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General Nutrition Knowledge Among High School Students

Annique Cornejo
apcornejo@llu.edu

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James E. Carter III

Lida Gharibvand

Gurinder Bains

Department of Nutrition and Dietetics, Loma Linda University

Abstract

Background: Obesity now affects 1-in-5 children and adolescents in the United States. As of 2018, the prevalence of obesity has reached 18.5% and affects about 13.7 million children. Obese children are at increased risk for high blood pressure and high cholesterol that can lead to cardiovascular disease, impaired glucose tolerance, insulin resistance, and type 2 diabetes. Since health habits are commonly established during the formative years, it is imperative that good food choices and basic knowledge about nutrition be taught at an early age. This study examined whether students had received sufficient teaching about nutrition, particularly as it relates to obesity, by the time they reach high school age.

Objective: To identify the level of nutrition knowledge among public and private high school students to assess if gender, age, grade level, and physical activity are correlated with survey scores.

Design: A self-administered, anonymous questionnaire was administered that consisted of 20 questions—fifteen questions about general nutrition knowledge and five questions on demographics.

Participants: Data was collected on 1,325 high school participants ranging in age from 13-18 years from a local private school (Loma Linda Academy) and a nearby public school (Redlands East Valley High School).

Main outcomes: Addressing nutrition knowledge in order to improve the teaching of concepts that could lead to a healthier lifestyle beginning at a young age.

Secondary outcomes: Incorporating nutrition education in adolescent years may decrease risk factors for obesity in adult years.

Statistics: Frequency (%), chi-square test, ANOVA, and *post hoc* tests were used to analyze data. Data were analyzed using SPSS Statistics Software version 25.0 (SPSS Inc., Chicago, IL, USA).

Results: The average score of all students was 42%. There was a significant difference between total scores and age, grade, physical activity level, and if a nutrition course had previously been taken. (P<0.001, P<0.001, P=0.039, and P=0.004, respectively)

Conclusion: General nutrition knowledge among high school students is inadequate. Teaching nutrition knowledge in the adolescent years can lead to a healthier lifestyle as an adult. This may reduce risk factors for chronic diseases and obesity in the future and thereby improve quality of life. It is urgent that schools re-design their curriculum to improve nutrition knowledge.

INTRODUCTION

Obesity now affects 1 in 5 children and adolescents in the United States.[1] The Center for Disease Control (CDC) has reported dismal results in the latest study on obesity prevalence in America.[2] As of 2018, 18.5% of children and adolescents are categorized as obese. Among 12- to 19-year-olds the obesity prevalence hit 20.6%. Childhood obesity is also more common among certain populations. Hispanics (25.8%) and non-Hispanic blacks (22.0%) had higher obesity prevalence than non-Hispanic whites (14.1%). Non-Hispanic Asians (11.0%) had lower obesity prevalence than non-Hispanic blacks and Hispanics.

The importance of addressing childhood obesity is vital due to its harmful long-term effects on the mind and body. Obese children are at increased risk for high blood pressure and high cholesterol, which are risk factors for cardiovascular disease (CVD).[1] They also have increased risk of impaired glucose tolerance, insulin resistance, and type 2 diabetes.[1] Breathing problems, such as asthma and sleep apnea, may arise as well as joint problems and musculoskeletal

discomfort, fatty liver disease, gallstones, and gastro-esophageal reflux (*i.e.*, heartburn).[1] Childhood obesity is also related to psychological problems such as anxiety and depression, low self-esteem, lower self-reported quality of life, and social problems such as bullying and stigma.[1]

Nutrition education at a young age may decrease risk factors for obesity in adulthood. Knowledge is a factor necessary for the changes in dietary habits. Studies have been completed on nutrition knowledge of adolescents. For example, a 2015 study by Milosavljevic offered insight on nutritional knowledge of adolescents.[3] Results revealed that less than one third of adolescents demonstrated satisfactory knowledge. Boys, adolescents from rural environments, and overweight adolescents showed significantly less nutrition knowledge compared to the other (non-rural and non-obese) boys and girls.[3] These results pointed out weak areas in nutritional knowledge and uncovered unhealthy eating habits. Furthermore, a study by Kim (2015) compared nutrition knowledge of those who have previously been a part of nutrition education to those who have not received nutritional education.[4] The degree of nutrition knowledge was higher among the boys and students who underwent a nutrition education program. They had a higher ratio of regular meal time patterns and a more balanced diet. A correlation between nutrition education and enhanced dietary patterns was observed.

Limited research on the relationship of nutrition knowledge has been conducted in athletes. For example, a study conducted in 2017 by Manore, *et al.* shows that data on sports nutrition knowledge is low.[5] This study looked at high school soccer players who completed two questionnaires (demographics/health history and sports nutrition).[5] The sport nutrition knowledge score was 45.6%, with higher scores from those of white ethnicity in the national school lunch program vs. those of Latino ethnicity in the national school lunch program.[5] The authors of the study speculated that adolescent athletes, especially females and Latinos, would

benefit from sport nutrition education that enhances food selection skills for health and sport performance.[5] Interestingly, another study done in 1984 by Douglas and Douglas on nutrition knowledge and food practices of high school athletes indicated that the female athletes had better knowledge of nutrition but poorer food practices than the male athletes.[6] This graduate research study focused on differentiating nutrition knowledge using multiple demographics.

Although limited research has been completed on the extent of nutrition knowledge among high school athletes, a questionnaire has been developed that assesses nutrition knowledge of general athletes. The Nutrition for Sport Knowledge Questionnaire (NSKQ) is an 89 item, valid and reliable measure of sports nutrition knowledge. [7]

For this study, 15 questions were devised that covered general nutrition knowledge on protein, starch, fats, fiber, vitamins, and minerals. The idea was inspired by the General Nutrition Knowledge Questionnaire. This questionnaire was originally developed in the UK in the 1990s by Parmenter and Wardle and is still widely in use. By utilizing components of the General Nutrition Knowledge Questionnaire, a connection between nutrition knowledge among high school students can be better understood The 15 questions used for this graduate research study were inspired by the General Nutrition Knowledge Questionnaire.

Since previous studies have shown poor nutrition knowledge among high school students, interventions to increase nutrition knowledge have been implemented by several schools. A New York High School implemented a wellness program during the 2012-2013 year for 14 high schools to promote changes in nutrition, mental health, and physical activity behaviors.[9] The program significantly increased participants knowledge, mental health, and physical activity.[9] Another school in Southern Appalachia implemented a Coordinated School Health (CSH) program, which is a systematic approach to improving the health and well-being of school-age

children. It was recommended for the potential to promote healthy weight in adolescents through strategic programming. Even though schools are concerned about adolescent obesity and the impact it has on a child's health, the types and quality of programming available to address the issue is variable.[10] Researchers from a study in Los Angeles randomly selected 12 elementary schools to participate in a "hybrid" school-based nutrition education program to look at the effects of nutrition programming diffused throughout a large urban community on attitudes, beliefs, and behaviors, related to fruit and vegetable consumption.[11] The intervention resulted in a significant change in teacher influence on students' attitudes toward fruits and vegetables, even after adjusting for gender, grade, and race/ethnicity.[11]

The purpose of this graduate student research study was to identify the level of nutrition knowledge among high school students based on demographics and physical activity level. The scientific knowledge gained from this study may help with the understanding of nutrition knowledge among high school students. Possible additional outcomes included improved nutrition education and programs in high schools.

For this graduate research study, a self-administered, anonymous questionnaire was given that consisted of 20 questions total—15 questions about general nutrition and 5 questions on demographics. The survey was limited to 20 questions due to limited class time availability at both Redlands East Valley and Loma Linda Academy High Schools.

METHODS

Subjects:

1,325 high school males and females from Loma Linda Academy and Redlands East Valley High School. All methods and procedures were approved by the Institutional Review Board of Loma Linda University.

Inclusion criteria:

Inclusion:

- High school students at Loma Linda Academy and Redlands East Valley High School.

- Ages 13-18+

Instruments:

The method used for this study was based on a single questionnaire. The questionnaire consisted of a total of 20 questions comprised of two components. The anonymous questionnaire was administered by volunteer high school faculty. The format used for the questionnaire was a multi-page printed copy.

Component 1: General Nutrition Knowledge Questionnaire—this was developed by the graduate student researcher, principal investigator, and reviewed by the nutrition and dietetics faculty from Loma Linda University School of Allied Health. For this study, 15 questions were given to participants to identify current levels of nutrition knowledge among high school students.

Component 2: Demographic Questions—part of the survey contained anonymous demographic questions that were developed by the student investigator. These questions assessed participant's gender, age, grade level, physical activity level (athletes vs. non-athletes) based on how many

hours a week they exercise, and whether they have previously taken or are currently taking a nutrition course.

PROCEDURES

Participants were allotted 10 minutes for the questionnaire during a one-time meeting. Students were to take home the parent information letter and information sheet. This was a passive letter of consent. If a parent disagreed to have their child participate, they were able to contact the school. Otherwise, students were permitted to take the survey.

Statistical Analysis:

Frequency (percentage) was computed for categorical variables. Chi-square test was used to examine the association between the five characteristic variables (gender, age, grade, exercise, and course) and each question on the questionnaire. ANOVA was used to look at the total score among age, grade, physical activity level, and nutrition course. *Post hoc* test was used to look at multiple comparison of the means for each variable. Data were analyzed using SPSS Statistics Software version 25.0 (SPSS Inc., Chicago, IL, USA). All analyses were performed at an alpha level of 0.05.

RESULTS

For Loma Linda Academy, 446 surveys were given, and 182 responded. The number of surveys given to Redlands East Valley was 2,358 with 1,143 respondents. The results are based on a combination of data from both schools, since there was not a significant difference in the total scores between the public and private schools in the study (p =0.2824).

Baseline characteristics of participants are shown in *Table 1*. Out of 2,798 questionnaires given, 1,325 students responded. From the 1,325 surveys, there was one outlier from a student who received a perfect score.

Table1. Frequency (%) of selected demographics (n=1,325)

Characteristics	Frequency (Percentage)
Gender	
Male	646 (48.8)
Female	648 (48.9)
Age	
<13	4 (0.3)
13	
14	159 (12.0)
15	307 (23.2)
16	296 (22.3)
17	328 (24.8)
18	186 (14.0)
>18	31 (2.3)
Grade	
9th	334 (25.2)
10th	308 (23.2)
11th	297 (22.4)
12th	372 (28.1)
Exercise	
0-1 hrs/wk	130 (9.8)
2-3 hrs/wk	256 (19.3)
4-5 hrs/wk	275 (20.8)
6-7 hrs/wk	210 (15.8)
7-8 hrs/wk	381 (28.8)
Course	
Yes	638 (48.2)
Currently	88 (6.6)
No	528 (39.8)

Table 2 shows the frequency and percentage of each question, based on the participant's "correct", "incorrect", or "not sure" responses. The total score was calculated based on each correct answer, which is worth one point. The results of the chi-square test showed the significance association between each question among the demographic variables.

Table 2. Frequency, percentage, and correlation significance by survey question.

Question	Frequency (%)	Gender	Age	Grade	Exercise	Course
1. Which fats do experts say are the most detrimental to health?	C: 290 (21.9) I: 705 (53.2) N: 311 (23.5)	**.023***	**.007***	**.02***	.093	.214
2. Which of these foods is not considered to be a starchy food group?	C: 837 (63.2) I: 311 (23.5) N: 164 (12.4)	**.000****	**.001***	**.000****	**.002***	**.005***
3. Which of the following foods has the most protein per gram?	C: 611 (46.1) I: 549 (41.4) N:157 (11.8)	**.007***	**.000****	**.000****	.911	.505
4. Which of the following foods is cholesterol-free?	C: 563 (42.5) I: 431 (32.5) N: 317 (23.9)	.899	**.004***	**.000****	.676	.462
5. Which of the following foods is/are low in saturated fat?	C: 107 (8.1) I: 937 (70.7) N: 267 (20.2)	.110	.062	**.006***	.324	.148
6. Which of the following foods is least likely to raise your blood sugar level?	C: 529 (39.9) I: 576 (43.5) N: 212 (16.0)	.628	.381	**.001***	.397	.207
7. Which of these unfortified breads contain the most vitamins and minerals?	C: 1,025 (77.4) I: 156 (11.8) N: 133 (10.0)	.255	.613	.654	**.007***	.067
8. Which of the following oils contains mostly monounsaturated fat?	C: 338 (25.5) I: 458 (34.6) N: 507 (38.3)	.821	**.011***	**.003***	.109	.409
9. Which one of the following has the most calories for the same weight?	C: 57 (4.3) I: 1,001 (75.5) N: 244 (18.4)	.153	.164	.287	.654	.120
10. Which of the following vitamins have the most antioxidant properties?	C: 392 (29.6) I: 446 (33.7) N: 470 (35.5)	.966	**.001***	**.000****	.821	.188
11. Which of the following does not provide an adequate supply of iron?	C: 464 (35.0) I: 580 (43.8) N: 267 (20.2)	.383	.145	**.003***	.956	.232
12. From which macronutrient should most of your calories be obtained?	C: 368 (27.8) I: 720 (54.3) N: 225 (17.0)	**.001***	.346	.640	.076	**.013***
13. Which would be the best choice for a low fat, high fiber snack?	C: 263 (19.8) I: 874 (66.0) N: 167 (12.6)	.110	.657	.564	.575	.454

14. Which would be the best choice for a <u>low fat</u>, <u>high fiber</u> light meal?	C: 454 (34.3) I: 195 (14.7) N: 663 (50.0)	.197	.588	.097	.426	.275
15. Which of the following foods has a positive impact on bone health?	C: 434 (32.8) I: 404 (30.5) N: 447 (33.7)	**.002***	.204	**.011***	.069	.422
TOTAL:	C: 6,732 (33.9) I: 8,343 (42.0) N: 4,551 (22.9)	.944	**.000****	**.000****	**.039***	**.004***

C = Correct; I = Incorrect; N = Not sure.
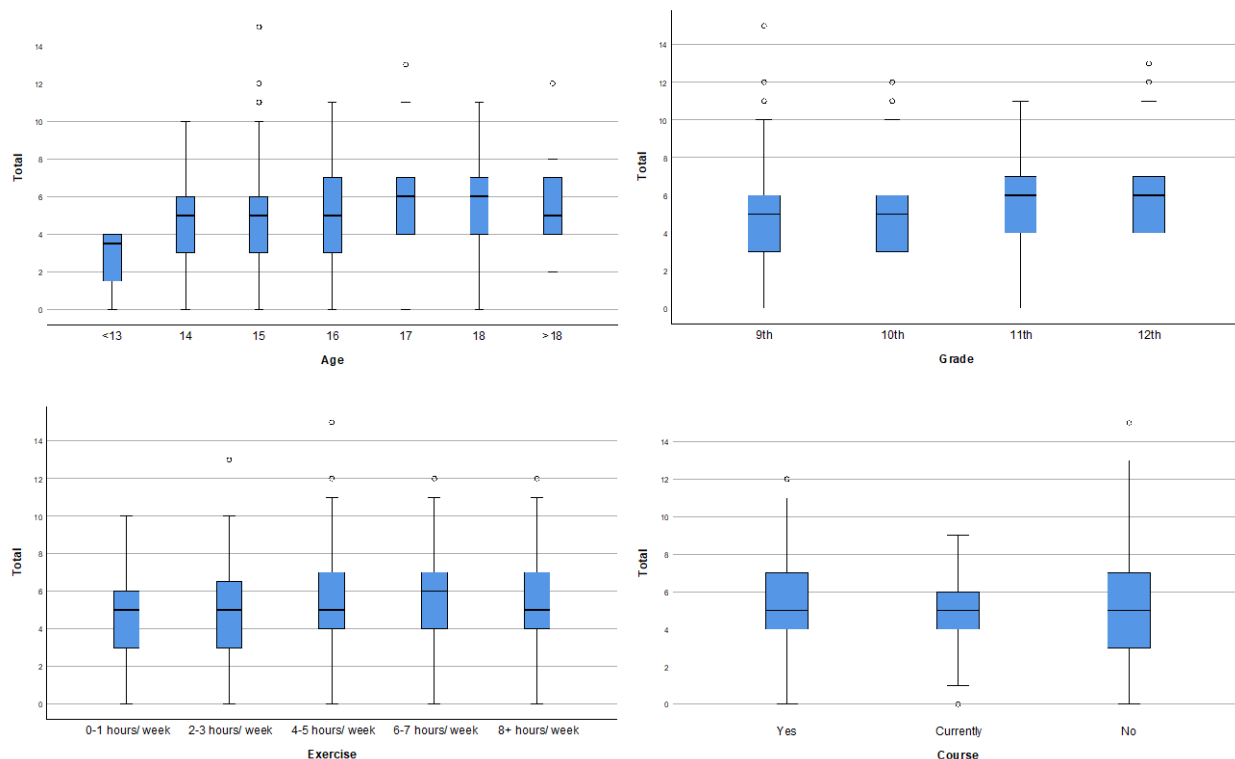* Significant at 5% significance level.
** Significant at 1% significance level.
† P-valves based on chi-square test (χ^2).

Figure 1 shows that there was a significant difference between total scores and age, grade, physical activity level, and nutrition course (p<0.001, p<0.001, p=0.039, and p=0.004, respectively).

Figure 1. Means of total scores within each demographic variable.

ANOVA test showed that the total score was different among age, grade, physical activity level, and nutrition course variables. *Post hoc* test showed that age group 17 is statistically

significantly higher than students less than or equal to 16 years old. The mean total score for 17-year-old's was 5.42 compared to mean total score of 2.75, 4.76, 4.96, and 4.92, respectively. Age group 18 scored statistically significantly higher than 14, 15, and 16-year-old's. Thus, as students get older, their total scores increase.

Post hoc showed that the mean total score for 11th grade (5.27) and 12th grade (5.74) was statistically significantly higher than 9th grade (4.72) and 10th grade (4.70). This means the juniors and seniors scored statistically significantly higher than the other grade levels.

Post hoc analysis also revealed that those who exercise 6-7 hours per week (with a mean of 5.42) scored statistically significantly higher than those who exercised 0-1 hours per week (mean = 4.71) and those who exercised 2-3 hours per week (mean = 4.88)

Those who have taken a nutrition course (mean = 5.43) scored statistically significantly higher than those who had not taken a nutrition course (mean = 4.87).

DISCUSSION

The purpose of this study was to identify the level of nutrition knowledge among high school students to assess if gender, age, grade level, and physical activity are correlated. Originally, we hypothesized that there would be a difference between the two schools for two reasons: Loma Linda Academy is a private school located in the nation's only "blue zone"—an area where individuals live longer than the average expectancy. Many residents from Loma Linda are vegetarian and very physically active, so we hypothesized that they would be more health conscious and have a higher level of nutrition knowledge. We thought this would transfer to students at Loma Linda Academy who might have more health-conscious parents. We were

surprised to see that there was not a significant difference in overall scores between the private and public schools.

As expected, the older students scored higher than younger students. As students get older, they likely gain more exposure to nutrition knowledge both inside and outside of the classroom. Since students do not typically take more than one nutrition course throughout high school and it is not a mandatory course for all students, the general nutrition knowledge probably increases with age due to increased exposure to extracurricular sources of information.

Students who exercised more scored higher on the survey than those who exercised only 0-1 hours per week. This was expected, since individuals who exercise more are typically those who are more health conscious and try to eat healthier. Unfortunately, overall scores were still low. These low score findings were parallel to the study done in 2017 by Manore, *et al.*, which revealed low scores on sport nutrition knowledge.[5] A study by Douglas and Douglas compared nutrition knowledge and food practices of high school athletes between male and females and found that the female athletes had better knowledge of nutrition but poorer food practices than the male athletes.[6] In contrast, our study found that there was no significant difference between males and females in nutrition knowledge.

Students who had taken a previous course on nutrition were expected to score higher on the survey, which was the case in this study. However, the overall score of those who had already taken a course on nutrition was still quite low, being marginally better than those without any previous academic training in nutrition. Foundational aspects of nutrition are either not being taught or the knowledge is not being retained by students.

Educators need to be alerted about the steps that should be taken to improve the teaching of concepts that can lead to a healthier lifestyle, beginning at a young age. One recommendation is

for schools to hire Registered Dietitian Nutritionists (RDNs) to teach a few classes in a health course, or to serve as a guest lecturer in a physical education course, or to keep RDNs on staff for students to receive personalized assessment, education, and nutritional guidance. This type of intervention can have a positive effect on nutrition knowledge. A study done in 2015 by Kim compared nutrition knowledge of those who had previously underwent a nutrition education program to those who have not received nutritional education.[4] This showed a positive impact among the boys and students who underwent a nutrition education program, where their degree of nutrition knowledge was higher.

An alarming result was the total low score of only 42%. These results are similar to a study done by Milosavljevic that tested nutrition knowledge of adolescents using a modified version of the GNKQ that revealed less than one third of adolescents demonstrated satisfactory knowledge.[3]

Limitations

The first limitation to our study was the low response rate. Overall, 2,804 surveys were given between the two schools and only 47% (1,325) responded. It is not clear how much this was due to unwillingness or lack of parental consent. However, the number of participants was more than sufficient for statistical analysis.

The second limitation is the amount of time allotted by the high schools. Ten minutes may not be enough time for some students to take a survey. We received numerous incomplete surveys.

Another limitation is that for Loma Linda Academy, we printed the surveys on one side of the pages only. To save printing costs, the second, larger survey for Redlands East Valley was

printed on both the front and back of pages. Unfortunately, 52 students failed to turn over the last page and did not answer the two final demographic questions.

A few surveys had responses that were obviously not provided by serious participants, such as those with repeating patterns or with the same answer choice filled in all the way through the questionnaire. We nonetheless recorded all responses and relied on statistical analysis to identify and eliminate outliers.

The most common answer given was "E", for "not sure". Some survey respondents marked "E" for every response, so it is difficult to ascertain if the student was truly ignorant about every question or were just expressing apathy towards the survey.

Although we believed that the questions devised for the survey were general nutrition questions, the low scores indicated otherwise. For instance, the question "Which one of the following has the most calories for the same weight?" (a) Sugar (b) Starchy foods (c) Fiber (d) Vegetable oil was not expected to be challenging, yet only 4.3% of students answered this question correctly.

Conclusion

Obesity rates have increased among adolescents in the United States and will likely continue to do so unless the status quo is challenged. Climbing obesity rates could be due to a lack of nutrition knowledge in the youth. Additional studies that broaden the demographic categories to uncover further possible connections to nutrition knowledge are recommended, such as income, household size, location, and access to healthy food.

General nutrition knowledge among the youth is quite inadequate, as evident by this study and others. It is imperative that schools re-design their curriculum to improve nutrition

knowledge. Teaching nutrition education at a younger age can lead to a healthier lifestyle in the future and work towards prevention of obesity.

Additional high schools may become aware of the lack of knowledge in nutrition, leading to the concern of high school administrators and parents. This can ultimately lead to more Registered Dietitians being involved in high schools. Future directions can also include nutrition knowledge intervention programs in comparison to individuals who were not involved in the intervention program. Also, this survey can potentially be used in other high schools by other RDN's conducting research on identifying nutrition knowledge. Nutrition knowledge shows promise in improving the quality of life by promoting healthier eating habits.

Additionally, nutrition knowledge in the adolescent years can lead to healthier lifestyle in the future as an adult. As mentioned above, nutrition knowledge at a young age can lead to adopting healthier eating behaviors and reducing the risk of chronic diseases such as high blood pressure, and high cholesterol, which are both risk factors for CVD, impaired glucose tolerance, insulin resistance, and type 2 diabetes. These chronic diseases lead to a decrease in quality of life, therefore preventing them can overall improve quality of life. Although the lack of nutrition knowledge may lead to the increased prevalence of obesity, other factors may also be attributed, therefore a decision on lack of nutrition knowledge by itself being the cause for these obesity rates cannot be made. This study was significant in adding to the literature, but future research is needed to explore this relationship.

REFERENCES

1. Childhood Obesity Causes & Consequences. 2016.

https://www.cdc.gov/obesity/childhood/causes.html.

2. Prevalence of Childhood Obesity in the United States. 2018;

    https://www.cdc.gov/obesity/data/childhood.html.

3. Milosavljevic D, Mandic ML, Banjari I. Nutritional knowledge and dietary habits survey in high school

    population. *Coll Antropol.* 2015;39(1):101-107.

4. Kim YA. Dietary Habit and Nutrition Knowledge of High School Students in the Incheon Area. 2015.

5. Manore MM, Patton-Lopez MM, Meng Y, Wong SS. Sport Nutrition Knowledge, Behaviors and

    Beliefs of High School Soccer Players. *Nutrients.* 2017;9(4).

6. Douglas PD, Douglas JG. Nutrition knowledge and food practices of high school athletes. *J Am Diet

    Assoc.* 1984;84(10):1198-1202.

7. Trakman GL, Forsyth A, Hoye R, Belski R. Development and validation of a brief general and sports

    nutrition knowledge questionnaire and assessment of athletes' nutrition knowledge. *J Int Soc Sports

    Nutr.* 2018;15:17.

8. Kliemann N, Wardle J, Johnson F, Croker H. Reliability and validity of a revised version of the General

    Nutrition Knowledge Questionnaire. *Eur J Clin Nutr.* 2016;70(10):1174-1180.

9. Heo M, Irvin E, Ostrovsky N, et al. Behaviors and Knowledge of HealthCorps New York City High

    School Students: Nutrition, Mental Health, and Physical Activity. *J Sch Health.* 2016;86(2):84-95.

10. Southerland JL, Williams CL, Dula TM, Slawson DL. School-based adolescent obesity prevention

    programming: perceptions of school personnel in Southern Appalachia. *South Med J.*

    2015;108(2):125-129.

11. Prelip M, Slusser W, Thai CL, Kinsler J, Erausquin JT. Effects of a school-based nutrition program diffused throughout a large urban community on attitudes, beliefs, and behaviors related to fruit and vegetable consumption. *J Sch Health.* 2011;81(9):520-529.