

Analysis of General Nutritional Knowledge of High School Students

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Abstract

Background: High school student nutritional knowledge is an under-researched demographic in the U.S. The present study aimed to explore the general nutritional knowledge of high school students and examine if there are any differences between sex, grade level, and BMI.

Methods: The General Nutritional Knowledge Questionnaire-Revised (GNKQ-R) was employed to measure the nutritional knowledge level of a sample of local high school students enrolled in a food sciences/culinary arts class. Data were analyzed using GNU PSPP and Microsoft Excel 2016.

Results: The results indicated although differences existed between the groups there were no statistical differences between gender, BMI, and grade level among the students. The overall knowledge scores of the sample showed 49.1% of students had moderate nutritional knowledge.

Conclusions: The present study shows the need for nutritional education in high schools is something that should be addressed with educators to ensure students are provided the information needed to make informed nutritional decisions into adulthood.

Keywords: General Nutritional Knowledge Questionnaire-Revised (GNKQ-R), BMI, obesity, disease, assessment, student

Introduction

Emerging evidence has highlighted the importance of nutrition on health status and longevity. For individuals to make healthy changes to their diets, they must have the proper knowledge to do so. In the U.S. there is a dire need for increased nutritional education among all population groups due to the growing epidemic of obesity and diabetes. This study aims to determine the current adolescent population's nutritional knowledge and differences between the groups within this population to assist policymakers and educators with a starting point to address the need for nutritional education to help adolescents with their health decisions as they enter adulthood.

The research done by Castillo et al. sought to find out the nutrition knowledge of adolescents with eating disorders and their parents and compared them to adolescents without eating disorders and their parents¹. Of the individuals who completed the questions, neither group correctly answered more than half of the questions¹. Even more concerning, is the number of undiagnosed cases of these eating disorders due to the adolescent population not having a basis of knowledge for what these eating disorders may look like and the ability to determine the difference between healthy and unhealthy diet practices. The results of the study conclude that both populations of adolescents lacked sufficient knowledge about nutrition and the need for nutritional education to be incorporated into educational programs so adolescents can understand what a healthy diet looks like¹. Uninformed adolescents become uninformed adults and this vicious cycle will cease to end if nutritional education is not made a focus within school curriculums.

Obesity has been associated with an increased risk of 13 cancers². This puts it at 40% of all cases of cancer in the U.S.². High sugar content contributes to obesity. Nutrition and physical education must be looked at together as a whole and not as separate parts. Although physical activity is a part of school curriculums research shows it has limited health benefits if not paired with proper nutrition³. Poor diet and inactivity are key contributors to the development of cancer, whereas food literacy is associated with positive eating behaviors^{3,4}. Both adolescents and adults show difficulty in being able to read food labeling⁴. Understanding these labels is crucial in creating informed consumers. Research also points out the importance

of sleep in making healthier food choices⁴ and adolescents who know how to prepare foods are more likely to consume a healthier diet than their counterparts⁴.

Studies examining differences between vegetarian and plant-based diets show a vegetarian diet designation does not mean healthier foods, but rather the absence of animal-based foods⁵. In contrast, a plant-based diet suggests foods come from plant sources⁵. Under this designation, vegetarians often still consume highly processed, high fat, high sugar foods⁵. On the other hand, the plant-based designation encourages limits to animal product consumption but also discourages the consumption of processed foods that do not contain animal ingredients⁵.

A large percentage of obesity is caused by high-calorie foods, high sugars, poor fibers, and high fats⁶. WHO reports in 2010, 40 million children under 5 were overweight⁶. The food industry needs to find innovative ways to engage the public⁶. Marketing of unhealthy foods to children and youth has a major impact on consumer choices of unhealthy foods⁶. The majority of diseases and mortality are related to lifestyle-related behaviors⁶. Most people determine the health of foods on calorie content; high calories are unhealthy, and low calories are healthy⁶. This is a dangerous assumption and does not guarantee that an individual will make better food choices and consume the nutrients needed to sustain a healthy diet.

School is an important social environment for adolescents⁷. Vending machines and nutrition education classes can both have an impact on eating habits⁷. Another important factor is that eating behaviors are shaped by environment, family, and genetics⁸. Evidence points to a connection between dietary habit improvement and education-based interventions in nutrition⁹. The school environment is ideal for nutrition education⁹. Implementation of “homemaking skills” to female populations contributes to higher scores in nutritional knowledge⁹. Making these programs a part of the required curriculum could reduce the gender stigma behind them and increase nutritional knowledge and education in a fun and practical way that will have real-world applications.

Subjects and Methods

Selection and procedure

The sample included 55 high school students (25 male and 30 female) from a rural suburban high school in central California who were enrolled in either a Food Science or Culinary Arts class. A dietary questionnaire representing a modified version of the General

Nutritional Knowledge Questionnaire-Revised¹⁴ was self-administered during school hours via a Google Forms Survey. This study was conducted and approved by the Liberty University IRB and written informed consent was obtained for all participants.

Questionnaire

The questionnaire included questions regarding height, gender, weight, and grade level. Descriptions of the participants regarding height, gender, weight, and BMI are shown in Table 1. Each participant's knowledge was assessed through four sections, containing 48 questions, and one section containing nine questions regarding demographic information for a total of 57 queries.

	Female (N 30)	SD	Male (N 25)	SD	Total (N 55)	SD
Height (cm)	162.56	5.08	175.26	7.62	167.64	161
Weight (kg)	62.14	14.97	73.03	22.23	67.13	19.05
BMI <18	17	1.74	17	1.73	17	2
BMI 18.5-24.9	21.75	0.58	21	1.71	21	2
BMI 25-29.9	28.33	8.29	26.75	3.32	27	6
BMI >30	36	6.29	35.5	6.28	36	6

BMI- body mass index

Section 1 included questions about dietary recommendations given by experts.

Section 2 included questions regarding the participant's awareness of food groups and their practical ability to connect certain foods with specific nutrients.

Section 3 included questions about the participant's ability to apply theoretical knowledge of foods to food choices.

Section 4 questioned the participant's level of knowledge about the connection of specific foods with certain diseases.

The nutritional knowledge questionnaire was adapted and modified from the original validated version of the GNKQ-R for UK adults which was originally developed by Parmenter and Wardle in 1999¹⁴. The questionnaire was modified, where appropriate, to replace the original UK-based references with more applicable alternatives to fit the U.S. population.

The raw data was scored 1 for correct responses and 0 for incorrect or “I’m not sure” responses. Due to the complexity of some questions, it was possible to obtain more than one correct answer for one question as indicated in the scoring rubric of the survey. The total number of points for each section consisted of the following values: 19, 36, 13, and 18; respectively with a total of 86 possible points which were used to determine the tertiles of the participant’s knowledge scores.

Additionally, each student’s knowledge score was transformed into a percentage utilizing Bloom's cutoff points⁹. Scores between 80 and 100% were considered a high level of knowledge, scores between 60 and 79% were considered a moderate level, and scores less than 60% were considered a poor level of knowledge.

Statistics

Statistical analysis and the percentage of distribution of participants were analyzed utilizing GNU PSPP and Microsoft Excel 2016. The obtained scores are expressed as mean and standard deviations. Percentage distribution scores for each tertile were analyzed with GNU PSPP as well. Data is categorized by gender, BMI, and grade level. ANOVA test was used to determine the differences between each group.

Results

A total of 67 students participated in this study. However, 12 students were excluded due to incomplete submissions. Overall, almost half of the students had a moderate level of nutritional knowledge.

Knowledge Score	Min	Max	Mean \pm SD	Bloom's Cut Off		
				Poor, n (%)	Moderate	High
S1	1	14	8.96 \pm 2.57	49 (89.1)	6 (10.9)	0 (0.0)
S2	3	28	18.69 \pm 4.51	40 (72.7)	15 (27.3)	0 (0.0)
S3	0	12	6.84 \pm 2.97	28 (50.9)	24 (43.6)	3 (5.5)
S4	3	18	10.55 \pm 3.56	24 (43.6)	24 (43.6)	7 (12.7)
Total of All Sections	3	18	43.87 \pm 10.59	19 (34.5)	27 (49.1)	9 (16.4)

Poor knowledge scores were the highest for Section 1: Expert Recommendations at 89.1% and lowest for Section 4: Food Groups & Nutrients section at 43.6%. In all, the poor level of knowledge is the highest among all categories, except for Section 4 which ties the number of individuals in the moderate level. Girls showed higher knowledge than boys in all sections except in the Food Groups & Nutrients (Table 3). Seniors showed better knowledge across all sections, whereas freshmen showed the lowest knowledge across all categories. Interestingly, participants with a BMI>30 showed the best knowledge in the Nutrition & Disease category (87.5% vs. 66.7% in overweight, 45.5% in normal weight, and 71.4% in underweight participants). They scored the lowest in contrast to the other BMI categories in the sections of Expert Recommendations (12.5%) and Food Choices (25%). However, due to the small number of participants in this category (N=9), no firm conclusions can be drawn from this data. In total, the differences between each of the cutoff points show 49.1% of students have moderate nutritional knowledge.

The mean score for Expert Recommendations was 8.96 out of a possible 19 (Table 3).

	S1:Expert Recommendations			S2: Food Groups/Nutrients			S3: Food Choices			S4:Nutrition & Disease			Total		
	Min	Max	Mean \pm SD	Min	Max	Mean \pm SD	Min	Max	Mean \pm SD	Min	Max	Mean \pm SD	Min	Max	Mean \pm SD
All Participants	1	63	8.96 \pm 2.57	3	28	18.69 \pm 4.51	0	12	6.84 \pm 2.97	3	18	10.55 \pm 3.56	13	64	43.87 \pm 10.59
Girls	1	63	11.1 \pm 10.16	10	25	19.03 \pm 3.51	0	11	7.43 \pm 2.63	3	18	10.67 \pm 3.73	13	62	45.4 \pm 9.65
Boys	3	13	8.68 \pm 2.37	3	28	18.28 \pm 5.53	0	12	6.12 \pm 6.12	4	17	10.4 \pm 3.42	19	64	42.04 \pm 11.54
Freshman	7	7	7 \pm 0	19	21	20 \pm 1.41	10	10	9.5 \pm 0.71	7	25	11 \pm 5.66	44	50	47 \pm 11.54
Sophomore	3	12	8.94 \pm 2.19	10	25	17.94 \pm 4.51	11	11	6.47 \pm 2.92	4	16	10 \pm 2.92	19	56	41.88 \pm 9.39
Junior	6	11	8.77 \pm 1.64	3	24	16.46 \pm 5.27	9	9	5.92 \pm 2.81	4	14	9.69 \pm 3.88	21	58	39.85 \pm 10.64
Senior	1	63	11.74 \pm 11.62	10	28	20.39 \pm 3.66	12	12	7.39 \pm 0.65	3	18	11.39 \pm 3.71	13	64	47.35 \pm 11.06
BMI <18	6	11	8.14 \pm 1.68	10	25	16.86 \pm 4.45	4	12	8.43 \pm 2.44	9	15	11.71 \pm 2.5	35	60	44.14 \pm 8.76
BMI 18.5-24.9	1	63	10.76 \pm 9.78	3	28	18.52 \pm 5.08	0	11	6.7 \pm 3.12	3	17	9.64 \pm 3.55	13	64	42.79 \pm 11.89
BMI 25-29.9	7	11	9.43 \pm 1.62	13	22	19 \pm 3.27	5	10	7 \pm 2.08	4	18	12.57 \pm 4.61	28	59	46.71 \pm 10.61
BMI >30	3	13	9 \pm 3.02	18	24	20.75 \pm 2.19	0	10	5.88 \pm 3.36	6	14	11.5 \pm 2.45	32	52	45.63 \pm 6.21

BMI- body mass

There was no statistical significance between males and females ($p=0.48$). The item regarding fruit and vegetable serving recommendations showed the lowest correct response rate with a total of 7.1% of participants. The mean score for Food Groups & Nutrients was 18.69 from a possible 36. There was no statistical significance between males and females ($p=0.68$). The item regarding the main type of fat in foods showed the lowest correct response rate in this section with 16.2% of participants answering correctly and a staggering 55.9% stating they were not sure of the correct response. The mean score for Food Choices was 6.84 from a possible 13. There was no statistical significance between males and females ($p=0.10$). The item regarding choosing an alternative chip to reduce the amount of fat in their diet showed the lowest correct response with only 8.8% of participants answering correctly. The mean score for Nutrition & Disease was 10.55 from a possible 18. There was no statistical significance between males and females ($p=0.44$). Common mistakes regarding body mass index classification had the lowest correct response at 10.3% and a total of 44.1% of participants indicated they were not sure. Also, within this category, the nutritional recommendations to lower cancer risk received a correct response of 17.4% with a total of 33.3% of students indicating they were not sure.

Discussion

This study aimed to identify the general knowledge of high school students about nutrition. The sample included a greater number of females than males due to the gender distribution of the classes that were surveyed. The number of students with normal BMI consisted of 60% of the sample population and approximately 26% were classified in the overweight/obese category. Although other studies have shown there is a prevalence of overweight and obesity among boys, the data from this study shows no statistical significance in BMI between males and females ($p=0.90$). Approximately 13% were classified as underweight. The number of participants in this classification can be cause for concern due to the prevalence of eating disorders among individuals in this age group¹. However, due to the small sample populations for the overweight and underweight groups ($N=14$ and $N=7$, respectively), firm conclusions cannot be made regarding this information.

Although 49.1% of participants showed adequate knowledge across all categories combined, it is of greater concern the lowest percentage of adequate knowledge exists in Expert Recommendations (7.3%) and following closely Food Group & Nutrients (10.9%). The results of

knowledge concerning Nutrition and Disease show sufficient awareness across all participant designations, which is promising. However, more importantly, is ensuring high school students can take the knowledge they have regarding this topic and turn it into action via good food choices to dampen the growing epidemic of diet-related disease in the United States². This study shows there is much more room for improvement when it comes to educating this population about their nutritional food choices and the effects these foods will have on their future health.

The limitations of this study include the small sample size of high school students. To obtain a better insight into the nutritional knowledge of students a larger population will be needed to draw more accurate conclusions regarding each of the section topics surveyed. Future research should include a larger number of participants and a larger variety of students from all BMI categories. Surveying of other high schools should also be considered to analyze comparison data to see if this has any influence on nutritional knowledge. Future research could also include longitudinal studies on students who have food science/culinary classes to measure the differences in knowledge as well as include questions regarding the student's specific eating habits to see if this knowledge is being transferred into actions.

The inclusion of items regarding where students obtain their nutritional information could also provide further insight into what resources are being used and whether or not further education is needed to ensure these resources are trusted and reliable. This survey utilized self-reporting measures in a classroom setting. Future research could also include utilizing scales and measuring tapes when obtaining anthropometric data from the students to ensure accuracy.

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