money did all members of your household earn last year?

- ○ $0 to $9,999
- ○ $10,000 to $24,999
- ○ $25,000 to $49,999
- ○ $50,000 to $74,999
- ○ $75,000 to $99,999
- ○ $100,000 to $124,999
- ○ $125,000 to $149,999
- ○ $150,000 to $174,999
- ○ $175,000 to $199,999
- ○ $200,000 and up
- ○ Don't know

Do you make the primary decisions about the food your child/children eat?

- ○ Yes
- ○ No

Do you make some of the decisions about the food your child/children eat?

- ○ Yes
- ○ No [Thank you for your participation]

Section II: Feeding Frequency Questionnaire

On a typical week, I feed my child/children (Check all that apply)

- [ ] Hot dogs
- [ ] Bacon
- [ ] Lunchmeat turkey
- [ ] Ham
- [ ] Roast beef
- [ ] Lunchmeat chicken
- [ ] Sausage (Including chicken, turkey, beef and pork sausage):
- [ ] Pepperoni (Including turkey, beef and pork pepperoni):
- [ ] Salami
- [ ] Bologna
- [ ] Canned meat (Spam, Vienna Sausage, etc.):
- [ ] Jerky
- [ ] None of the above

How many days in a typical week do you personally feed your child (age 6-12) hotdogs?

	Never	1 day	2 days	3 days	4 days	5 days	6 days	7 days
Child 1	○	○	○	○	○	○	○	○
Child 2	○	○	○	○	○	○	○	○
Child 3	○	○	○	○	○	○	○	○
Child 4	○	○	○	○	○	○	○	○

On a day you feed your child **(age 6-12)** hotdogs, you serve about how many servings? (Serving size: about 1 hotdog)

	Less than 1 serving	1 serving	2 servings	3 servings	More than 3 servings
Child 1	○	○	○	○	○
Child 2	○	○	○	○	○
Child 3	○	○	○	○	○
Child 4	○	○	○	○	○

How many days in a typical week do you personally feed your child **(age 6-12)** bacon?

	Never	1 day	2 days	3 days	4 days	5 days	6 days	7 days
Child 1	○	○	○	○	○	○	○	○
Child 2	○	○	○	○	○	○	○	○
Child 3	○	○	○	○	○	○	○	○
Child 4	○	○	○	○	○	○	○	○

On a day you feed your child **(age 6-12)** bacon, you serve about how many servings? (Serving size: About 3 slices of bacon)

	Less than 1 serving	1 serving	2 servings	3 servings	More than 3 servings
Child 1	○	○	○	○	○
Child 2	○	○	○	○	○
Child 3	○	○	○	○	○
Child 4	○	○	○	○	○

How many days in a typical week do you personally feed your child **(age 6-12)** lunchmeat turkey?

	Never	1 day	2 days	3 days	4 days	5 days	6 days	7 days
Child 1	○	○	○	○	○	○	○	○
Child 2	○	○	○	○	○	○	○	○
Child 3	○	○	○	○	○	○	○	○
Child 4	○	○	○	○	○	○	○	○

On a day you feed your child **(age 6-12)** lunchmeat turkey, you serve about how many servings? (Serving size: 2 slices that are about the size of CDs)

	Less than 1 serving	1 serving	2 servings	3 servings	More than 3 servings
Child 1	○	○	○	○	○
Child 2	○	○	○	○	○
Child 3	○	○	○	○	○
Child 4	○	○	○	○	○

How many days in a typical week do you personally feed your child **(age 6-12)** ham?

	Never	1 day	2 days	3 days	4 days	5 days	6 days	7 days
Child 1	○	○	○	○	○	○	○	○
Child 2	○	○	○	○	○	○	○	○
Child 3	○	○	○	○	○	○	○	○
Child 4	○	○	○	○	○	○	○	○

On a day you feed your child **(age 6-12)** ham, you serve about how many servings? (Serving size: 2 slices that are about the size of CDs)

	Less than 1 serving	1 serving	2 servings	3 servings	More than 3 servings
Child 1	○	○	○	○	○
Child 2	○	○	○	○	○
Child 3	○	○	○	○	○
Child 4	○	○	○	○	○

How many days in a typical week do you personally feed your child **(age 6-12)** roast beef?

	Never	1 day	2 days	3 days	4 days	5 days	6 days	7 days
Child 1	○	○	○	○	○	○	○	○
Child 2	○	○	○	○	○	○	○	○
Child 3	○	○	○	○	○	○	○	○
Child 4	○	○	○	○	○	○	○	○

On a day you feed your child **(age 6-12)** roast beef, you serve about how many servings? (Serving size: 2 slices that are about the size of CDs)

	Less than 1 serving	1 serving	2 servings	3 servings	More than 3 servings
Child 1	○	○	○	○	○
Child 2	○	○	○	○	○
Child 3	○	○	○	○	○
Child 4	○	○	○	○	○

How many days in a typical week do you personally feed your child **(age 6-12)** lunchmeat chicken?

	Never	1 day	2 days	3 days	4 days	5 days	6 days	7 days
Child 1	○	○	○	○	○	○	○	○
Child 2	○	○	○	○	○	○	○	○
Child 3	○	○	○	○	○	○	○	○
Child 4	○	○	○	○	○	○	○	○

On a day you feed your child **(age 6-12)** lunchmeat chicken, you serve about how many servings?
(Serving size: 2 slices that are about the size of CDs)

	Less than 1 serving	1 serving	2 servings	3 servings	More than 3 servings
Child 1	○	○	○	○	○
Child 2	○	○	○	○	○
Child 3	○	○	○	○	○
Child 4	○	○	○	○	○

How many days in a typical week do you personally feed your child **(age 6-12)** sausage?

	Never	1 day	2 days	3 days	4 days	5 days	6 days	7 days
Child 1	○	○	○	○	○	○	○	○
Child 2	○	○	○	○	○	○	○	○
Child 3	○	○	○	○	○	○	○	○
Child 4	○	○	○	○	○	○	○	○

On a day you feed your child **(age 6-12)** sausage, you serve about how many servings? (Serving size: About the size of 2 breakfast sausage links)

	Less than 1 serving	1 serving	2 servings	3 servings	More than 3 servings
Child 1	○	○	○	○	○
Child 2	○	○	○	○	○
Child 3	○	○	○	○	○
Child 4	○	○	○	○	○

How many days in a typical week do you personally feed your child **(age 6-12)** pepperoni?

	Never	1 day	2 days	3 days	4 days	5 days	6 days	7 days
Child 1	○	○	○	○	○	○	○	○
Child 2	○	○	○	○	○	○	○	○
Child 3	○	○	○	○	○	○	○	○
Child 4	○	○	○	○	○	○	○	○

On a day you feed your child **(age 6-12)** pepperoni, you serve them approximately Serving size: Approximately 14 pieces (1 oz) of pepperoni

	Less than 1 serving	1 serving	2 servings	3 servings	More than 3 servings
Child 1	○	○	○	○	○
Child 2	○	○	○	○	○
Child 3	○	○	○	○	○
Child 4	○	○	○	○	○

How many days in a typical week do you personally feed your child **(age 6-12)** salami?

	Never	1 day	2 days	3 days	4 days	5 days	6 days	7 days
Child 1	○	○	○	○	○	○	○	○
Child 2	○	○	○	○	○	○	○	○
Child 3	○	○	○	○	○	○	○	○
Child 4	○	○	○	○	○	○	○	○

On a day you feed your child **(age 6-12)** salami, you serve about how many servings? (Serving size: 2 slices that are about the size of CDs)

	Less than 1 serving	1 serving	2 servings	3 servings	More than 3 servings
Child 1	○	○	○	○	○
Child 2	○	○	○	○	○
Child 3	○	○	○	○	○
Child 4	○	○	○	○	○

How many days in a typical week do you personally feed your child **(age 6-12)** bologna?

	Never	1 day	2 days	3 days	4 days	5 days	6 days	7 days
Child 1	○	○	○	○	○	○	○	○
Child 2	○	○	○	○	○	○	○	○
Child 3	○	○	○	○	○	○	○	○
Child 4	○	○	○	○	○	○	○	○

On a day you feed your child **(age 6-12)** bologna, you serve about how many servings? (Serving size: 2 slices that are about the size of CDs)

	Less than 1 serving	1 serving	2 servings	3 servings	More than 3 servings
Child 1	○	○	○	○	○
Child 2	○	○	○	○	○
Child 3	○	○	○	○	○
Child 4	○	○	○	○	○

How many days in a typical week do you personally feed your child **(age 6-12)** canned meat?

	Never	1 day	2 days	3 days	4 days	5 days	6 days	7 days
Child 1	○	○	○	○	○	○	○	○
Child 2	○	○	○	○	○	○	○	○
Child 3	○	○	○	○	○	○	○	○
Child 4	○	○	○	○	○	○	○	○

On a day you feed your child **(age 6-12)** bologna, you serve about how many servings? (Serving size: 2 slices that are about the size of CDs)

	Less than 1 serving	1 serving	2 servings	3 servings	More than 3 servings
Child 1	○	○	○	○	○
Child 2	○	○	○	○	○
Child 3	○	○	○	○	○
Child 4	○	○	○	○	○

How many days in a typical week do you personally feed your child **(age 6-12)** jerky?

	Never	1 day	2 days	3 days	4 days	5 days	6 days	7 days
Child 1	○	○	○	○	○	○	○	○
Child 2	○	○	○	○	○	○	○	○
Child 3	○	○	○	○	○	○	○	○
Child 4	○	○	○	○	○	○	○	○

On a day you feed your child **(age 6-12)** jerky, you serve about how many servings? (Serving size: About 1 average size Slim Jim stick OR about one third of a small bag of jerky)

	Less than 1 serving	1 serving	2 servings	3 servings	More than 3 servings
Child 1	○	○	○	○	○
Child 2	○	○	○	○	○
Child 3	○	○	○	○	○
Child 4	○	○	○	○	○

Section III: Nutrition Knowledge Questionnaire

Select all of the foods below that are considered "processed meat"

- [ ] Hotdog
- [ ] Ham
- [ ] Tofu
- [ ] Deli (lunchmeat) turkey
- [ ] Bone-in steak
- [ ] Bacon
- [ ] Sausage
- [ ] Jerky
- [ ] Chicken Breast
- [ ] Spam
- [ ] Reduced sodium bacon
- [ ] Turkey Breast
- [ ] Low-fat Hotdog
- [ ] Filet steak
- [ ] Ground turkey
- [ ] Meat that has been braised
- [ ] Meats with nitrates
- [ ] Meats that are salted
- [ ] Meats that are baked
- [ ] Meats that are cured

Respond true or false:

	True	False
There are health risks associated with diets low in fiber	○	○
Some preservatives in food can cause cancer	○	○
Saturated fat contributes to heart disease risk	○	○
Hot dogs **do not** contain a significant amount of sodium	○	○
Bacon contains fiber	○	○
The food my child eats now **will** affect their risk of disease later in life	○	○
Children **cannot** develop type 2 diabetes (diabetes mellitus)	○	○
Health organizations in the United States have found processed meat to be associated with cancer	○	○
The way meat is cooked affects how healthy it is	○	○
Eating processed meat can cause colorectal (i.e. colon) cancer	○	○
Eating processed meat that is made from poultry **is not** bad for you	○	○
Colorectal cancer is in the top 3 most common forms of cancer in the United States	○	○
Health experts in the United States are **not sure** if processed meat causes cancer	○	○
The American Institute for Cancer Research recommends eating **no more than** two servings of processed meat per day	○	○