Eating habits associated with nutrition-related knowledge among university students enrolled in academic programs related to nutrition and culinary arts in Puerto Rico

CURRENT STATUS: POSTED

Christian Rivera - Medina
Universidad Ana G Mendez

crivera140@uagm.edu Corresponding Author
ORCID: https://orcid.org/0000-0002-3486-4312

Mercedes Briones Urbano
Universidad Internacional Iberoamericana

Aixa De Jesus Espinosa
Universidad de Puerto Rico Recinto de Ciencias Medicas

Angel Toledo Lopez
Sistema Universitario Ana G Mendez

DOI: 10.21203/rs.3.rs-18764/v1

SUBJECT AREAS
Nutrition & Dietetics
Abstract

Background: University students frequently develop unhealthy eating habits. However, it is unknown if students enrolled in academic programs related to nutrition and culinary arts have healthier eating habits. To evaluate the relationship of the eating habits and nutritional status of university students enrolled in academic programs related to nutrition and culinary arts with their knowledge in nutrition as well as cooking methods and techniques.

Methods: This descriptive cross-sectional study was conducted in the spring of 2019, during which time students completed a survey that measured their eating habits, and their knowledge in nutrition as well as cooking methods and techniques. Anthropometric measurement data were also collected for nutritional status estimation. The non-probabilistic convenience sample comprised 93 university students pursuing their Bachelor’s degree in Nutrition and Dietetics, Culinary Nutrition and Culinary Management in Universidad Ana G. Mendez, Puerto Rico. The statistical analysis included summary measures. Relationships between variables were measured using Chi-square and Fisher’s exact tests, and statistical significance was set at p<0.05.

Results: An inadequate body mass index (BMI) was observed in 59% of the sample. Eating habits, knowledge in nutrition, and knowledge in cooking methods and techniques were inadequate in 86%, 68%, and 41% of the population, respectively. Eating habits were associated with knowledge in nutrition and the type of academic program enrolled in, but not with knowledge in cooking methods and techniques.

Conclusions: Most of the students reported having inadequate eating habits and BMI values. The Nutrition and Dietetics students had the best knowledge levels pertaining to nutrition compared to the Culinary Management students, a majority of whom had inadequate knowledge levels. Our results demonstrate that there are other factors inherent to students’ university life that may have a stronger influence on eating habits than knowledge in appropriate nutritional practice.

Trial registration: Universidad Ana G Méndez Institutional Review Board January 23, 2019 Protocol number: 06-085-18

Introduction
Eating habits are defined as “conscious, collective, and repetitive behaviors, which lead people to select, consume and use certain foods or diets, in response to social and cultural influences”. University students are in a stage of change that renders them more susceptible to the development of unhealthy eating habits. Stress, short sleep durations, economic limitations, lack of time, and lifestyle-related changes are some factors that affect eating habits.

Given their field of study and nature of coursework, university students enrolled in programs related to health and food, such as Nutrition and Dietetics, Culinary Nutrition and Culinary Management, are expected to have better eating habits than those of their peers. The existing literature presents conflicting results pertaining to whether knowledge of nutrition as well as cooking methods and techniques may influence the eating habits of university students. It is unknown if knowledge of nutrition and cooking methods and techniques within the Puerto Rican student population represents a protection factor that leads them to practice healthy eating habits or if, on the contrary, these students present eating habits that are similar to those of the rest of the university population.

Mihalopoulos et al. stated that, once students are exposed to university life, they tend to gain 15 pounds as they acquire unhealthy eating habits that promote the development of overweight and obesity. Additionally, Sanchez-Ojeda et al. demonstrated that students enrolled in health-related academic programs have unhealthy lifestyles, characterized by unbalanced and deficient diets, presenting overweight and obesity.

It is important to investigate the eating habits of Puerto Rican university students, whose diets often feature low dietary fiber intake, and higher intakes of carbohydrates such as rice, bread, cereal, and refined flour-based foods. Such students also show high intakes of dairy products such as whole milk and its derivatives, refined sugar, legumes, tubers, and a variety of animal proteins with a high fat content, causing their diets to be high in calories, simple carbohydrates, saturated fats, and sodium. In addition, they tend to consume fast food, sweets, carbonated drinks, and fried foods due to their accessibility and affordability.

The Puerto Rico Department of Health in its report, Puerto Rico Community Health Assessment:
Secondary Data Profile,\textsuperscript{9} indicates that the prevalence of overweight and obesity has increased since 1996. Puerto Rico Behavioral Risk Factor Surveillance System statistics show that 66\% of the population had overweight and obesity,\textsuperscript{10} significantly increasing the prevalence of chronic diseases such as cardiovascular disease and diabetes, which are invariably associated with eating habits.\textsuperscript{11}

Wilson et al.\textsuperscript{12} identified that university students have inadequate cooking skills, rendering them susceptible to the development of poor eating habits that promote weight gain. Having a high level of knowledge on cooking methods and techniques at the time of food preparation may result in lower intake levels of processed foods and higher intakes of foods prepared from scratch.\textsuperscript{13,14} Scientific evidence links university students with knowledge in cooking methods and techniques with better diet quality,\textsuperscript{15} a higher consumption of vegetables and fruits, and a more varied and balanced dietary intake.\textsuperscript{16} Furthermore, positive influences on body mass index (BMI) and better overall health have also been observed in these students.\textsuperscript{16} The benefits of self-confidence and knowledge in food preparation were also evidenced in a study by Reicks et al.\textsuperscript{17} who found that knowledge in food preparation increases the intake of fruits and vegetables.

Students enrolled in nutrition-related programs are expected to be at an advantage in terms of the acquisition and learning of nutritional concepts, and in a better position to implement healthy eating habits, as their academic program provides competencies for this purpose. Therefore, it is expected that such students can implement the information received in the course of their study to improve their eating habits and lifestyles. However, a study conducted among university students at the University of Alicante Spain Department of Human Nutrition and Dietetics by Rizo-baeza et al.\textsuperscript{18} demonstrated that the consumption of macro and micronutrients did not adhere to dietary guidelines, showing that the presence of nutrition-related knowledge does not influence decision-making pertaining to healthy diets and lifestyles.

Accordingly, this study aimed to evaluate the relationship of the eating habits and nutritional status of university students enrolled in academic programs related to nutrition and culinary arts with their
knowledge in nutrition, as well as cooking methods and techniques.

Materials And Methods

Study design

This cross-sectional study focused on the eating habits, nutritional status, knowledge levels pertaining to nutrition, and the cooking methods and techniques of university students. For eligibility to participate, students had to be at least 18 years or older and pursuing a Bachelor’s degree in streams related to nutrition and culinary management at the Universidad Ana G. Mendez. The study protocol was submitted and approved by the university’s Institutional Committee for the Protection of Human Subjects in Research.

After study approval, the investigator coordinated with faculty members based on the academic calendar dates and time for the administration of the questionnaire within their classrooms. Once the students were present in the classrooms, the researcher provided information to all prospective participants regarding the study and its objectives, what participation would entail, including the measurement of weight and height for BMI estimation, and the length and duration of the self-administered questionnaire. Informed consent was provided to these students, with the information discussed by the researcher. Prospective participants were informed that no incentive for participation would be offered, and there were no penalties for discontinuing participation. Each student could drop out of the study at any time during the administration of the questionnaire by hand. Following this, those interested in participating voluntarily were provided the questionnaire. The researcher was present at all times during the administration of the questionnaire to clarify possible doubts and answer questions.

After students completed the self-administered questionnaire, the researcher obtained their weight and height values. An appropriate distance was established that separated participants whose values were being measured from the rest of the group to safeguard their privacy. These values were noted in the predetermined area of the questionnaire.

Survey development

To develop an instrument capable of measuring students’ eating habits, and knowledge in nutrition as well as cooking methods and cooking techniques, several existing instruments were reviewed. A panel
of experts, comprising an expert in evaluation processes, a chef, a nutritionist-dietitian licensed to practice in Puerto Rico, and a doctor in nutrition, was consulted to review the initial instrument. After this, a pilot test was conducted on 16 students, to evaluate the ease of use and clarity of the instrument. Based on the results of the pilot study, items were revised, merged, or eliminated. In addition, content was reworded as needed to achieve good comprehension. The survey was also approved by the Academic Commission of the International Iberoamerican University UNINI México. This process promoted the adaptation of queries to meet linguistic and cultural aspects related to the sample under investigation, and questions from previously validated surveys were identified and used to develop the current questionnaire.

The initial survey comprised 170 items, with the final version comprising 164 items, including closed multiple-choice questions and assessment Likert Scales. The instrument was divided into four sections: student profile (socio-economic and personal characteristics), eating habits, knowledge in nutrition, and knowledge in cooking methods and cooking techniques.

The student profile section included questions regarding sociodemographic information such as age, sex, family composition, civil status, residence, income, and employment. In terms of education, students were asked about their year of study, career of choice, and if they were studying part-time or full time. Questions regarding the preparation of food in the residence, use of kitchen equipment and meal planning, caloric intake, type of diet, and physical activity were also included.

Specific questions regarding eating habits were used from the Youth Risk Behavior Surveillance System of the Center for Disease Control for the identification of unhealthy dietary behaviors. Additionally, questions from the “NHSGGC Community-based Cooking Skills Program Follow-up Questionnaire” by García et al. were also used since they assisted in the identification of barriers within cooking and healthy eating, and allowed for the measurement of elements in food planning, purchasing and food preparation from scratch. The Food Consumption Frequency Questionnaire by Goni et al. was also integrated, allowing for the identification of nutritional alterations caused by an inadequate diet, and observation of the possible quantity and quality of the foods consumed during a
certain period of time as well as eating habits.

Students were asked about the frequency of consumption of foods and beverages in the last month to further measure their dietary diversity, and capture individual usual food consumption levels by obtaining data on the frequency with which the student consumed food items based on a predefined food list. Based on previous surveys, 19, 20, 21 the list included 34 items within the basic food groups (fruits, vegetables, proteins, dairy products, grains, fats), ways of consuming foods (boiled, fried) and, eating or cooking habits (eating out, cooking at home, ready-made meals, preparing from scratch). In addition, nine questions pertaining to food omission, food portions and weight loss strategies, and elements considered in the nutritional facts label were included to better identify and understand the application of healthy eating habits.

A section detailing the kind of meals that were consumed during the day (breakfast, lunch, dinner, and snacks) and which food groups were included in each of the daily meals was employed. Students were asked about the application of various cooking methods and techniques (boiled, steam, stew, fried, sautéed, roasted, grill, bake, and sous-vide) on a provided list of proteins, vegetables, and carbohydrates. This set of inquiries facilitated the investigation of the effect of students’ application of cooking methods and techniques on their food consumption.

An evaluative scale was developed for eating habits. According to each response, a score of 1 was assigned when adequate eating habits were applied according to the recommendation guidelines. Also, if the student consumed proteins, vegetables or carbohydrates in more than four cooking methods or techniques, one point was awarded. Contrarily, if the frequency of consumption, meals consumed during the day, food groups included in each meal were not in accordance with nutritional guidelines no points were given. Values between 0% and 69% were considered “Inadequate,” 70% and 79% “Satisfactory,” and 80% and 100% “Adequate.”

To measure the level of knowledge on nutrition and whether it was adequate, satisfactory or inadequate, 36 questions were adapted from a study by Tamayo et al.22 The questions acquired from this survey help in the recognition of the areas of limitation in students’ understanding of healthy eating habits. The questions included were based on the level of knowledge on nutritional
recommendations regarding daily food and water intake, food groups in the plate, food portions and benefits of fiber consumption. Furthermore, the ability to identify the risk associated with the intake of excess salt and drinks with high concentrations of sugar, healthy cooking techniques and unhealthy fat intake, and yes/no questions about basic nutritional concepts pertaining to high-fiber foods, foods with cholesterol, nutritional fact labels, and healthy habits for portion control were also evaluated. Students were awarded one point when a correct answer was stated, and values between 0% and 69% were considered “Inadequate,” 70% and 79% “Satisfactory,” and 80% and 100% “Adequate.” The section on cooking methods and techniques comprised 55 questions divided into three subsections: confidence in culinary competencies, knowledge in methods and techniques, and frequency of the application of cooking methods and techniques. Data from a previous study of culinary skills and consumption of processed or prepared foods in university students$^{23}$ as well as a cooking skills scale used in a study by Hartmann et al.$^{24}$ were used for the development of this section. The selected sections of these surveys were included within this survey as they measured students’ cooking competencies and knowledge on how to cook, and their relationship with eating habits. Questions from the Basic Culinary Aptitude Questionnaire were also adapted, for the measurement of students’ knowledge levels and applicability of cooking methods and techniques.$^{25}$ The General Knowledge Questionnaire on Nutrition and Food, pertaining to food, nutrients and alterations, or processes related to food, was used.$^{26}$ Finally, a questionnaire on cooking skills based on a study by Ternier$^{27}$ was used to determine if knowledge and skills in food preparation influenced food purchases and consumption. This section included a self-confidence scale for cooking competencies and questions on the use of cooking methods and techniques. One point was assigned when the student answered “Confident” or “Very confident” with regards to culinary competencies. In addition, we also employed yes/no questions for the identification of cooking methods and techniques, as well as recommended techniques for the nutrient retention of certain foods. If the student was able to answer the statement correctly one point was awarded. A Likert Scale (0 denoting “Never” and 3 “Always”) was also used to measure
cooking frequency and practice. If the frequency of the application of culinary practices was “Most of the time” or “All the time” one point was awarded. Similar to the previous sections, values between 0% and 69% were considered “Inadequate,” 70% and 79% “Satisfactory,” and 80% and 100% “Adequate.”

Statistical analysis
Descriptive statistics such as frequency distributions, proportions, means and standard deviations (SDs) were used to summarize the data. Associations between categorical variables were measured using Fisher’s exact test or a Chi-Square test. Statistical significance was set at p<0.05. Data were analyzed using the Statistical Package for the Social Sciences (version 25, 2019 IBM SPSS Statistics)\textsuperscript{28} and R (version 3.4.4).\textsuperscript{29}

Sample
The sample of this study comprised all university students pursuing a Bachelor’s degree at the Universidad Ana G. Méndez in Puerto Rico and who were enrolled in the following academic programs: Nutrition and Dietetics, Culinary Nutrition and Culinary Management. The total population comprised 93 students. As the target population was small, non-probabilistic intentional sampling was used, wherein the total population of the students of interest was chosen at the time of questionnaire administration. A total of 93 students completed the survey.

Results
Participant characteristics
Data on the student profile are shown in Table 1. The sample comprised 59 (63.4%) women, with an average age of 24.3±6.7 years. The majority of the students were single (n = 69; 74%) and had a job (n = 62; 66%). Most of the students (n = 85; 91.4%) reported cooking food at home and having an omnivorous diet (n = 70; 75.2%). In terms of career, the program with the highest number of students was Culinary Management (n = 42, 45.2%), followed by Culinary Nutrition (n = 28, 30.1%). Only twelve students were in their first year, and there were no first-year students in the Dietetics and Nutrition program. A total of 23 students were in their second year, and 29 students each were in their third and fourth years, respectively. A majority (n = 73; 78.5%) of the students were classified as having a low income.
Fifty-five students (59.1%) had an inadequate BMI, presenting low weight (n = 5; 5.3%), overweight (n = 25; 26.9%) and obesity (n = 25; 26.9%). A statistically significant difference was observed between students’ BMI and academic program type. A higher percentage of students in the Nutrition and Dietetics program (56%) had a normal weight, followed by those in the Culinary Nutrition program (50%). The academic program with the highest prevalence of obesity was Culinary Management (n = 18; 42.9%), followed by Culinary Nutrition (n = 5, 17.9%).

Table 1
Sample characteristics of student profile are shown for three academic programs related to nutrition and culinary arts.

| Variable                          | University Career Nutrition and Dietetics | Culinary Nutrition | Culinary Management |
|-----------------------------------|------------------------------------------|--------------------|---------------------|
| Gender                            | n  | %   | n   | %   | n   | %   |
| Male                              | 9  | 39.1 | 6   | 21.4 | 19  | 45.2 |
| Female                            | 14 | 60.9 | 22  | 78.6 | 23  | 54.8 |
| Age (Median, IQR)                 | 22 | 21.5-23.0 | 25.5 | 21.5-30.3 | 21 | 20-2 |
| Marital Status                    | n  | %   | n   | %   | n   | %   |
| Single                            | 18 | 78.3 | 16  | 57.1 | 35  | 83.3 |
| Married/Cohabit                   | 5  | 21.7 | 10  | 35.7 | 6   | 14.3 |
| Divorced                          | -  | -    | 1   | 3.6  | 0   | -   |
| Widowed                           | -  | -    | 1   | 3.6  | 1   | 2.4 |
| Residence                         | n  | %   | n   | %   | n   | %   |
| Family residence under caretaker  | 18 | 78.3 | 10  | 35.7 | 36  | 85.7 |
| Caretaker of family residence     | 3  | 13.0 | 16  | 57.1 | 4   | 9.5  |
| Student housing                   | 2  | 8.7  | 2   | 7.1  | 2   | 4.3  |
| Income                            | n  | %   | n   | %   | n   | %   |
| Low                               | 14 | 60.9 | 22  | 78.6 | 37  | 88.1 |
| Medium                            | 9  | 39.1 | 6   | 21.4 | 5   | 11.9 |
| Study and work                    | n  | %   | n   | %   | n   | %   |
| Full time student                 | 9  | 24.3 | 10  | 35.7 | 18  | 42.9 |
| Full time student and work        | 12 | 39.1 | 5   | 18.9 | 10  | 23.8 |
| Part time student                 | 2  | 9.7  | 13  | 46.4 | 14  | 33.3 |
| Cooks in home                     | n  | %   | n   | %   | n   | %   |
| Yes                               | 21 | 91.3 | 28  | 100  | 36  | 85.7 |
| No                                | 2  | 8.7  | -   | -    | 6   | 14.3 |
| Plans meals before grocery shopping | n  | %   | n   | %   | n   | %   |
| Yes                               | 11 | 47.8 | 15  | 53.6 | 15  | 35.7 |
| No                                | 9  | 52.2 | 12  | 42.9 | 25  | 64.3 |
| Does not shop for groceries       | 3  | 13.0 | 1   | 3.6  | 2   | 4.8  |
| Knows daily intake of calories    | n  | %   | n   | %   | n   | %   |
| Yes                               | 21 | 91.3 | 13  | 46.4 | 27  | 64.3 |
| No                                | 2  | 8.7  | 15  | 53.6 | 15  | 35.7 |
| Type of diet                      | n  | %   | n   | %   | n   | %   |
| Omnivores                         | 15 | 65.2 | 21  | 75.0 | 34  | 80.9 |
| Other                             | 8  | 34.8 | 7   | 25.0 | 8   | 19.1 |
| Physical Activity                 | n  | %   | n   | %   | n   | %   |
| Yes                               | 17 | 73.9 | 18  | 64.3 | 30  | 71.4 |
| No                                | 6  | 26.1 | 10  | 35.7 | 12  | 28.6 |
| Nutritional status (BMI)          | n  | %   | n   | %   | n   | %   |
| Underweight                       | 3  | 13.0 | 1   | 3.6  | 1   | 3.4  |
| Normal weight                     | 13 | 56.5 | 14  | 50.0 | 11  | 26.2 |
| Overweight                        | 5  | 21.7 | 8   | 28.6 | 12  | 28.6 |
| Obese                             | 2  | 8.7  | 5   | 17.9 | 18  | 42.9 |
| Year of study                     | n  | %   | n   | %   | n   | %   |
| Freshmen                          | -  | -    | 5   | 17.9 | 7   | 16.7 |
| Sophomore                         | 7  | 30.4 | 6   | 21.4 | 10  | 23.8 |
| Junior                            | 6  | 26.1 | 8   | 28.6 | 15  | 51.7 |
| Senior                            | 10 | 43.5 | 9   | 32.1 | 10  | 23.8 |

* p-value less than 0.05

Eating habits
Table 2 shows the summary of the students’ eating habits. The percentage of practiced healthy habits ranged from 27.8% to 82.9%. A majority of the students (n = 80, 82.9%) had inadequate eating habits, followed by nine students with satisfactory habits, and four with adequate eating habits. Adequate eating habits were reflected in household food consumption (n = 90; 96.8%) or cooking from scratch (n = 78; 83.9%) and dinner consumption every day (n = 76; 81%). The inadequate eating habits of the majority of the sample pertained to the intake of nutritionally unbalanced meals lacking the integration of the five food groups. As shown in Table 2, the students’ inadequate eating habits based on dietary guidelines were characterized by high intake levels of fried foods, charcuterie and carbonated beverages. In addition, students were not adhering to the dietary guidelines regarding consumption of vegetables, fruits, water, whole milk, and 100% fruit juice, portion control, and snacking two to three times daily.

Table 2

Percentage of students in academic programs related to nutrition and culinary arts with adequate eating habits according to recommended guidelines.

| Eating habit according recommended guidelines | Students with adequate eating habits |
|-----------------------------------------------|-----------------------------------|
| Fat (butter, margarine, oils and other fat)    | 83                                |
| Low sugar sodas (diet soda)                   | 80                                |
| Boiled meals                                  | 80                                |
| Eats lunch every day                          | 73                                |
| Eats candies or sweets                        | 69                                |
| Eats food made from scratch                   | 69                                |
| Whole grain flour                             | 69                                |
| Considers the list of ingredients of the products to consume | 68 |
| Eats Charcuterie (sausage, cured meats)       | 45                                |
| Whole milk / Reduced fat milk                 | 45                                |
| Drinks Water                                  | 44                                |
| Portion control                               | 40                                |
| Daily intake of 2-3 snacks                    | 32                                |
| Eats fruits (fresh, canned or frozen)         | 27                                |
| Eats salads or vegetables (fresh, canned or frozen) | 19 |
| Eats fried food                               | 19                                |

Knowledge in nutrition

The level of knowledge in nutrition varied from 22.1% to 91.7%, according to the evaluation scale, with the majority of students (n = 64, 68.8%) showing inadequate knowledge levels, followed by 16 (17.2%) with satisfactory levels, and 13 (14%) with adequate levels, as defined in this survey. Table 3 shows the questions that were answered incorrectly by the majority of students. None of the first-year students had adequate nutrition-related knowledge levels. Of those with adequate levels, more than half (n = 7, 53.8%) were in their fourth year and 38.5% were in their third year. No association was
observed between students’ knowledge in nutrition and their BMI (p = 0.46).

Table 3
Frequency and percentage of students in academic programs related to nutrition and culinary arts with correct knowledge in questions related to nutrition.

| Premise                                          | Students with correct knowledge |
|--------------------------------------------------|---------------------------------|
| Fiber content of legumes                          | n 46                            | % 49.5                          |
| Amount of fruits and vegetable servings per day    | n 46                            | % 49.5                          |
| Foods in balanced breakfast                       | n 45                            | % 48.4                          |
| Recommended dairy products                        | n 45                            | % 48.4                          |
| Main source of calcium                            | n 45                            | % 48.4                          |
| Recommended water intake per day                  | n 39                            | % 41.9                          |
| Contribution of breakfast on daily diet           | n 36                            | % 38.7                          |
| Recommended strategies to lose weight             | n 33                            | % 35.5                          |
| Calories represented in nutritional label: per package | n 30          | % 32.3                          |
| Recommended sugar and sodium content in nutritional label | n 25            | % 26.9                          |
| Definition of overweight                          | n 21                            | % 22.6                          |

Knowledge in cooking methods and techniques

The level of knowledge in cooking methods and techniques was between adequate and satisfactory in 58% of the students. Students felt, on average, confident or very confident in 18 of the 26 culinary competencies included in this section of the questionnaire. Table 4 shows a summary of the premises in which the students presented adequate or inadequate knowledge levels. The mean score of the subsection measuring the level of knowledge in cooking methods and techniques was 61.4% (SD = 18), with the lowest score being 0 and highest 95%. Culinary Nutrition students presented the highest knowledge levels in terms of cooking methods and techniques (n = 18; 64.3%), followed by those enrolled in Culinary Management (n = 26; 61.9%). Less than half of the students in the Nutrition and Dietetics program (n = 10, 43.5%) reported adequate or satisfactory knowledge levels in cooking methods and techniques. No association was found between students’ knowledge in cooking methods and techniques, and their eating habits (p = 0.35), university career (p = 0.61) or BMI (p = 0.54).
Frequency and percentage of students in academic programs related to nutrition and culinary art with correct cooking methods and techniques, and adequate application of culinary competencies and knowledge.

| Variables                        | n  | %  |
|----------------------------------|----|----|
| Knowledge in cooking methods and techniques |    |    |
| Definition of boiling            | 89 | 9  |
| Definition of microwave cooking  | 85 | 9  |
| Using spices to add flavor to food without using salt or fat | 84 | 9  |
| Cooking technique for the retention of chlorophyll. | 32 | 3  |
| Sous-vide reduces food mass      | 31 | 3  |
| Using low sodium salt to add flavor to food without using additional salt or fat | 16 | 1  |
| Culinary Competencies            |    |    |
| Food preservation techniques     | 64 | 6  |
| Cooking carbohydrates            | 89 | 9  |
| Reading recipes                  | 82 | 8  |
| Using leftovers to prepare new meals | 51 | 5  |
| Cooking technique: boil          | 89 | 9  |
| Cooking technique: steam         | 89 | 9  |
| Cooking technique: sous-vide     | 43 | 4  |
| Cooking technique: baking        | 84 | 9  |
| Cooking technique: smoked        | 54 | 5  |
| Cooking method: fat              | 56 | 6  |
| Application of knowledge         |    |    |
| Prepares meal with more than three ingredients | 78 | 8  |
| Visualize food and its plating before cooking | 76 | 8  |
| Use of measuring equipment while cooking from scratch | 51 | 5  |
| Preparation of grocery list and plan what to eat daily or during the week | 46 | 4  |

An association was observed between academic program type and eating habits, which revealed that Culinary Management students had the most inadequate eating habits. Similarly, knowledge in nutrition was associated with academic program type, with Culinary Management students showing the most inadequate knowledge levels followed by those enrolled in Culinary Nutrition, as shown in Table 5. The level of knowledge in nutrition among the students of the Nutrition and Dietetics program was predominantly adequate and satisfactory (73%). In addition, as shown in Table 6, the level of knowledge in nutrition was also associated with students’ eating habits. Nonetheless, eating habits were not associated with knowledge in cooking and techniques, BMI or the year of study.
Frequency and percentage of students in three nutrition and culinary arts programs and its relationship with knowledge in nutrition and knowledge in cooking methods and techniques.

Table 5

| Variable                                | Academic Programs | Culinary Nutrition | Culinary Management |
|-----------------------------------------|-------------------|--------------------|---------------------|
|                                          | n    | %       | n    | %       | n    | %       |
| Eating habits                           |      |         |      |         |      |         |
| Adequate                                | 3    | 13.0    | -    | -       | 1    | 2.4     |
| Satisfactory                            | 2    | 8.7     | 6    | 21.4    | 1    | 2.4     |
| Inadequate                              | 18   | 78.3    | 22   | 78.6    | 40   | 95.2    |
| Knowledge in nutrition                  |      |         |      |         |      |         |
| Adequate                                | 10   | 43.5    | 2    | 7.1     | 1    | 2.4     |
| Satisfactory                            | 7    | 30.4    | 8    | 28.6    | 1    | 2.4     |
| Inadequate                              | 6    | 26.1    | 18   | 64.3    | 40   | 95.2    |
| Knowledge in cooking methods and        |      |         |      |         |      |         |
| techniques                              |      |         |      |         |      |         |
| Adequate                                | 4    | 17.4    | 12   | 42.9    | 14   | 33.3    |
| Satisfactory                            | 6    | 26.1    | 6    | 21.4    | 12   | 28.6    |
| Inadequate                              | 13   | 56.5    | 10   | 35.7    | 16   | 38.1    |

Discussion

BMI was used as an indicator of nutritional status in this study. No association was observed between BMI and eating habits as the majority of students reported having unhealthy eating habits, similar to the results of other studies. On the other hand, a relationship between BMI and academic program type was observed. More than half of the students in the Nutrition and Dietetics program had a healthy BMI, compared to those in the Culinary Management program, in which the smallest proportion of students with a healthy BMI was observed, with almost half of the students classified as obese. Therefore, students in academic programs related to nutrition could have a protective factor in terms of the maintenance of a healthy BMI. As the great majority of students reported having...
inadequate eating habits, no relationship was observed between these two factors. Nevertheless, the highest proportion of unhealthy BMI was found in students with inadequate eating habits. Similarly, no correlation was observed between the level of knowledge in nutrition and BMI, indicating that knowledge alone does not necessarily promote adequate BMI. Discerning the relationship between cooking skills and BMI is important, since the preparation of meals at home is increasingly promoted as a strategy to reduce the incidence of overweight and obesity. However, unlike in other studies, this relationship was not reflected in those enrolled in the Culinary Nutrition and Culinary Management programs, who showed adequate and satisfactory levels of knowledge in cooking methods and techniques, but inadequate levels of knowledge in nutrition and inadequate BMI values. These results indicate that the presence of culinary skills does not influence the maintenance of an adequate BMI in these students.

The majority of students reported having unhealthy eating habits, in agreement with previous students. In this study, a strong relationship was observed between eating habits and knowledge in nutrition. Similarly, eating habits were associated with the academic program type, indicating that a student's nutrition-related knowledge, which was also associated with the academic program type, may contribute to the intake of a healthier diet. In this cohort, there were no first-year students in the Nutrition and Dietetics program, which may explain the greater level of knowledge in nutrition in this particular group than in the other two programs. Nonetheless, almost all the culinary management students had inadequate levels of knowledge in nutrition, unhealthier BMI values, and deficient eating habits.

Although this study makes several contributions to the existing literature, there are some limitations that should be considered. First, validity assessments were not conducted for the survey, implying that none of the measured behaviors and conclusions can be confirmed. In addition, the sample was limited to students enrolled in study fields related to nutrition and culinary arts in the only educational institution in Puerto Rico that houses all three academic programs at a bachelor level, which limits generalizability of the results.
The majority of students presented inadequate eating habits, as established by the survey, which inhibited the possibility of clearly distinguishing additional factors that may influence eating habits. Likewise, the cross-sectional nature of the study limits the possibility of observing possible changes in students’ knowledge levels, eating habits or nutritional status during their academic progression.

Conclusions
The eating habits of the university students were inadequate, revealing that enrollment in academic programs related to nutrition and culinary arts does not necessarily promote healthy eating habits. Nonetheless, statistically significant data showed that eating habits were related to student’s levels of knowledge in nutrition but not cooking methods and techniques. Students enrolled in the Nutrition and Dietetics program had higher levels of knowledge in nutrition but also presented inadequate eating habits, concluding that they presented the same barriers in relation to their eating habits as the Culinary Nutrition and Culinary Management students. In turn, the Culinary Management students showed knowledge levels that were superior to those observed among students enrolled in the other two programs in relation to cooking methods and techniques; however, they presented the same inadequate eating habits as the rest of the population.

In relation to the students’ nutritional status, it was found that there was an association between students BMI and academic program. Evidencing that students in academic programs such as Nutrition and Dietetics may be more aware of their BMI. However, no correlation between students’ BMI and knowledge in nutrition, cooking methods and techniques was found in this study. It was also determined that students with adequate and inadequate BMI values had inadequate eating habits, encouraging the need to investigate the different factors that influence BMI among university students. Furthermore, it is appropriate to mention that there were gaps between the knowledge and its application, and that other factors inherent to students’ university life may be present, the strength of which may surpass that of knowledge in appropriate nutritional practices.

Declarations
Ethical Approval and Consent to participate

Universidad Ana G Méndez Institutional Review Board
January 23, 2019

Protocol number: 06-085-18

Consent for publication

Not applicable

Availability of supporting data

Not applicable

Competing interests

Not applicable

Funding

Not applicable

Authors’ contributions

Christian Rivera Medina: Corresponding Author, Conceptualization, Methodology, Investigation, Writing - Original Draft

Dr. Mercedes Briones Urbano: Writing - Review & Editing

Aixa De Jesus Espinosa: Formal Analysis, Writing - Review & Editing

Dr. Angel Toledo Lopez: Writing - Review & Editing

Acknowledgements

I would like to acknowledge the help and guidance from Dr. Mercedes Briones Urbano, Aixa de Jesús Espinosa and Dr. Ángel A. Toledo López. I have received permission to publish from those named in the acknowledgments.

Authors’ information

Corresponding Author: Christian Rivera Medina RD, LD

Contact information: Tel: (787) 257-7373 ext. 3100

Email: crivera140@uagm.edu

Affiliation: Universidad Ana G. Méndez

190 Km 1.8 00983, Carr. Boca De Cangrejos, Carolina

Full name: Dr. Mercedes Briones Urbano
Contact information: Tel: +34 934 93 99 00
E-mail: mercedes.briones@unini.org
Affiliation: International Iberoamerican University
Address: Passeig García i Faria, 29, 08005 Barcelona, Spain
Full name: Aixa de Jesús Espinosa

Contact information: Tel: 1 (787) 758-2525 ext. 1690
E-mail: aixa.dejesus@upr.edu
Affiliation: School of Medicine University of Puerto Rico, Medical Sciences Campus
Address: PO BOX 365067 San Juan, PR 00936-5067
Full name: Dr. Angel A. Toledo López

Contact information: Tel: 1 (787) 257-7373
E-mail: atoledo@uagm.edu
Affiliation: Universidad Ana G. Méndez
Address: 190 Km 1.8 00983, Carr. Boca De Cangrejos, Carolina

References
1. Eating Habits. FEN. http://www.fen.org.es/blog/habitos-alimentarios/. Published October 1, 2014. Accessed January 20, 2019
2. Sogari G, Velez-Argumedo C, Gómez MI, Mora C. College students and eating habits: a study using an ecological model for healthy behavior. Nutrients. 2018;10(12). pii: E1823.
3. Mihalopoulos NL, Auinger P, Klein JD. The Freshman 15: Is it real? J Am Coll Health. 2008;56(5):531-534.
4. Sánchez-Ojeda MA, De Luna-Bertos E. [Healthy lifestyles of the university population]. Nutr Hosp. 2015;31(5):1910-1919. doi:10.3305/nh.2015.31.5.8608
5. Cuadra C, & Davidson R. (2013). Eating Puerto Rico: A History of Food, Culture, and Identity. University of North Carolina Press.
www.jstor.org/stable/10.5149/9781469608846_ortzcuadra. Accessed November 11, 2018.

6. Mattei J, McClain AC, Falcón LM, Noel SE, Tucker KL. Dietary Acculturation among Puerto Rican Adults Varies by Acculturation Construct and Dietary Measure. *J Nutr*. 2018;148(11):1804-1813. doi:10.1093/jn/nxy174. Accessed November 11, 2018.

7. El Ansari W, Stock C, Mikolajczyk RT. Relationships between food consumption and living arrangements among university students in four European countries - A cross-sectional study. *Nutr J*. 2012;11(1):28.

8. Deliens T, Clarys P, De Bourdeaudhuij I, Deforche B. Weight, socio-demographics, and health behaviour related correlates of academic performance in first year university students. *Nutr J*. 2013;12(1):162.

9. Rodríguez Ayuso IR, Geerman K, Pesante F. Puerto Rico Community Health Assessment: Puerto Rico Community Health Assessment: Secondary Data Profile.; 2012. https://estadisticas.pr/files/BibliotecaVirtual/estadisticas/Inventario/DS_PRCHASecondaryDataProfile.pdf. Accessed November 30, 2019.

10. Puerto Rico of Department Health. Resumen General de la Salud en Puerto Rico 2004-2013; (March 2004). http://www.salud.gov.pr/Estadisticas-Registros-y-Publicaciones/Publicaciones/Resumen_General_Situacion_de_la_Salud_2004-2013_Update_tablas_Final_21marzo.pdf. Accessed July 3, 2017.

11. Bhupathiraju SN, Hu FB. Epidemiology of Obesity and Diabetes and Their Cardiovascular Complications. *Circ Res*. 2016;118(11):1723-1735. doi:10.1161/CIRCRESAHA.115.306825. Accessed August 2, 2018.

12. Wilson CK, Matthews JJ, Seabrook JA, Dworatzek PDN. Self-reported food skills of university students. *Appetite*. 2017;108:270-276.
13. Murray DW, Mahadevan M, Gatto K, et al. Culinary efficacy: An exploratory study of skills, confidence, and healthy cooking competencies among university students. Perspect Public Health. 2016;136(3):143-151.

14. Wang MC, Rauzon S, Studer N, et al. Exposure to a comprehensive school intervention increases vegetable consumption. J Adolesc Health. 2010;47(1):74-82.

15. Mills S, White M, Brown H, et al. Health and social determinants and outcomes of home cooking: A systematic review of observational studies. Appetite. 2017;111:116-134.

16. Raber M, Chandra J, Upadhyaya M, et al. An evidence-based conceptual framework of healthy cooking. Prev Med Rep. 2016;4:23-28.

17. Reicks M, Trofholz AC, Stang JS, Laska MN. Impact of cooking and home food preparation interventions among adults: outcomes and implications for future programs. J Nutr Educ Behav. 2014;46(4):259-276.

18. Rizo-Baeza MM, González-Brauer NG, Cortés E. [Quality of the diet and lifestyles in health sciences students]. Nutr Hosp. 2014;29(1):153-157. doi:10.3305/nh.2014.29.1.6761

19. Center for Disease Control and Prevention. YRBS Questionnaire Content -1991-2017. 2015;(August 2016).
https://www.cdc.gov/healthyyouth/data/yrbs/pdf/2017/yrbs_questionnaire_content_1991-2017.pdf. Accessed June 22, 2017.

20. Garcia AL, Reardon R, Hammond E, Parrett A, Gebbie-Diben A. Evaluation of the “Eat better feel better” cooking program to tackle barriers to healthy eating. Int J Environ Res Public Health. 2017;14(4):380.

21. Goni Mateos L, Aray Miranda M, Martínez HA, Cuervo Zapate M. Validación de un cuestionario de frecuencia de consumo de grupos de alimentos basado en un sistema
22. Tamayo AP, Cubero J, Constantino J, Macrás R. Previous knowledge in nutrition of a group of students of secondary education of a penitentiary Spanish center. http://digibug.ugr.es/bitstream/10481/35575/6/PozoTamayo_Conocimientos.pdf. Accessed June 28, 2017.

23. Sainz García P, Ferrer Svoboda MC, Sánchez Ruiz E. [Cooking Skills and Consumption of Ready Meal in University Students of Barcelona, Spain]. Rev Esp Salud Publica. 2016;90:e1-e13. http://www.ncbi.nlm.nih.gov/pubmed/27650661.

24. Hartmann C, Dohle S, Siegrist M. Importance of cooking skills for balanced food choices. Appetite. 2013;65:125-131.

25. Schaeffer L, Hudak S, Weiner A, Miller B. NDEP Assessment of Food Preparation 2013. pdf. NDEP Newsline. 2013. https://works.bepress.com/leann_schaeffer/4/. Accessed July 5, 2017.

26. Sánchez V, Aguilar A, González F, Esquius I, Vaqué C. Evolución en los conocimientos sobre alimentación: una intervención educativa en estudiantes universitarios. Rev Chil Nutr. 2017;44(1):3-3.

27. Ternier S. Understanding and measuring cooking skills and knowledge as factors influencing convenience food purchases and consumption. Studies by Undergraduate Researchers at Guelph. 2010;3(2):69-76.

28. IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.

29. R Core Team (2013). R: A language and environment for statistical R Foundation for Statistical Computing, Vienna, Austria. URL http://www.R-project.org/.

30. Vargas ME, Becerra F. Estado nutricional y consumo de alimentos de estudiantes universitarios admitidos a nutrición y dietética en la Universidad Nacional De
31. Vargas ME, Becerra F. Nutritional status and food consumption of university students admitted to nutrition and dietetics program at the National University of Colombia. *Rev Salud Pública*. 2016;17(5):762-775.

32. Flego A, Herbert J, Waters E, et al. Jamie’s Ministry of Food: Quasi-experimental evaluation of immediate and sustained impacts of a cooking skills program in Australia. *PLoS One*. 2014;9(12):e114673.

33. Wolfson JA, Bleich SN. Is cooking at home associated with better diet quality or weight-loss intention? *Public Health Nutr*. 2015;18(8):1397-1406.