THE EFFECT OF KNOWLEDGE, BEHAVIORS, AND ATTITUDES TOWARDS DIETARY FATTY ACIDS ON BLOOD LIPID LEVELS

by

Amber Deckard

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Project Approved:

Supervising Professor: Dr. Jada Stevenson, PhD, RDN, LD
Department of Nutritional Sciences

Dr. Anne VanBeber, PhD, RDN, LD
Department of Nutritional Sciences

Rebecca Dority, MS, RDN, LD, CDE
Department of Nutritional Sciences

Samantha Davis, MS, RDN, LD
Department of Nutritional Sciences

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ABSTRACT

Background: Research has shown a strong relationship between dietary fatty acids (FAs) and their impact on blood cholesterol. Few studies have examined knowledge, behaviors and attitudes (KBA) towards dietary FAs impact blood lipid levels.

Objective: To determine: 1) KBA of FAs using the modified General Nutrition Knowledge Questionnaire (GNKQ); and 2) correlations between anthropometric data, GNKQ responses, and blood lipid levels.

Design: This study utilized a cross-sectional research design.

Methods: Upon IRB approval, 104 women ages 18-40yr consented and completed the modified GNKQ via Qualtrics®. The GNKQ consisted of 70 questions and took approximately 15min to complete. Additionally, a subset of nine women also were instructed to fast for 12-15hrs prior to testing at the Obesity Prevention Laboratory at TCU. Height (cm), weight (kg), BMI (kg/m2), waist-to-hip ratio were recorded. Next, a fasting blood sample (5mL) was obtained. The blood samples were sent to AnyLabTestNow® (Fort Worth, Texas) for a lipid panel. Results were then analyzed via IBM SPSS® (Statistics Version 25.0. Armonk, NY). Significance was set at $p<0.05$.

Results: More than 80% of participants were aware of saturated, monounsaturated, and polyunsaturated FAs, but only 33.3% were able to identify their proper food sources. Of the 34 knowledge-based questions, approximately 1.9% demonstrated poor knowledge (answered 0-11 questions correctly), 54.3% moderate knowledge (12-23 questions correctly), and 43.8% strong knowledge (24-34 questions correctly). For the subset, there was a significant negative correlation between LDL and participants who self-reported consuming less or maintaining

current consumption of animal fat (r= -0.725, p=0.027). There were no other significant correlations between KBA and lipid panel results.

Conclusion: Despite self-reported awareness, participants lack knowledge of dietary FAs. The subset results showed strong correlation between LDL and consumption of animal fat representing the relationship between diet and lipid levels. Overall, more research should ensue with a larger sample.

CHAPTER 1
INTRODUCTION

Americans are currently experiencing an obesity epidemic with an estimated 70.7% of adults over the age of 20 finding themselves in the overweight or obese classifications. Researchers predict that by the year 2030, approximately 50% of the United States (U.S.) population will be classified as obese. Continuously growing at an alarming rate, the obesity epidemic is not projected to stop any time soon[1].

Obesity is a disease that is often accompanied by other comorbidities including, but not limited to: insulin resistance, Type II Diabetes, inflammatory conditions, cardiovascular disease (CVD), cancer, and decreased longevity. Each of these diseases can be assuaged through lifestyle changes and nutrition intervention; in fact the number one leading cause of death in the U.S. is CVD which is directly related to weight and is preventable. A large contributor to CVD is plaque buildup caused by deposits of fatty acids in the arteries. Over time, diets high in fat will continue to accumulate plaque until a clot forms leading to serious and fatal conditions. Many research studies have examined the impact of various dietary fatty acids on CVD and overall health, including looking into how lifestyle factors including smoking, lack of physical activity, excessive sodium and alcohol intake directly impact CVD[2]). Research is lacking on how knowledge and education of dietary fatty acids can affect blood lipid levels.

The purpose of this this research project was two-fold. We aimed to determine 1) knowledge, attitudes, and behaviors of dietary fats using the modified General Nutrition Knowledge Questionnaire (GNKQ); and 2) correlations between anthropometric data, GNKQ responses and blood lipid levels. We hypothesize there will be an inverse relationship between knowledge of dietary lipids as a whole and the blood lipid levels compared to the standard

ranges. We hypothesize that the more knowledge an individual has on about dietary fats, the lower their adverse blood lipids will be.

CHAPTER II

LITERATURE REVIEW

Chronic Disease

In the U.S., two in every three adults are classified as being overweight or obese. This is a key factor into health and disease prevention, because individuals falling into this weight classification are at greater risk for insulin resistance, type II diabetes, hypertension, inflammatory conditions, and various other diseases/conditions[3]. These conditions are often comorbidities and accompany other preexisting medical diagnosis or will escalate into others. For example, through lack of treatment or control what was originally diagnosed as hypertension can develop into CVD. There is a strong relationship across international guidelines in regarding the importance of exercise, weight balance, cessation of smoking, monitoring hypertension, and optimal lipid profile as precautions to prevent CVD[4]. One reason for a lack of optimal blood lipid levels and this development into CVD may be a diet high in fatty acids.

Dietary Fatty Acids

Dietary fatty acids (FA) are essential for survival and are a key component of the diet; however, too much consumption is linked to obesity and CVD[7]. Due to the risk of excess FA accumulating in the body and leading to other co-morbidities, the breaking down and oxidation of fat in the body is beneficial and prevents accumulation from occuring. Weight gain occurs when fat accumulates in the form of triacylglycerols in adipocytes. Due to this accumulation of fat, health complications associated with excess weight can occur.

There are four different types of FAs found in varying quantities in different types of fats: saturated fatty acids (SFA), polyunsaturated fatty acids (PUFA), monounsaturated fatty acids (MUFA), and trans fatty acids (TFA). Each of these fats alter the cholesterol levels in the body differently.

Cholesterol Trends

An increase in SFA in the diet increases the LDL cholesterol and the total blood cholesterol levels as well. A high PUFA diet has a reducing effect on LDL, HDL, total cholesterol, and triglyceride levels. A high MUFA diet has the most benefits with it lowering LDL levels and total cholesterol without lowering the HDL levels. A diet high in TFA increases LDL and total cholesterol levels[8]. Summarized in Table 1.1.

Researchers have determined PUFA rich meals, as discussed earlier, to be beneficial to overall health and disease prevention. The researchers further have found that, when an individual consumes a PUFA rich diet, it initiates fat oxidation to a greater extent after eating the occasional high SFA meal versus a control diet in which PUFA levels are low, approximately seven percent, as compared to the PUFA rich diet which is 21%[9]. PUFA trigger the oxidation to occur of the saturated fats at a higher extent, breaking them down more efficiently and effectively. This is beneficial for health, because when saturated fats accumulate in the body this is what leads to high LDL content and unhealthy cholesterol tendencies as discussed earlier. When stating diets high in the certain fatty acid, it is meaning diets exceeding the daily recommendations of those listed in Table 1[10].

Table 1: FATTY ACID'S EFFECT ON BLOOD LIPID LEVELS

Fatty Acid	Effect
SFA	Increases total cholesterol Increases LDL cholesterol
PUFA	Decreases total cholesterol Decreases LDL cholesterol Decreases HDL cholesterol
MUFA	Decreases total cholesterol Decreases LDL cholesterol
TFA	Increases total cholesterol Increases LDL cholesterol

*Saturated Fatty Acids (SFA), Polyunsaturated Fatty Acids (PUFA), Monounsaturated Fatty Acids (MUFA), and Trans Fatty Acids (TFA).
**Low Density Lipoprotein (LDL) also known as "bad cholesterol", High Density Lipoprotein (HDL) also known as "good cholesterol".

Table 2: RECOMMENDED INTAKE OF FATTY ACIDS

	Recommended Dietary Intake (% of total kcal)
SFA	<10%
MUFA	13%-18%
PUFA	6%-11%
TFA	<1%

*Saturated fatty acids (SFA), Polyunsaturated fatty acids (PUFA), Monounsaturated fatty acids (MUFA), and Trans fatty acids (TFA).

Lipid Panel

The Mayo Clinic defines cholesterol as the waxy substance found in fats in the blood that can be deposited in blood vessels and hardening leading to atherosclerosis and many other

chronic diseases discussed in *Chronic Diseases*[5]. Cholesterol levels are determined through a blood lipid panel blood test which looks at the individual components of cholesterol: Total cholesterol, low-density lipoprotein (LDL), high-density lipoprotein (HDL), triglyceride levels, and a risk ratio (LDL/HDL in ratio format). The optimal levels are stated in Table 3[6]. Optimal levels have been established based on research done on where atherosclerosis and other chronic diseases begin to occur; ranges are based on NCEP guidelines and are used for treatment and diagnosis at all medical clinics and research facilities including the Mayo Clinic stated prior. According to the Mayo Clinic, high cholesterol is an asymptomatic condition, and will develop into plaque deposits, atherosclerosis, and eventually CVD. Due to the lack of symptoms, it is important for annual doctor visits that include a lipid panel and working to maintain those optimal levels[5].

Table 3: OPTIMAL LIPID PANEL LEVELS

	Normal Ranges
Total cholesterol	<200 mg/dL
LDL cholesterol	<150 mg/dL
HDL cholesterol	>39 mg/dL
Triglycerides	<100 mg/dL
Risk Ratio	<3.22

Education

Recently, there has been an interest in how education and income levels affect a person's health. Researchers have found that the greater the income the lower one's likelihood of disease and premature death. The higher the income the lower the risk of disease, and the lower the income the increased risk of disease, both representing an inverse relationship between income and disease diagnosis[11]. Considering income as a factor in health sheds new light for public

health fields and nutrition education. When looking at nutrition education though, little research has been done. In Europe, the "Think Again About Cholesterol Survey" helped shed some light on the lack of nutrition education. The survey found that 1 in 4 adults believed that cholesterol does not need to be a concern until someone shows signs or symptoms, and 92% of participants did not know their own LDL levels or had never had their cholesterol levels tested[12]. This survey, though beneficial, still did not look at how knowledge of diet relates to health.

In another study in northern Italy, researchers looked at how teachers could potentially help prevent CVD. Five teachers received Primary Prevention of Adult Cardiovascular Disease education (PP-CVD). The PP-CVD education consisted of multiple readings regarding information on atherosclerosis, risk factors, preventative measures, and diet impact with emphasis on adolescence and the young-adult population. One booklet in particular written by Roberto Aquilani, one of the lead researchers on the study, was chosen by the researchers for the five teachers to adopt into their preexisting biology curriculum. The booklet offered education on risk factors, impact, and ways to improve blood lipid levels through the diet. Teachers then went about their usual schedules teaching thirteen classes at the high school, with the modified biology curriculum containing nutrition education. After a six-month period, compared to the control group, the teachers who had been educated had students who improved their lipid profile consequently to autonomous changes in dietary habits; this was seen through multiple choice questions for comprehension of material, anthropometric data, food diaries, and blood values. More than 70% of students had both a reduction of > 10% in LDL cholesterol and an increase of >7% in HDL cholesterol. Students additionally in the PP-CVD educated classrooms reported less snacks and sugary beverages per week then those in the control.[13]. This survey shows the relationship in education over CVD prevention and lipid profiles. However, when students do

not receive any education, the question remains; how does present knowledge on nutrition overall and specific nutrients effect lipid panel? More research is needed to relate education of a specific nutrient to health as in how the knowledge of fats affect an individual's lipid panel.

CHAPTER III

METHODS

Study Design

The TCU Institutional Review Board approved this cross-sectional designed study that utilized a modified GNKQ questionnaire. The questionnaire originally contained over 200 questions discussing general nutrition knowledge and all components of the diet: vitamins/minerals, carbohydrates, proteins, and fats. All questions not pertaining to dietary fatty acids were excluded from the questionnaire. The modified GNKQ was then entered into Qualtrics. Participants could choose to either complete the online questionnaire via Qualtrics only, or to complete the questionnaire and participate in a lipid panel. Individuals taking the online questionnaire via Qualtrics were sent a link via email or scanned a QR code from poster recruitment. The link or code took them directly to the consent form which had to be answered with a "Yes" before beginning the questionnaire. For the subset of participants participating in the lipid panel, testing occurred at the Obesity Prevention Laboratory (OPL) at TCU following an overnight fast (12-14h). Knowledge, behaviors and attitudes towards fats was measured via an awareness score and IBM SPSS® (Statistics Version 25.0. Armonk, NY). Significance was set at $p<0.05$. Further, blood lipids were measured via a lipid panel.

Participants

The recruitment process utilized TCU Announce, flyers, and in-person recruiting during class lectures and organization meetings Upon completion of recruiting participants, 107 women had completed the modified GNKQ; however, three of the responses had to be excluded due to not falling within the age range of 18 to 40 years old. Additionally, a subset of ten women consented to participate in the lipid panel. One of the women in the subset had to be excluded due to inability to obtain a blood draw on the day of her appointment. During the recruitment process, participants whom expressed interest in the lipid panel were emailed to discuss availability; once confirmed, participants were instructed to fast for 12 to 14 hours before their scheduled lab visit. Lab visits were scheduled for Friday November 16 from 7:00am to 9:00am and Wednesday November 28 from 7:00am to 9:00am. Participants were scheduled in 15-minute intervals and instructed to arrive to the second floor of the Annie Richardson Bass Building at TCU at their respected time.

Study Protocol

During the recruitment process, after speaking at class lectures or organization meetings, the professor or president who send out an email with the Qualtrics link included to complete the questionnaire. The link took the individual directly to the consent form, and once answered the questionnaire would begin. The GNKQ questionnaire consisted of 70 total questions broken down into three categories: 34 knowledge questions, 21 behavior questions, and 15 awareness questions. The knowledge-based questions were the only questions used for scoring; however, researchers utilized all questions in the statistical analysis.

The subset of participants would complete the questionnaire the morning of their appointment. Researchers greeted participants upon arriving to the Bass building and escorted them to an exam room where anthropometrics, BMI, and hip/waist ratio information were recorded. Participants were then escorted across the hall by a researcher for a 10ml fasting blood draw collection. Blood samples were centrifuged at 4◦C at 3,000rpm for 15min and chilled in a cooler immediately following centrifuging. Once the blood draw was complete, researchers escorted participants to a waiting area where they could complete the 15-minute GNKQ. Once participants completed the questionnaire, researchers escorted them out of the building. At the end of all blood draws, researchers transferred the blood samples to Any Lab Test Now where lipid panels were completed.

Statistical Analyses

The IBM SPSS version 24 statistical package will be used for all data analysis (SPSS Inc., Armonk, NY). Descriptive statistics including mean, range, and standard deviation will be calculated for all blood lipid variables. All values will be expressed as mean±standard error of the mean (SEM) unless otherwise indicated. Frequency and percentages will be computed to describe the characteristics of the sample. Correlations between anthropometric data, GNKQ responses, and blood lipid levels. The questionnaire will be completed and results recorded through Qualtrics Survey. Statistical significance is set at $p<0.05$.

CHAPTER IV

RESULTS

Participants

The mean age (years) of participants who completed the survey was 25 ± 7.3. Participants reported a mean weight (kg) of 61.1 ± 31.6. Participants recorded their classification and major as well; results are shown in Figures 1 and 2.

GNKQ – Knowledge-based Questions

Researchers assigned participants with an awareness score based on the number of knowledge-based questions answered correctly. When researchers analyzed the score criteria, participants who answered 0 to 11 correctly, received a score of poor awareness of lipids in the diet. Participants who answered 12 to 23 questions correctly received a score of moderate awareness of lipids in the diet, and participants who answered 24 questions correctly received a score of strong awareness of lipids in the diet. The mean score was a 23.7, which equates to 69.7% of the questions answered correctly. Only one individual classified as a senior Nutrition major answered all 34/34 questions correctly. Results of the 104 participants' awareness score is in Figure 3. Table 5 shows an example of the type of knowledge-based questions asked and highlights the reported percentage of individuals who answered them correctly.

GNKQ – Behavior-based Questions

Participants were asked behavior-based questions to get an idea of foods consumed in the typical week. Olive oil was the most reported fat used when cooking at home with 48.6% of participants utilizing it; while the second most reported fat was butter with 27.1% of participants.

Participants were additionally asked a series of questions regarding how often they eat a particular food item; the results are in Table 4, which displays the percentage of participants who reported eating the food item multiple days of the week.

Table 4: GNKQ PARTICIPANT DIET BEHAVIORS

Often eat…	Consumed multiple times a week
Meat	74.8%
Regular-Fat Cheese	73.8%
Fried Foods	50.4%
Regular-Fat Chips	72.0%
Regular-Fat Ice Cream	42.9%
Processed Meats	41.5%

GNKQ – Attitude-based Questions

A series of questions in the GNKQ allowed researchers to understand the attitude towards fats and whether or not the participants knew of the different types of fats in the diet. One question contained a series of parts giving a type of fat and allowing the participant to answer; “yes” “no” or “not sure”; these responses are in Table 6. When individuals were asked how concerned they were with their fat consumption, 40.2% stated they were concerned, while the majority, 59.8%, claimed the opposite.

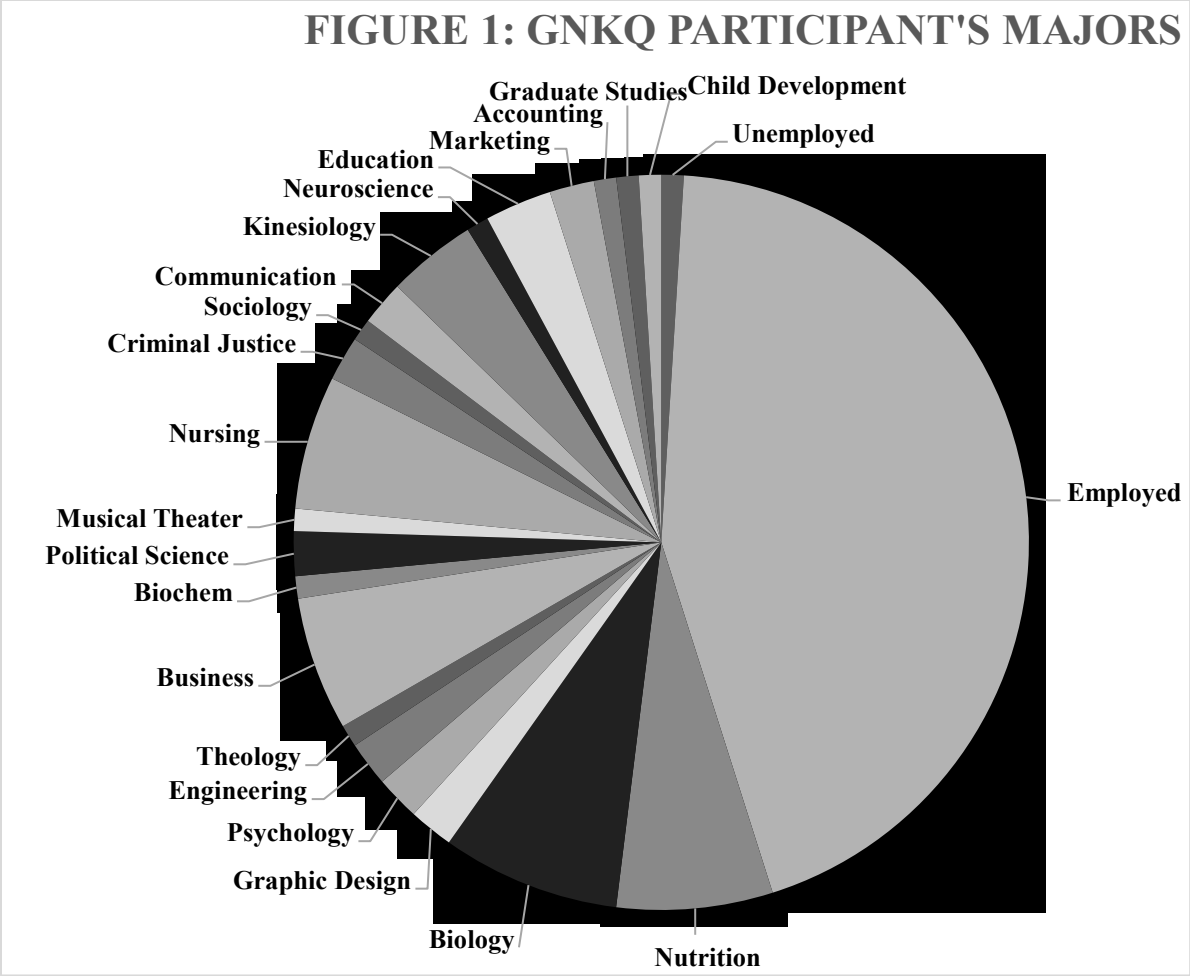


FIGURE 1: GNKQ PARTICIPANT'S MAJORS
Graduate Studies
Child Development
Accounting
Unemployed
Marketing
Education
Neuroscience
Kinesiology
Communication
Sociology
Criminal Justice
Nursing
Employed
Musical Theater
Political Science
Biochem
Business
Theology
Engineering
Psychology
Graphic Design
Biology
Nutrition

Figure 2: GNKQ PARTICIPANT'S CLASSIFICATIONS

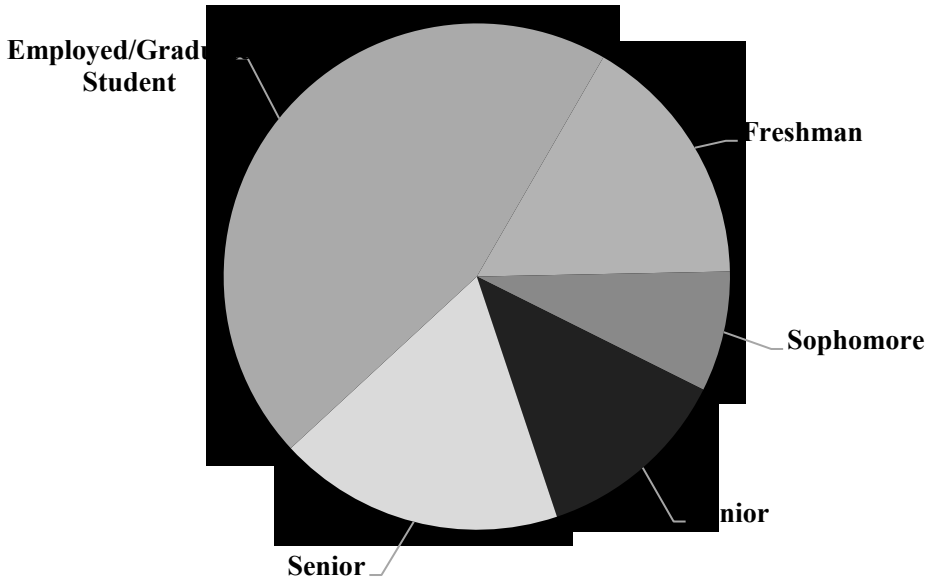


Figure 3: GNKQ Awareness Scores

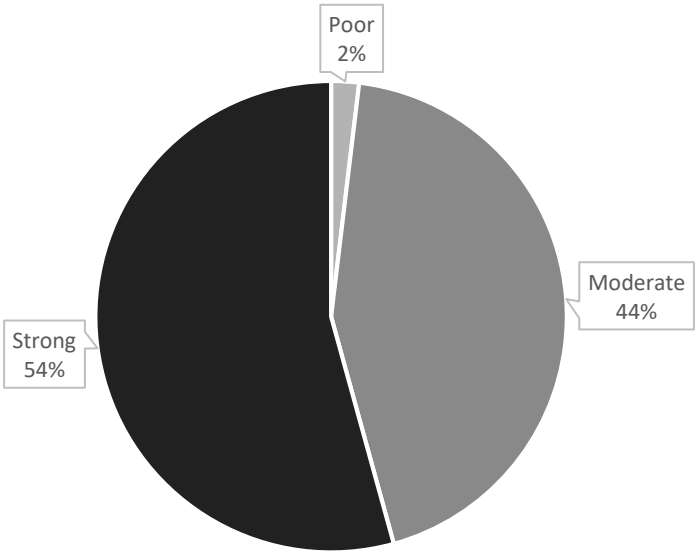


Table 5: GNKQ AWARENESS VS. KNOWLEDGE

	Reported Awareness	Correctly Identified
Saturated Fat	99.1%	44.9%
Trans Fat	99.1%	74.8%
Monounsaturated Fat	73.6%	25.2%
Polyunsaturated Fat	73.8%	30.8%
Fish Oil	95.3%	-
Omega 3	93.4%	-
Omega 6	68.6%	-
Animal Fat	84.1%	-
Vegetable Oil	99.1%	-
Hydrogenated Oil	65.4%	-
Partially Hydrogenated Oil	58.5%	-
Tropical Oil	35.6%	-
Steric Acid	26.7%	-

Table 6: SURVEY RESPONSE FREQUENCIES

	Correctly Identified	Answer
Experts recommend which fat to be cut down in diets	93.5%	*Saturated Fat*
To maintain a healthy diet people should cut fat out completely	97.2%	*FALSE*
Are there any health problems related to the amount of fat in the diet	63.6%	*TRUE*
Some foods contain a lot of fat but no cholesterol	35.5%	*TRUE*
Experts recommend eat more or less meat	59.8%	*LESS*
Which cooking method requires fat to be added	68.2%	*Sautéing*

Subset: Lipid Panel Participants

A subset of ten participants were recruited for a lipid panel; one participant was excluded due to the inability to obtain a blood draw. The mean age of the subset was 19.6 ± 1.5 years. The mean anthropometric measurements obtained are in Table 7. Discuss anthropometrics a bit. Everyone normal weight with a favorable WHR? Majors and classifications are presented in Figure 4. In this subset, effort was made to include various majors. The same awareness scoring methods were used for the lipid panel participants, and the results are recorded in Figure 5. Mean results of the lipid panel compared to normal levels are represented in Figure 7. All participants had HDL above the recommended amounts, >39 milligrams per deciliter (mg/dL); and all participants had a risk ratio below the recommended amounts, <3.22. Two participants had LDL levels above recommended limits, <100 mg/dL, and one participant had total

cholesterol above recommended amounts, <200 mg/dL. All participants had triglyceride levels within normal limits, <150 mg/dL.

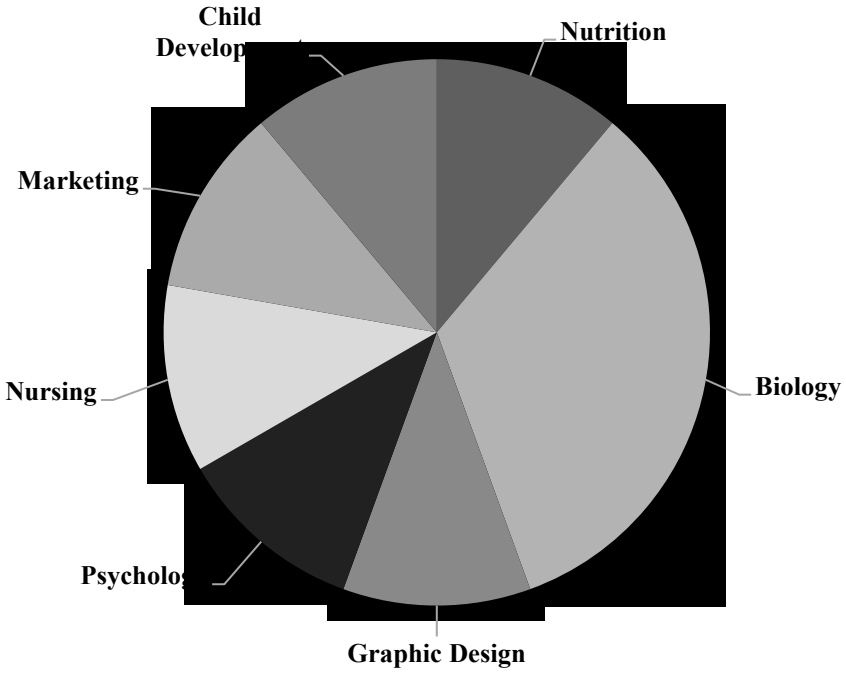
Correlations

Correlations for lipid levels/body composition versus GNKQ responses are displayed in Table 8. A significant, positive correlation was found between HDL level of the participants, and how often they reported eating the skin or fat on meat ($r=0.803$, $p=0.009$), with the higher the HDL level the more the individuals reported consuming the skin or fat on meat. Additionally, a significant positive correlation was discovered between the higher an individual's LDL level and the more times participants reported eating fried foods ($r=0.696$, $p=0.037$).

A significant positive correlation was present between the larger the individuals' weight, the higher their risk ratio ($r=0.846$, $p=0.004$). Risk ratio is the ratio of (HDL/LDL) represented as a number to show the risk of developing conditions from high LDL levels like CVD. There was a significant positive correlation between BMI and waist-hip ratio ($r=0.740$, $p=0.023$) as well. The higher the individuals' triglyceride levels, the larger their waist-hip ratio ($r=0.757$, $p=0.018$). Waist-hip ratio was positively correlated both with age ($r=0.832$, $p=0.005$) and how often an individual reported eating fried foods ($r=0.733$, $p=0.025$).

Table 7: LIPID PANEL PARTICIPANT CHARACTERISTICS	
Height (cm)	164.6 ± 6.1
Weight (kg)	61.1 kg ± 10.8
BMI	22.5 ± 3.7
Waist Measurement (cm)	70.82 ± 0.43
Hip Measurement (cm)	95.71 ± 0.59
Waist/Hip Ratio	0.74 ± 0.01

Figure 4: LIPID PANEL PARTICIPANT'S MAJORS



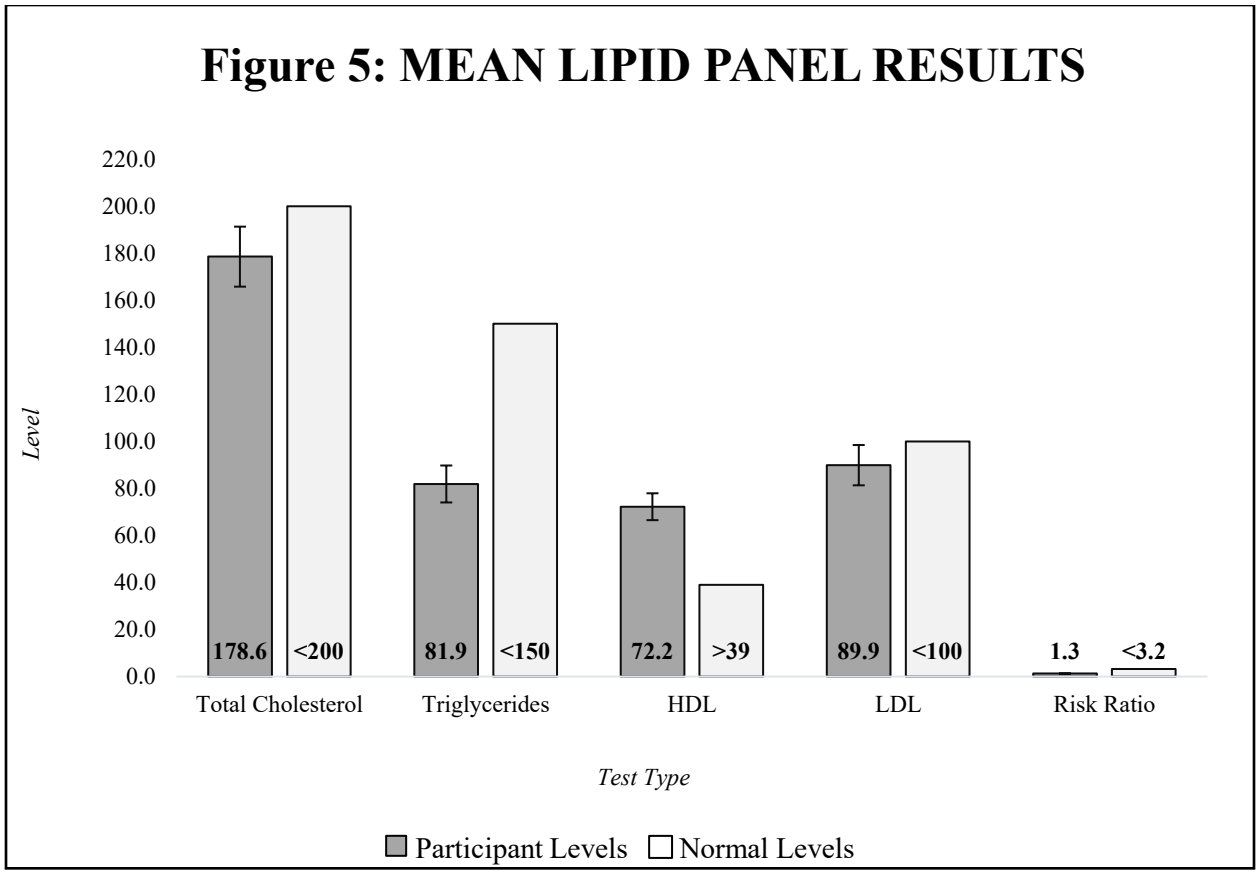


Figure 5: MEAN LIPID PANEL RESULTS
220.0
200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Level
178.6
<200
81.9
<150
72.2
>39
89.9
<100
1.3
<3.2
Total Cholesterol
Triglycerides
HDL
LDL
Risk Ratio
Test Type
Participant Levels
Normal Levels

Table 8: CORRELATIONS BETWEEN LIPID PANEL RESULTS AND GNKQ RESPONSES

	Often Eat Meat	Often Eat Fried Foods	Often Eat Skin or Fat on Meat	Age	BMI	Weight	Waist-Hip-Ratio	HDL	LDL	Triglycerides	Risk Ratio
Often Eat Meat		0.432; p=0.246	0.806**; p=0.009	-0.742; p=0.200	-0.258; p=0.503	-0.483; p=0.188	-0.237; p=0.539	0.767*; p=0.016	0.205; p=0.597	0.115; p=0.769	-0.441; p=0.234
Often Eat Fried Foods			0.432; p=0.246	-0.742*; p=0.022	-0.443; p=0.232	-0.489; p=0.181	-0.733*; p=0.025	-0.011; p=0.977	-0.696*; p=0.037	-0.345; p=0.363	-0.689*; p=0.40
Often Eat Skin or Fat on Meat				-0.478; p=0.193	0.038; p=0.923	-0.187; p=0.630	-0.191; p=0.622	0.803**; p=0.009	0.245; p=0.525	0.099; p=0.800	-0.361; p=0.340
Age					0.118; p=0.763	0.291; p=0.447	0.832**; p=0.005	-0.275; p=0.473	0.410; p=0.273	0.478; p=0.194	0.633; p=0.067
BMI						0.907**; p=0.001	0.266; p=0.489	-0.231; p=0.550	0.448; p=0.226	0.473; p=0.198	0.740*; p=0.023
Weight							0.350; p=0.356	-0.413; p=0.269	0.413; p=0.269	0.358; p=0.344	0.846**; p=0.004
Waist-Hip Ratio								-0.098; p=0.802	0.548; p=0.127	0.757*; p=0.018	0.642; p=0.062
HDL									0.466; p=0.206	-0.103; p=0.792	-0.371; p=0.326
LDL										0.424; p=0.255	0.639; p=0.064
Triglycerides											0.564; p=0.114
Risk Ratio											

*Table represents correlations for the subset of nine individuals between lipid panel results and survey responses. Body Mass Index (BMI), High Density Lipoprotein (HDL), Low Density Lipoprotein (LDL), and Risk Ratio (HDL/LDL). * denotes a significance at the 0.05 level (2-tailed). ** denotes a significance at the 0.01 level (2-tailed).

CHAPTER V

DISCUSSION

The aim of this study was two-fold. We aimed to determine: 1) knowledge, attitudes, and behaviors of dietary fats using the modified GNKQ; and 2) correlations between anthropometric data, GNKQ responses, and blood lipid levels. During review of the GNKQ responses, we found a common trend of women reporting awareness of specific types of fats in the survey; however, when asked a knowledge-based question to identify where this specific fat was located, the women were unable to correctly identify where it was located, representing a nutrition education gap.

When looking at frequencies further, when participants were asked general questions regarding what experts recommend in the diet to prevent heart disease as in more or less salty foods, fat, sugar, fruits/vegetables, and fiber; greater than 75% answered each of these questions correctly. The majority of participants know what experts recommend as a healthy diet to prevent heart disease. This is another theme found by Gillian Anne Hendrie et al. where 90% or more of the participants taking part in a nutrition knowledge study were aware of the expert recommendations to eat more fruits and vegetables[14]. Furthermore, our research found that less than 50% of participants know the specific serving amounts regarding how much fish to consume each week, along with other food serving specifics. This was a common theme seen in Gillian Anne Hendrie et al.'s study as well where only 56% of participants knew the recommended number of fruits and vegetables to consume each day[14]. Participants know the surface level questions regarding what to eat; however, do not know the detailed questions regarding serving sizes. The mean score for the GNKQ was a 69.7% in our study. We found no significance when comparing the individual awareness scores to age or income level; however in

Emily R McLeod et al. study, they found quite the opposite. In mothers of low, middle, and upper socioeconomic status there was a significant positive correlation between the higher socioeconomic status, the higher the general nutrition knowledge score was[15].

When researchers analyzed the lipid panel results and anthropometric data, a strong positive correlation was discovered between an individual's triglyceride levels and their waist-hip ratio. This positive correlation was also seen in Dr. Mabel Yap's study where high serum triglyceride levels were higher in individuals with higher waist-hip ratios[16]. High waist-hip ratios and high triglyceride levels are both risk factors for obesity and CVD; this correlation is not surprising when considering the accompanying effect the two risk factors have on overall health then.

A few limitations in this research study warrant discussion. The modified GNKQ used contained questions that were subjective to the individual including the answer choices of often, sometimes, and rarely/never. What is often to one individual may not be often to another; thus, the frequency of food consumption reported may not have been accurate for each individual or consistent for all individuals. Additionally, this research project was originally joined with another, which consisted of solely female participants ranging in age from 18 to 40 years old, thus why we set the same inclusion criteria on our participants; this limited us from exploring males and a larger age range. Due to timing and scheduling constraints, the sample of women who completed the lipid panel were all college students ranging in age of 18 to 22 years old, which is a small age range to represent the comparison of knowledge and lipid panel results across all life spans. Furthermore, due to funding and time limitations, the small subset of lipid participants does not provide sufficient results. We recommend further research with a larger subset consisting of both males and females, complete both a survey and lipid panel.

CHAPTER VI

CONCLUSIONS

The present findings indicate that individuals are aware of the different types of FAs and fats in the diet; however, the majority lacks the ability to correctly identify where these fats are located. Additionally, the findings show that individuals are aware of the diet experts recommend to prevent heart disease. When individuals were asked higher level thinking questions regarding the diets impact on disease and cholesterol levels, individuals were not able to answer them correctly. This is important for future nutrition education and public health efforts to focus on bridging knowledge gaps. Despite the present findings of the subset participants and their cholesterol levels within normal limits, this is not indicative as the population as a whole. More research should be done including both males and females on a larger scale completing both a questionnaire and lipid panel.

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