AMERICAN UNIVERSITY OF BEIRUT

NUTRITION KNOWLEDGE, ATTITUDES, AND PRACTICE TOWARDS BREAST CANCER PREVENTION AMONG UNIVERSITY FEMALE STUDENTS IN LEBANON

by
NOUR MOHAMMAD DEEB

A thesis
submitted in partial fulfillment of the requirements
for the degree of Master of Science
to the Department of Nutrition and Food Sciences
of the Faculty of Agricultural and Food Sciences
at the American University of Beirut

Beirut, Lebanon
April 2023

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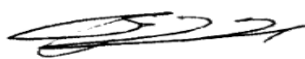
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ACKNOWLEDGEMENTS

ABSTRACT

OF THE THESIS OF

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                                         Major: Nutrition

Title: Nutrition Knowledge, Attitudes, and Practice towards Breast Cancer Prevention among University Female Students in Lebanon

Background: According to the International Agency for Research on Cancer (IARC), breast cancer (BC) became the most diagnosed cancer type in 2020 worldwide, in general, and in Lebanon in specific. The median age at diagnosis of patients with BC in Lebanon is 10 years earlier than that in the United States (U.S.). Early preventive measures in the Lebanese young female population could mitigate the increased incidence of the disease. Accumulating evidence is showing that adopting adequate dietary practices could reduce the burden of BC.

Objectives: The objective of this study is to assess nutrition-related BC prevention knowledge, attitudes, and practice (KAP) of female university students, and to examine the relationship between sociodemographic, anthropometric, behavioral, and general characteristics of students and their KAP.

Methods: A cross-sectional study was carried out between February and March 2023 on a convenient sample of 356 American University of Beirut (AUB) female students aged between 18 and 25 years old, with no previous or current diagnosis of BC from all 7 faculties at AUB.
A self-administered questionnaire was used to obtain information on nutrition KAP towards BC prevention as well as information on the sociodemographic, anthropometric, behavioral, and general characteristics of the students. The knowledge part of the questionnaire addressed the students' knowledge of the relationship between diet and BC, and impact of other non-modifiable and modifiable nutrition-related BC risk factors, and the relationship between certain food items with BC. The attitude part of the questionnaire collected information on whether the students believe that nutrition or food selection can decrease the risk of BC, and that adherence to a healthy diet can reduce the risk of developing BC in the next generation. The practice questionnaire collected information on the students' usual intake of specific foods reported to be associated with BC. Descriptive and analytical statistics were used to assess nutrition-related BC prevention knowledge, attitudes, and practice (KAP) of female university students, and to examine the association between sociodemographic, anthropometric, behavioral, and general characteristics of students and their KAP. The final scores of each of the KAP were summed up for every student. The ranges of answers varied between 0-18 for knowledge, 0-28 for attitude, and 0-30 for practice.

Knowledge and practice scores were considered poor (scores < median score) and good (scores ≥ median score). Good knowledge scores were noted for those who received a score of ≥ 12.00, and good practice scores were given for those with scores ≥ 10.00. Attitudes were categorized as negative (scores < median of 20.00) and positive (scores ≥ median score of 20.00). All analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 25.

Results: The mean and median scores of knowledge, attitude, and practice of the total sample were similar with 11.68 ± 3.30, 19.62 ± 2.84, and 9.40 ± 5.59, for the mean and 12.00, 20.00, and 10.00, for the median respectively. The ranges of scores obtained for KAP were 2-18, 9-27, and 0-30, respectively.
A significantly higher percentage of students had good knowledge and positive attitude scores if they were majoring in a health-related major as compared to those in non-health-related majors (73.2% vs 45.5%, and 62.7% vs 41.1%,, respectively).
The mean GPA of students having good knowledge scores was significantly greater than that of students having poor knowledge scores (3.54 ± 0.40 vs 3.43 ± 0.48, respectively). Students having positive attitude or good practice scores were more likely to have a GPA ≥3.63 compared to those having a negative attitude or poor practice (51.6% vs 37.8%, and 50.9% vs 37.8%, respectively).
Those having a positive attitude score were also significantly less likely to report their "amount of perceived stress" as ≥3 compared to those having negative attitude (93.3% vs 97.7%). The mean knowledge and attitude scores of the health-related majors' students were significantly higher than that of non-health-related majors' students (12.67 ± 2.97 vs 10.9 ± 3.35, and 20.46 ± 2.69 vs 19.00 ± 2.80, respectively). There was a statistically significant positive correlation between the overall knowledge and the overall attitude ($r=0.41$). However, there was no statistically significant correlation between practice and each of the knowledge or attitudes' scores. Both health-related majors and GPA (capped at 4.0) were significant predictors of both total knowledge and total attitude scores, while only GPA was a significant predictor of total practice score.

Conclusion: This study showed that pursuing a health-related major positively influenced the students' nutrition knowledge and attitude scores of BC prevention, and that having a higher GPA predicted better nutrition KAP toward BC prevention. The amount of perceived stress negatively influenced nutrition attitude scores. These findings provide evidence for a relationship between health education and KAP and encourage further expansion in the Lebanese female population to develop evidence-based culture-specific awareness campaigns to mitigate the increasing trend of BC in the Lebanese female population. Future studies are needed, on a larger scale, to unravel the predictors of nutrition-related BC prevention practices, in the Lebanese population.

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ABBREVIATIONS

BC: Breast Cancer
COVID-19: Coronavirus disease
WHO: World Health Organization
BRCA1: breast cancer gene 1
BRCA2: breast cancer gene 2
DES: Diethylstilbestrol
WCRF: World Cancer Research Fund
IARC: International Agency for Research on Cancer
U.S.: United States
BMI: Body mass index
PUFAs: polyunsaturated fatty acids
SFA: saturated fatty acid
CRC: colorectal cancer
IUMS: Iran University of Medical Science
UAE: United Arab Emirates
DM: Diabetes Mellitus
AUB: American University of Beirut
KAP: Knowledge, attitudes, and practice
IRB: Institutional Review Board
CITI: Collaborative Institutional Training Initiative

CHAPTER I

INTRODUCTION AND LITERATURE REVIEW

A. Breast Cancer Worldwide

"Breast cancer (BC) is a disease in which cells in the breast grow out of control" (Centers for Disease Control and Prevention, 2022c). BC is also the most frequently diagnosed cancer type, representing 1 in 8 cancer diagnoses globally (Arnold et al., 2022; Union for International Cancer Control, 2020). In 2020, there were approximately 2,261,419 new cases of BC cancer worldwide, representing around 11.7% of all cancer types (Global Cancer Observatory, 2020). This incidence is estimated to increase globally by around 40% by the year 2040 (Arnold et al., 2022). In addition, there were around 684,996 deaths from BC globally in 2020, making it the second leading cause of cancer death among women worldwide (Centers for Disease Control and Prevention, 2022a; Global Cancer Observatory, 2020). These deaths from BC are expected to rise by more than 50% to become around 1 million in 2040 (Arnold et al., 2022). In the United States (U.S.), BC is the most common cancer in women, excluding skin cancers. Each year, BC accounts for 1 in 3 of all new female cancers (American Cancer Society, 2023).

B. Breast Cancer in Lebanon

In 2020, there were 1954 new BC cases in Lebanon, accounting for 16.9% of cancers in both sexes and 33.7% of cancers among females (Global Cancer Observatory, 2021). During 2005-2015, BC accounted for around 37% of cancer cases among females and 20% of all cancer cases in Lebanon, making it the most prevalent cancer in the country and among the highest worldwide (Fares et al., 2019). The median age at diagnosis of

patients with BC in Lebanon is around 53 years, which is below the age of 60 years in the U.S., (Elias et al., 2021). Compared to other Arab countries, this higher incidence of BC in Lebanon might be partly due to a greater awareness of BC and the wider implementation of screening programs in the country. In fact, "The Lebanese Ministry of Public Health has been launching annual awareness campaigns for BC screening since 2002" (Sbaity et al., 2021). Moreover, differences in cancer registration between different countries might lead to differences in incidence rates (Fares et al., 2019). The high prevalence of obesity and smoking in the Lebanese population might also be contributing to this increased incidence (Sibai et al., 2003). Regarding mortality from BC, there were 723 deaths in 2020, accounting for 11.2% of all cancer deaths (Global Cancer Observatory, 2021).

C. Impact of COVID-19 on Breast Cancer

Before the Coronavirus disease (COVID-19) pandemic, BC prognosis and survival rates were improving in Lebanon with survival rates exceeding 80%–90% (Fares et al., 2019). In 2019, earlier stages of BC constituted 2/3 of the cases in the Lebanese population (Fares et al., 2019). However, the COVID-19 pandemic has caused delays in cancer diagnosis as well as disruptions in its treatment, globally, but especially in low- and middle-income countries (World Health Organization).

To further illustrate, a World Health Organization (WHO) survey done in 2020 revealed that more than 40% of the surveyed countries faced disruptions in cancer treatment (World Health Organization). The COVID-19 pandemic and the 2020 Beirut Port Explosion further exacerbated the economic crisis in Lebanon (Das, 2021). This is mainly due to shortages in qualified medical staff and several medications including those

used in chemotherapy, in addition to a lack of purchasing power (Das, 2021; Union for International Cancer Control, 2021). Thus, while primary prevention is always crucial, it is of particular importance during these harsh times.

D. Risk Factors of Breast Cancer

Several nonmodifiable and modifiable risk factors for BC have been identified (Centers for Disease Control and Prevention, 2022b; Raji Lahiji et al., 2019). Nonmodifiable risk factors include sex, race, ethnicity, family history of cancer, as well as genetic traits (Kazemi et al., 2021). These factors entail being a female, getting older, or having any of the following: genetic mutations in certain genes such as *BRCA1* and *BRCA2*, early menarche (less than 12 years), and/or late menopause (more than 54 years), dense breasts, personal history of BC or certain non-cancerous breast diseases, family history of BC or ovarian cancer, previous treatment using radiation therapy, and exposure to the drug diethylstilbestrol (DES) (Centers for Disease Control and Prevention, 2022b; El Asmar et al., 2018). However, evidence has demonstrated that only around 5 to 10% of BC cases can be attributed to inherited gene mutations, mainly mutations in *BRCA1* and *BRCA2* genes (Anand et al., 2008; *Breast Cancer Facts and Statistics*, 2023).On the other hand, up to 95% of the cases of BC can be attributed to environmental and lifestyle factors (Anand et al., 2008). In light of the increasing BC burden, it is crucial to pin down modifiable risk factors for BC prevention (Shatila et al., 2021). For example, physical inactivity, being overweight or having obesity after menopause, exogenous hormone uses, certain female reproductive factors, such as age at first pregnancy, and drinking alcohol have been identified as modifiable risk factors (Centers for Disease Control and

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Prevention, 2022b; Chlebowski, 2022). Regarding obesity, studies have also shown that high abdominal adiposity and a low percentage of lean body mass in the premenopausal period are risk factors for BC (Godinho-Mota et al., 2018). Hence, efforts should be spent to optimize dietary patterns and physical activity and manage obesity, especially in the younger age female groups of the population. This serves as a potential opportunity to decrease the global cancer burden.

E. A Focus on Diet and its Relationship with Breast Cancer

According to the World Cancer Research Fund (WCRF), around 35% of cancer incidences worldwide can be attributed to nutrition and lack of physical activity (Kabalan et al., 2021). Research findings have revealed that maintaining a healthy weight, limiting alcohol consumption, avoiding tobacco, following a healthy diet rich in fruit and vegetables, and exercising regularly can decrease cancer risk. Moreover, patients with obesity, receiving oncological treatment, were shown to have higher morbidity and mortality compared to those with normal Body Mass Index (BMI).

Several studies have shown that weight loss in postmenopausal women may decrease BC risk (Chlebowski, 2022). For example, a prospective analysis within the Nurse's Health Study revealed that the women who had never used hormone therapy and who maintained at least 10 kg of weight loss were at lower risk for BC than women who did not (RR 0.43, 95% CI 0.21-0.86) (Eliassen et al., 2006). Other retrospective studies have demonstrated similar results (Parker & Folsom, 2003). Although the relationship between diet and BC risk has been investigated in several epidemiologic studies, the potential associations between many specific food groups and BC risk remain relatively unclear

(Kazemi et al., 2021). Various meta-analyses demonstrated an inverse association between high consumption of marine omega-3 polyunsaturated fatty acids (PUFAs) (Zheng et al., 2013), soy foods (Zhao et al., 2019), vitamin D and calcium (Chen et al., 2010), folate (Chen et al., 2014), fiber (Chen et al., 2016), green tea (Gianfredi et al., 2018), and BC risk. In contrast, a positive association was found between processed meat consumption (Farvid et al., 2018) and saturated fatty acid (SFA) intake and BC risk (Boyd et al., 2003). A more recent meta-analysis of SFA intake and BC risk reported that a "positive association between higher dietary SFA intake and postmenopausal BC risk was observed in case-control but not in cohort studies".

Nutrition research on the relationship between diet and cancer has largely focused on one or few nutrients or food groups (Hoffmann, 2003). Although this approach has considerably improved the understanding of nutritional risk factors for cancer, this type of research has many limitations. Most importantly, people usually eat food rather than single nutrients. Consuming foods as a combination provides various nutrients resulting in interactive or synergistic metabolic effects. Moreover, "when a large number of variables are entered in a regression model, it is possible to obtain significant association simply by chance" (Hu, 2002).

In addition to that, cancer has a complex etiology, so it is "unlikely that its development will be mediated by a single nutrient or food" (Hu, 2002; Jones-McLean et al., 2010; Kant, 2010; Newby & Tucker, 2004). Thus, it is better to focus on dietary patterns when evaluating diet-disease associations (Jankovic, 2018). A systematic review and meta-analysis of the "association of dietary patterns with BC risk" published in 2010 demonstrated that following a prudent diet rich in "fruit, vegetables, legumes, poultry, fish, whole grains, and dairy", was associated with a decreased BC risk. On the other

hand, the Western/unhealthy dietary pattern, which is rich in refined carbohydrates, sugar, and trans fats, and the alcohol drinker dietary pattern were linked to an increased BC risk (Brennan et al., 2010).

A recent review identified the gaps and opportunities in BC research and its relationship to nutrition in Arab countries (Shatila et al., 2021). The identified gaps included "limited international collaborations, a preponderance of laboratory-based research at the expense of population-based research, focus on single supplement/nutrient/food research, limited use of dietary assessment tools, and studying nutrition in isolation of other environmental factors". However, this review also identified an important opportunity to enhance the research quality in Arab countries and improve the understanding of diet-BC relationship calling for increased "collaboration among Arab countries and with international partners" (Shatila et al., 2021).

F. Studying Nutrition Knowledge, Attitudes, and Practices Towards Breast Cancer Prevention

Nutritional behavior is highly associated with people's knowledge of and attitude toward a healthy diet. Hence, it is crucial to focus on all three domains (knowledge, attitude, and practice) for effective cancer prevention (Sasanfar et al., 2019). In Lebanon, data on knowledge and beliefs about cancer risk factors are scarce (Hatem et al., 2021). Some studies assessed the knowledge of risk factors of specific types of cancer such as colorectal cancer (CRC) (Tfaily et al., 2019) and BC (El Asmar et al., 2018), etc. However, to date, no study has examined the nutrition KAP towards BC prevention in Lebanon.

Assessing the level of awareness of environmental risk factors and cancer, studies were conducted on the Lebanese general population primarily to identify the predictors of respondents' attitudes regarding cancer preventability (Kabalan et al., 2021). The results revealed low awareness of infectious agents, diet, lifestyle, and several work exposures. Respondents were more likely to believe that cancer is preventable if they: believed that cancer has an environmental cause, were living an unhealthy lifestyle, had a high educational degree, were single, and did not smoke waterpipe. Interestingly, this study reported that most of the respondents agreed that cancer can be caused by genetic and environmental factors, and slightly more than half of them agreed that cancer could be preventable. The nutrition-related and behavioral cancer risk factors identified by the respondents include: "smoking, tobacco exposure, processed food, long-term use of preservatives, high sugar diet, alcohol, hormone in beef, red meat, unbalanced diet, obesity, and hormonal treatment after menopause" (Kabalan et al., 2021). However, the respondents had a low awareness level of additional nutrition-related risk factors such as a low-fiber diet, low physical activity level, and vitamin D deficiency. This study concluded that efforts should be made to improve awareness of the cancer risk factors regarding environmental risk factors including, but not limited to, diet and lifestyle (Kabalan et al., 2021).

Investigating other data from the middle east region, a recent study from Iran examined the relationship between demographic characteristics of female students from Iran University of Medical Science (IUMS) and their nutrition KAP concerning BC (Raji Lahiji et al., 2019). The study concluded that the "nutrition KAP towards BC prevention were influenced by factors such as age, the field of study, job, residency status and family history of BC". It also suggested that the populations believed that "having good

nutritional knowledge improves the individual's dietary practice which decreases the risk of BC or any other nutrition-related cancers. On the other hand, participants identified prominent barriers to eating healthy food among Iranian women which included interpersonal/cultural effects, lack of access to such foods, and food preferences. The study also reported that more than 50% of the respondents considered "unhealthy diet, weight gain, drinking alcohol, use of oral contraceptive pills and vitamin D deficiency" as risk factors of BC. Likewise, more than half acknowledged that adequate intakes of vegetables, fruits, fish, and olive oil are nutrition factors that can decrease the incidence of BC (Raji Lahiji et al., 2019).

Similarly, assessing KAP of nutrition and lifestyle factors regarding CRC risk in the United Arab Emirates (UAE) university students revealed that the majority (92.7%) of the participants reported good knowledge about CRC risk factors. Compared to males, females consumed more vegetables and less red and processed meats, and fewer of them were smokers (Hashim et al., 2022). This study also found that "being single, undergraduate, and having middle to low income were significantly associated with a higher risk of having poor knowledge about CRC". In contrast, studying medicine was significantly associated with a decreased risk of having poor knowledge. This study concluded that university students' dietary and lifestyle behaviors need to be improved and that the barriers should be addressed (Hashim et al., 2022). Another study was done in Lebanon to assess the knowledge and beliefs of risk factors of cancer, in general, and early cancer symptoms in Lebanese adults and examine whether participants' knowledge was correlated with their behavior (Hatem et al., 2021). This study concluded that efforts to reduce the cancer burden should not *solely* aim to improve knowledge, since high knowledge is not always associated with low-risk practices (Hatem et al., 2021).

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In Lebanon, other studies that assessed awareness of CRC risk factors, warning signs, and attitudes towards CRC guidelines and screening modalities, concluded that serious active measures should be implemented to improve CRC awareness and alleviate the barriers and misconceptions around it (Tfaily et al., 2019). Interestingly this study reported that the most known risk factors in the Lebanese population were smoking, family history, and alcohol consumption. On the other hand, the least commonly recognized risk factors were having Diabetes and following a sedentary lifestyle. This implied that, in line with previous findings, participants were more aware of the dietary risks of CRC than they were aware of the effect of weight and physical activity (Keighley et al., 2004; Lynes et al., 2016).

In view of the high incidence of BC in young Lebanese women and the need to understand contributory factors that might mitigate this situation, this study was conducted to assess and identify the nutrition related KAP towards BC prevention among female students at the American University of Beirut (AUB). The results can identify evidence-based interventions when designing public health programs, especially those related to breast health. This study will also reveal the association between sociodemographic, anthropometric, behavioral, and general characteristics of female students and their nutrition-related BC prevention KAP.

CHAPTER II

METHODOLOGY

A. Study Design and Sampling

A cross-sectional survey was carried out between February and March 2023 among a convenient sample of AUB female students aged between 18 and 25 years old, with no previous or current diagnosis of BC. The sample was obtained from all faculties at AUB to represent different majors, nationalities, and socio-economic situations. Students were approached randomly, especially from the most populated areas on campus.

B. Data Collection

Data collection included self-administered questionnaires to obtain information on nutrition KAP towards BC prevention as well as information on the sociodemographic, anthropometric, behavioral, and general characteristics of the students.

The questionnaires were developed through a review of the literature (Raji Lahiji et al., 2019; Sasanfar et al., 2019) and modifications were introduced to make them more culturally relevant. A committee of experts in nutrition, epidemiology, public health, and biomedical sciences reviewed and evaluated the various items included in the questionnaire. A pilot study was conducted on a convenient sample of 25 AUB female students. They were asked to fill out the questionnaires and provide their opinions regarding the clarity and simplicity of the items (face validity) (Tsang et al., 2017). Data from the pilot study were not included in the analysis.

The final questionnaire included 33 items with 6 knowledge, 7 attitude, 6 practice, and 16 questions about sociodemographic, anthropometric, behavioral, and general characteristics. The knowledge part of the questionnaire asked about non-modifiable and modifiable nutrition-related BC risk factors, and food items and their relationship with BC. The attitude part of the questionnaire asked whether the students believe that nutrition and food selection can decrease the risk of BC, that working on BC prevention is necessary a diet to prevent BC in people under the age of 25, and that being young means there is a lot of time to prevent BC. The practice questionnaire asked about the students' usual intake of vegetables, fruits, processed meat, red meat, fish, and dairy products.

Knowledge and practice scores were considered poor (scores < median scores of 12.00 and 10.00, respectively) and good (scores ≥ median of 12.00 and 10.00, respectively). Attitude scores were categorized as negative (scores < median of 20.00) and positive (scores ≥ median of 20.00).

1. Knowledge Questionnaire

There were 6 knowledge questions about nutrition-related BC prevention. The minimum that could be attained was 0 (i.e., the student doesn't have any knowledge of nutrition-related BC prevention) and the maximum score was 18 (i.e., the student is very knowledgeable about nutrition-related BC prevention).

For most questions, a score of 1 was given for the right answers and 0 for both false and " I don't know" answers. For question 2, regarding non-modifiable BC risk factors, the maximum score was 3, meaning that if the student ticked all 3 correct options a score of 3 was given. Similar to the other knowledge questions, 0 was given for incorrect

answers and for the phrase "I don't know". Final scores were summed up for every student.

Knowledge scores were considered good if they were ≥ 12.00. Knowledge scores were considered poor if they were <12.00 (scores < median score).

2. Attitudes Questionnaire

For the 7 attitude questions, a 5-point Likert Scale was assigned. For the questions, indicating a positive attitude toward the role of nutrition in BC prevention, the scores ranged between 0 indicating "strongly disagree" and 4 indicating "strongly agree". However, for questions indicating a negative attitude toward the role of nutrition in BC prevention, scores range between 0 indicating "strongly agree" and 4 indicating "strongly disagree".

Final scores were summed for each student. The minimum that could be attained was 0, and the maximum was 28, with a cutoff of below 20.00 indicating negative (scores < median score) and ≥ 20.00 indicating positive (scores ≥ median score).

3. Practice Questionnaire

The practice questionnaire contained 6 questions with a maximum score of 30. Students reported how often they consume vegetables, fruits, processed meat, red meat, fish, and dairy products:

- For fruits and vegetables, a score of 10 was given to students consuming at least 5 servings of fruits and vegetables per day (≥400g/day), a score of 5 if between 2.5 and 5 servings per day (200–<400g/day), and 0 if less than 2.5 servings per day (<200g/day).

- For red meat (mutton, beef, minced) and processed meat (Sausages, Makanik, Basterma, and Mortadella), a score of 10 was given to students consuming: Red meat ≤500g/week (≤18 oz) and processed meat <21g/week (<0.75 oz). A score of 5 was given if: Red meat ≤500g/week (18 oz) and processed meat 21–<100g/week (0.75 oz–<3 oz), and score of 0 if red meat >500g/week or processed meat ≥100 g/week (≥ 3 oz).

- For fish, a score of 5 was given to students eating at least 2 servings of fish per week, a score of 2.5 to eating greater than or equal to 1 but strictly less than 2 servings of fish per week, and 0 to eating less than 1 serving of fish per week.

- For dairy, a score of 5 was given to students having at least 2 servings of dairy per day, 2.5 to having more than or equal to 1 but strictly less than 2 servings per day, and 0 to having less than 1 serving per day.

The final scores for practice questions were summed up for every student which ranged from 0, meaning the very poor dietary practices for BC prevention, to 30 demonstrating the best dietary practices for BC prevention. The guidelines and scoring system were adapted from World Cancer Research Fund (WCRF)/ American Institute for Cancer Research (AICR) Cancer Prevention Recommendations (*Standardized Scoring System to Assess Adherence to WCRF/AICR Cancer Prevention Recommendations*, 2022). Practice scores were considered poor if less than the median of 10.00 (scores < median score) and good if greater than or equal to 10.00 (scores ≥ median score). For increasing the accuracy of portion sizes, a template depicting serving sizes and a 2D Food Portion Visual (Appendix III) were used to help the students estimate the quantity consumed of each food item.

4. *Socio-demographic, Anthropometric, Behavioral, and General characteristics Questionnaire*

A socio-demographic questionnaire collected data on students' age, faculty where they are enrolled, their academic major, and year at university (sophomore, junior, senior, fourth year, or master's), marital status, nationality, living situation (living alone, living with parents/relatives, or living with friends or roommates), number of rooms in their house (i.e. their permanent residence) and number of members (including themselves) who are co-residents in their house, family history of BC, height, weight, grade point average (GPA), smoking status, and perceived vulnerability to stress and amount of perceived stress (each on a scale of 1 to 6). The 2 questions on stress, were adapted from the 2 single-item measures of the ability to handle stress and the amount of stress, which were reliable and showed validity similar to longer questions (Barrington et al., 2014; Littman et al., 2006). The crowding index was calculated as the ratio of the number of people living in the household over the total number of rooms in the house (excluding the kitchen and bathrooms). The crowding index was used as a proxy of the socioeconomic status (Melki et al., 2004).

Note that a tip sheet (Appendix III) that included recommendations about nutrition and BC prevention was given to the students post data collection.

C. Data Analysis

A sample of 356 students was recruited. All analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 25. Categorical variables were reported as frequencies and percentages. Continuous variables were reported as means

and standard deviations (SD). Due to the low percentage of students having a BMI ≥ 30 kg/m^2 (indicating obesity), students with overweight or obesity were grouped. Thus, BMI was grouped into 3 categories: "underweight", "normal weight", and "overweight and obese". GPA (capped at 4.0) was dichotomized into 2 categories, based on a GPA of 3.63. This GPA was chosen, because it is almost equal to the median (3.6), and it corresponds to 85/100. Major was dichotomized into 2 categories: health-related vs non-health-related to study whether there are significant differences in the KAP among their respective students. A major was considered health-related if it satisfied any of the following conditions: being a major in the faculty of medicine (FM), faculty of health sciences (FHS), or Hariri School of Nursing (HSON), biology, psychology, nutrition, public health nutrition, food safety or following the pre-medical track.

BMI was calculated as weight (kilogram) divided by the square of height (meter) (kg/m2). Weight and height were both self-reported. Chi-square test was used to evaluate the relationship between two categorical data. Pearson statistical test was used to determine the correlation between two quantitative variables. A binary logistic regression was performed to determine the predictors of each of the nutrition-related BC prevention knowledge, attitude, and practice. Each outcome (knowledge, attitude, and practice) was treated as binary. The reference category for knowledge was poor knowledge, that of attitude was negative attitude, and that of practice was poor practice. For the 3 outcomes, Odds ratios (OR) with their 95% confidence intervals (CI) were obtained and reported in model 1 (unadjusted). Then, the analysis was adjusted (model 2) by including the variables that showed statistically significant associations at the level of the chi-squared and sample t-test analysis. For knowledge, model 2 was adjusted for faculty of education, major (health-related or non-health-related), and GPA (capped at 4.0). For attitude, model

2 was adjusted for faculty of education, GPA (capped at 4.0), amount of perceived stress, and major (health or non-health). For practice, model 2 was adjusted for GPA (capped at 4.0) and smoking status. Stepwise multiple regression was used, where each of the total nutrition-related BC prevention knowledge, attitude, and practice scores was regressed on the following students' characteristics: age (years) used as a continuous variable, marital status (married, engaged, or single), living situation (live alone, live with parents/relatives, or live with friends/roommates), faculty of education (FAFS, FAS, OSB, MSFEA, FHS, HSON, or FM), academic year (sophomore, junior, senior, fourth year, or master's), nationality (Lebanese or non-Lebanese), crowding index (<1 or ≥1), family history of BC (no or yes), BMI (kg/m^2) used as a continuous variable, GPA (capped at 4.0) used as a continuous variable, smoking status (ever smoker vs never smoker), perceived vulnerability to stress (<3 or ≥3), amount of perceived stress (<3 or ≥ 3), and major (health-related vs non-health-related). For all statistical analyses, P-values less than 0.05 indicated statistical significance.

D. Ethical Considerations

Ethical approval was obtained from AUB's Institutional Review Board (IRB). A Collaborative Institutional Training Initiative (CITI) certified AUB Nutrition Master's student who is a U.S. Registered Dietician and a Lebanese Licensed Dietician collected data from the students after obtaining their written informed consent. Moreover, all data collected and results were kept strictly confidential and measures were taken to ensure no breach of privacy. Proper measures were taken to keep the individual identifiable information confidential, only shared with the researchers listed in this IRB application,

and only used for the purposes of this research project. All identifiers (name, phone number, etc.) were de-identified once the data merging was complete. Students' contact information was securely stored at AUB for internal use during the study. The research data did not include identifying information. Identifiers were collected for study purposes; however, all data were de-identified and identifiers were not disclosed.

CHAPTER III

Results

A. Sociodemographic, Anthropometric, Behavioral, and General Characteristics of Study Sample

The sociodemographic, anthropometric, behavioral, and general characteristics of students are presented in Table 1. The study sample consisted of 356 AUB female students with a mean age of 19.59 ± 1.70 years (range between 18 and 25). Almost all of them were single (97.2%). Most of the students lived with their parents or relatives (77.8%), and almost half were from the FAS (47.6%). The faculty that had the 2nd largest number of students was MSFEA (17.7%), followed by FAFS and OSB (10.4% for each), then FHS (9.6%), HSON (3.1%), and FM (1.1%). Most of the respondents were undergraduates, and only 10.4% were master students. Moreover, the majority were Lebanese (88.8%), did not have any family history of BC (67.5%), and had a normal body weight (73.3%). The mean BMI of the study sample was $22.32 \pm 3.28 kg/m^2$. Half of the students had a crowding index ≥ 1 (57.8%). The mean GPA of the study sample was 3.49 ± 0.44 and more than half had a GPA $<3.63/4.0$ corresponding to 85/100 (55.1%). The majority never smoked (82.2%) and rated their "perceived vulnerability to stress" as ≥ 3 (77.6%) and their "amount of perceived stress" as ≥ 3 (95.5%).

Regarding the major of study, 43.1% were pursuing a health-related major and 56.9% were pursuing a non-health-related major. There was a statistically significant difference between those two categories of majors in terms of the faculty of education (p-value<0.001), where 13.7% of the students from FAFS, 54.2% of those from FAS, and all of those from FHS, HSON, and FM, were pursuing health-related majors. Moreover, there was a statistically significant difference between health-related and non-health-

related majors regarding the GPA, where slightly more than half of the students pursuing health-related majors (52.7%) had a GPA≥ 3.63 compared to around 38.9% of those pursuing non-health-related majors. However, the mean GPA of health-related majors' students was not statistically significantly different from that of their non-health-related majors' counterparts.

No statistically significant difference was found between health-related majors and non-health-related majors regarding age, marital status, living situation, academic year, nationality, crowding index, family history of BC, BMI classification, mean BMI, smoking status, perceived vulnerability to stress, and amount of perceived stress.

Table 1: Sociodemographic, Anthropometric, Behavioral, and General Characteristics of the Students (n=356) [†]

Variables	Total (n=356)	Health-related major vs non-health-related major		P-value[*]
		Health-related (n=153)	Non-health-related (n=202)	
	n (%)	n (%)	n (%)	
Age (years)				
< 22	301 (85.8)	133 (87.5)	167 (84.3)	0.40
≥ 22	50 (14.2)	19 (12.5)	31 (15.7)	
Mean age ± SD	19.59 ± 1.70	19.48 ± 1.68	19.69 ± 1.71	0.26
Marital status				0.78
Married	3 (0.8)	1 (0.7)	2 (1.0)	
Engaged	7 (2.0)	4 (2.6)	3 (1.5)	
Single	345 (97.2)	147 (96.7)	197 (97.5)	
Living situation				0.63
Live alone	27 (7.6)	14 (9.2)	13 (6.4)	
Live with parents/relatives	277 (77.8)	117 (76.5)	159 (78.7)	
Live with friends/roommates	52 (14.6)	22 (14.4)	30 (14.9)	
Faculty of Education				**<0.001**
FAFS	37 (10.4)	21 (13.7)	15 (7.5)	
FAS	169 (47.6)	83 (54.2)	86 (42.8)	
OSB	37 (10.4)	0 (0.0)	37 (18.4)	
MSFEA	63 (17.7)	0 (0.0)	63 (31.3)	
FHS	34 (9.6)	34 (22.2)	0 (0.0)	
HSON	11 (3.1)	11 (7.2)	0 (0.0)	
FM	4 (1.1)	4 (2.6)	0 (0.0)	

Academic year				0.73
Sophomore	130 (37.1)	57 (37.3)	72 (36.7)	
Junior	112 (32.0)	53 (34.6)	59 (30.1)	
Senior	54 (15.4)	20 (13.1)	34 (17.3)	
Fourth year	16 (4.6)	5 (3.3)	11 (5.6)	
Master's	38 (10.9)	18 (11.8)	20 (10.2)	
Nationality				0.94
Lebanese	316 (88.8)	136 (88.9)	179 (88.6)	
Non-Lebanese	40 (11.2)	17 (11.1)	23 (11.4)	
Crowding index				0.12
<1	146 (42.2)	70 (47.0)	76 (38.6)	
≥1	200 (57.8)	79 (53.0)	121 (61.4)	
Family history of BC				0.45
No	239 (67.5)	100 (65.4)	139 (69.2)	
Yes	115 (32.5)	53 (34.6)	62 (30.8)	
BMI classification				0.51
Underweight	37 (11.2)	18 (12.7)	19 (10.1)	
Normal	242 (73.3)	103 (72.5)	139 (73.9)	
Overweight and Obese	51 (15.5)	21 (14.8)	30 (16.0)	
Mean BMI ± SD	22.32 ± 3.28	22.23 ± 3.24	22.39 ± 3.32	0.67
GPA (capped at 4.0)				**0.018**
< 3.63 (corresponding to 85/100)	163 (55.1)	61 (47.3)	102 (61.1)	
≥ 3.63 (corresponding to 85/100)	133 (44.9)	68 (52.7)	65 (38.9)	
				0.20
Mean GPA ± SD	3.49 ± 0.44	3.53 ± 0.44	3.46 ± 0.44	
Smoking status				0.52
Ever Smoker	62 (17.8)	25 (16.3)	38 (19.0)	
Never Smoker	290 (82.2)	128 (83.7)	162 (81.0)	

				0.30
Perceived vulnerability to stress				0.30
< 3	79 (22.4)	30 (19.7)	49 (24.4)	
≥ 3	274 (77.6)	122 (80.3)	152 (75.6)	
Amount of perceived stress				0.95
< 3	16 (4.5)	7 (4.6)	9 (4.5)	
≥ 3	337 (95.5)	145 (95.4)	192 (95.5)	

†Chi-square test and independent t-test were conducted to determine differences in characteristics of the AUB female students by major.
*Bolded numbers indicate statistical significance (p-value<0.05).

B. Distribution of the KAP scores

Figure 1 shows the distribution of knowledge scores in the study sample of AUB female students. The mean nutrition-related BC prevention knowledge score in the total sample was 11.68±3.30, and the median was 12 (obtained range between 2 and 18). The minimum and maximum total knowledge scores that could be achieved were 0 and 18, respectively.

Figure 1: Distribution of the total nutrition-related BC prevention knowledge scores in the sample of AUB female students (n=356)
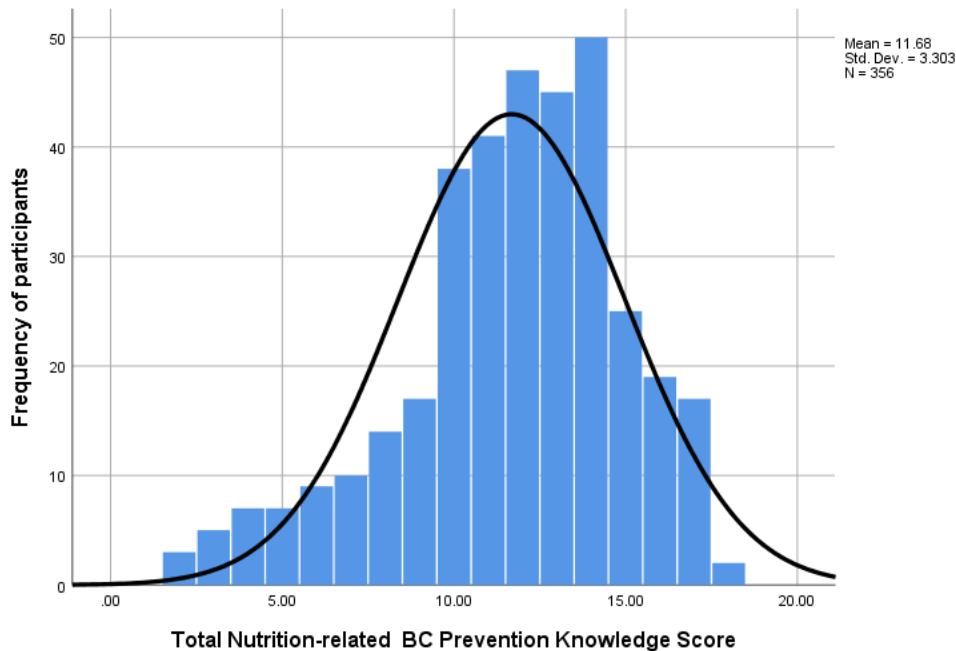
Figure 2 shows the distribution of the total nutrition-related BC prevention attitude scores in the sample of AUB female students. This distribution can be assumed to be normal compared to the normal curve displayed in Figure 2. The mean nutrition-related BC prevention attitude score in the total sample was 19.62±2.84, and the median was 20 (obtained range between 9 and 27). The minimum and maximum total attitude scores that could be achieved were 0 and 28, respectively.

Figure 2: Distribution of the total nutrition-related BC prevention attitude scores in the sample of AUB female students (n=356)
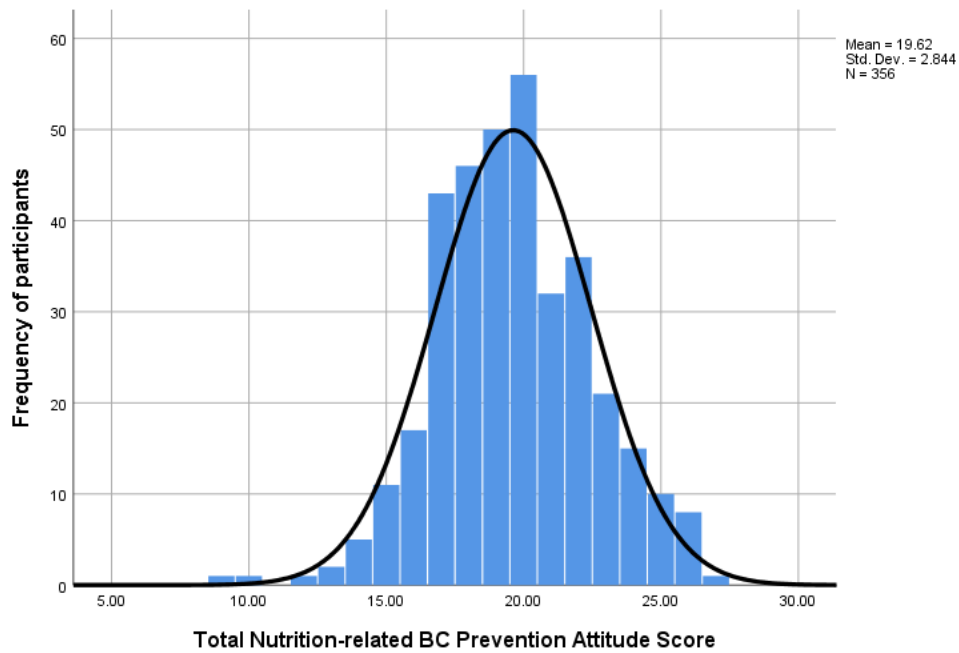
Figure 3 shows the distribution of the total nutrition-related BC prevention practice scores in the sample of AUB female students. This distribution can be assumed to be normal compared to normal curve displayed in the same figure. The mean nutrition-related BC prevention practice total score in the total sample was 9.40±5.59, and the median score was 10. The total practice scores ranged between 0 and 30, which were the minimum and maximum scores that could be attained, respectively.

Figure 3: Distribution of the total nutrition-related BC prevention practice scores in the sample of AUB female students (n=356)
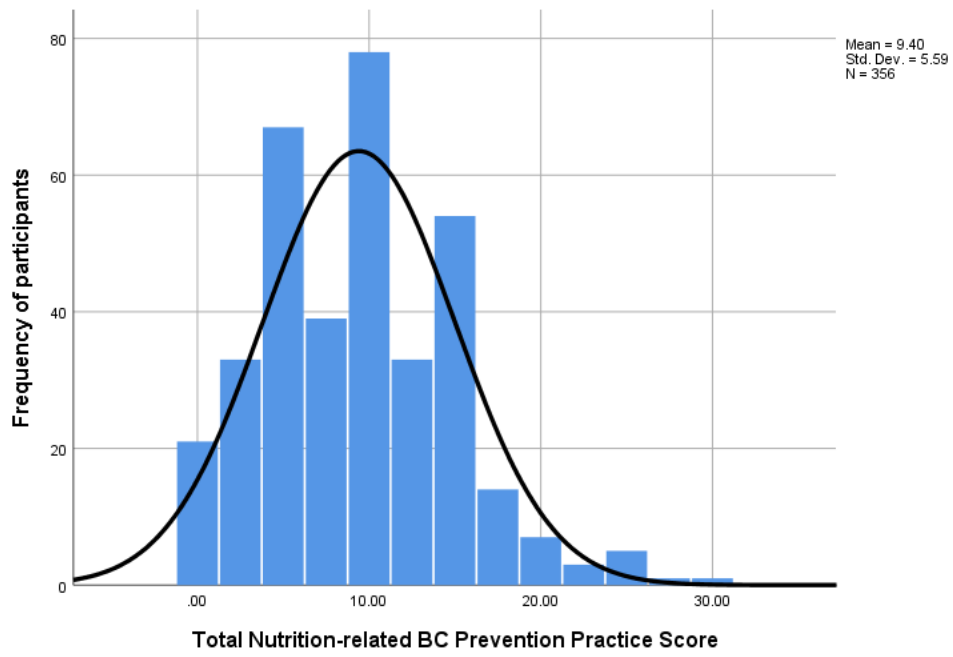
C. Knowledge

Comparing students following a health related major vs those following a non-health related major, Figure 4 shows that a significantly higher percentage of students had good nutrition-related BC prevention knowledge scores if they were majoring in a health-related major as compared to those following a non-health-related major (73.2% vs 45.5%; p<0.001).

Figure 4: Percent distribution of students according to nutrition-related BC prevention knowledge by major of study
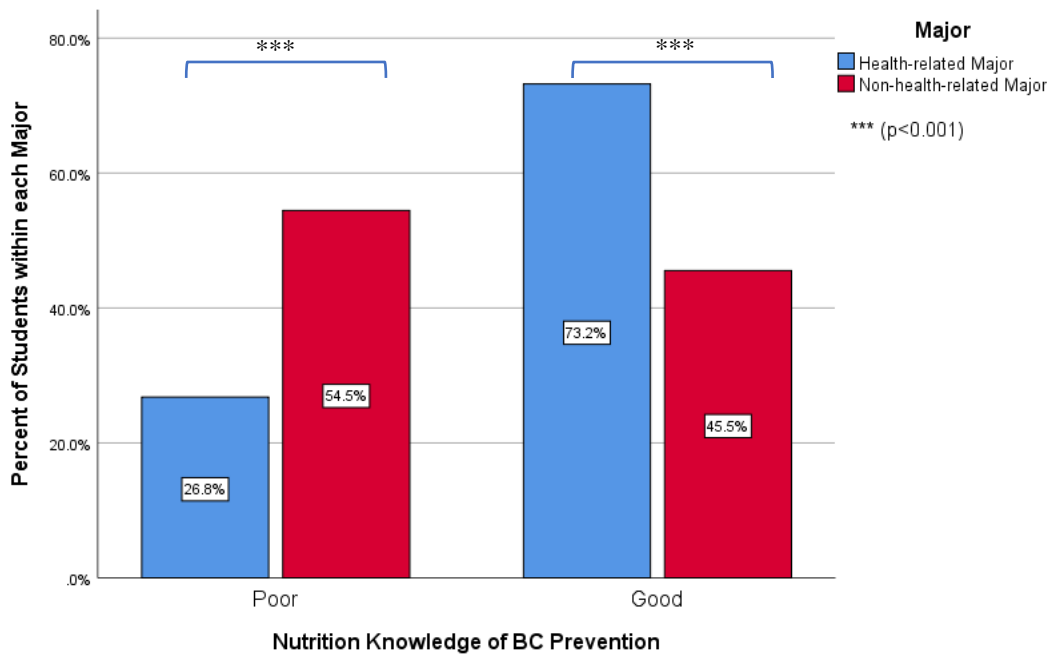
Note. The knowledge scores were categorized as poor (scores < median score of 12.00) and good (scores ≥ median score of 12.00)

Table 2 illustrates the average scores of the knowledge questionnaire in the total sample and compares the results of students according to their majors (health-related vs non-health-related). Approximately half of the students (50.8%) correctly answered that "scientific evidence has shown a relationship between diet and BC", and a statistically significant difference was noted between those pursuing health-related majors and those

pursuing non-health-related majors (62.7% vs 41.5% respectively, p-value<0.001). Regarding non-modifiable risk factors for BC, less than half of the total sample (42.4%) correctly identified that: being a female, being over 50 years old, and having a family history of BC are non-modifiable risk factors for BC. Similarly, there was a statistically significant difference between those pursuing health-related majors and non-health-related majors, where those pursuing a health-related major were more likely to positively identify that being a female, being over 50 years old, and having a family history of BC as risk factors for BC compared to those pursuing non-health related majors (54.9% vs 32.7% respectively, p-value<0.001).

Table 2 also shows that approximtely half of the total sample (48.6%) correctly answered question 3 confirming the impact of nutrition on BC. Students pursuing health-related majors were also statistically more likely to correctly answer this question compared to those pursuing non-health-related majors (54.9% vs 44.0% respectively, p=0.043).

Predominantly, 94% of the population studied, correctly responded that early diagnosis improves survival from BC, noting that health-related major students were statistically more likely to answer correctly (98.0% vs 92.0%, p-value=0.013) respectively. Less than half the students (46.1%) knew that contraceptive pills increase the risk of BC.

Regarding anthropometric and dietary factors as possible risk factors for BC, only 39.3% of the students knew that weight gain increases the risk of developing BC. In fact, students pursuing health-related majors were more likely to respond that: weight gain increases the risk of developing BC (47.0% vs 33.2%, p=0.008). As for nutritional factors, 79.5% of students responded that green vegetable intake is protective against BC with a

significant difference between those following a health-related major compared to those following a non-health-related one (85.0% vs 75.2%, p=0.025).

Responding to whether consumption of processed red meat is harmful, 60.2% of the students responded correctly with a significant difference between health-related major and non-health-related major (70.0% vs 53.1%, p-value=0.001), 61.6% of the total sample responded that high consumption of red meat is harmful with a significant difference between health-related major and non-health-related major (68.4% vs. 56.8%, p-value=0.026), and 67.4% responded that foods containing carotenoids are protective against BC with a significant difference between health-related major and non-health-related major (77.1 % vs 59.9%, p-value=0.001).

There was no statistically significant difference between the two types of majors in reporting knowledge that contracptive pills, smoking, and alcohol conumsuptmion increase the risk of BC, that physical activity does not increase the risk of BC, and that adequate fruit intake, consumption of fish (omega 3), and consumption of dairy products decrease the risk of BC.

Table 2: Knowledge Questionnaire Results and their Distribution according to Major[†]

Knowledge questions	Response[a]	Total n (%)	Health-related major vs non-health-related major		P-value[*]
			Health-related n (%)	Non-health-related n (%)	
Q1. Has scientific evidence shown a relationship between diet and breast cancer?	**a. <u>Yes</u>** b. No c. I don't know	180 (50.8)	96 (62.7)	83 (41.5)	**<0.001**
Q2. What is/ are the risk factors for breast cancer? (You can tick more than one)	**a. <u>Being a female</u>** **b. <u>Being over 50 years old</u>** **c. <u>Having a family history of breast cancer</u>** d. None of the above e. I do not know	151 (42.4)	84 (54.9)	66 (32.7)	**<0.001**
Q3. **What is the impact of nutrition on breast cancer?**	a. Low (up to 5%) **b. <u>Intermediate (around 30%)</u>** c. High (around 100%) d. It does not have an impact e. I do not know	172 (48.6)	84 (54.9)	88 (44.0)	**0.042**
Q4. **Does early diagnosis of breast cancer improve survival?**	**a. <u>Yes</u>** b. No c. I don't know	334 (94.4)	150 (98.0)	184 (92.0)	**0.013**

Q5. **Do these factors increase the risk of developing breast cancer?**					
- Contraceptive pills	**a. <u>Yes</u>** b. No c. I don't know	164 (46.1)	77 (50.3)	86 (42.6)	0.15
- Smoking	**a. <u>Yes</u>** b. No c. I don't know	265 (74.6)	118 (77.6)	146 (72.3)	0.25
- Weight Gain	**a. <u>Yes</u>** b. No c. I don't know	139 (39.3)	71 (47.0)	67 (33.2)	**0.008**
- Being physically active	a. Yes **b. <u>No</u>** c. I don't know	270 (75.8)	122 (79.7)	147 (72.8)	0.13
Q6. Foods in relation to breast cancer prevention					
- Green vegetable intake	**a. <u>Protective</u>** b. Harmful c. Not related d. I don't know	283 (79.5)	130 (85.0)	152 (75.2)	**0.025**

- Fruit intake	a. **Protective** b. Harmful c. Not related d. I don't know	267 (76.3)	121 (80.7)	145 (72.9)	0.09
- Consumption of processed red meat (e.g., sausages, Mortadella, Makanik, hot dogs, etc.)	a. Protective b. **Harmful** c. Not related d. I don't know	209 (60.2)	105 (70.0)	104 (53.1)	**0.001**
- High consumption of red meat	a. Protective b. **Harmful** c. Not related d. I don't know	217 (61.6)	104 (68.4)	113 (56.8)	**0.026**
- Consumption of fish (omega 3)	a. **Protective** b. Harmful c. Not related d. I don't know	243 (69.4)	107 (71.3)	135 (67.8)	0.48
- Consumption of dairy products	a. **Protective** b. Harmful c. Not related d. I don't know	105 (30.5)	41 (27.9)	63 (32.1)	0.4

- Alcohol consumption	a. Protective **b. <u>Harmful</u>** c. Not related d. I don't know	281 (79.8)	125 (82.8)	155 (77.5)	0.22
- Foods containing carotenoids (e.g., bell peppers, broccoli, cantaloupe, carrots, kale, mangoes, oranges, spinach, tomatoes, etc.)	**a. <u>Protective</u>** b. Harmful c. Not related d. I don't know	240 (67.4)	118 (77.1)	121 (59.9)	**0.001**

† The Chi-square test was conducted to determine differences in the nutrition-related BC prevention knowledge results of the AUB female students by major.

[a] The text in bold indicates the correct answer for each of the questions.

[*] Bolded numbers indicate statistical significance (p-value<0.05).

Using the Chi-square test and independent t-test, Table 3 illustrates a relationship between the sociodemographic, anthropometric, behavioral, and general characteristics of the students.

Regarding knowledge, there was a statistically significant association between the students' home faculty and nutrition-related knowledge in BC prevention (p=0.001). There was a non-significant association between knowledge and age, marital status, living situation, academic year, nationality, crowding index, family history of BC, BMI, GPA (classified according to 3.63/4.0), smoking status, perceived vulnerability to stress, and amount of perceived stress.

Table 3: Relation between nutrition-related BC prevention knowledge and sociodemographic, anthropometric, behavioral, and general characteristics in the sample of AUB female students (n=356) [†]

| Characteristics | Knowledge[i] | | P-value[*] |
	Poor	Good	
Age (years)			
≤ 22	126 (85.1)	175 (86.2)	0.78
≥ 22	22 (14.9)	28 (13.8)	
Mean age ± SD	19.53 ± 1.62	19.64 ± 1.75	0.58
Marital status, n (%)			0.22
Married	2 (1.3)	1 (0.5)	
Engaged	1 (0.7)	6 (2.9)	
Single	147 (98.0)	198 (96.6)	
Living situation, n (%)			0.62
Live alone	11 (7.3)	16 (7.8)	
Live with parents/relatives	121 (80.1)	156 (76.1)	
Live with friends/roommates	19 (12.6)	33 (16.1)	
Faculty of Education, n (%)			**0.001**
FAFS	9 (6.0)	28 (13.7)	
FAS	74 (49.3)	95 (46.3)	
OSB	19 (12.7)	18 (8.8)	
MSFEA	37 (24.7)	26 (12.7)	
FHS	8 (5.3)	26 (12.7)	
HSON	2 (1.3)	9 (4.4)	
FM	1 (0.7)	3 (1.5)	

Academic year, n (%)			0.99
Sophomore	57 (38.5)	73 (36.1)	
Junior	46 (31.1)	66 (32.7)	
Senior	23 (15.5)	31 (15.3)	
Fourth year	7 (4.7)	9 (4.5)	
Master's	15 (10.1)	23 (11.4)	
Nationality, n (%)			0.99
Lebanese	134 (88.7)	182 (88.8)	
Non-Lebanese	17 (11.3)	23 (11.2)	
Crowding index, n (%)			0.72
<1	60 (41.1)	86 (43.0)	
≥1	86 (58.9)	114 (57.0)	
Family history of BC, n (%)			0.87
No	102 (68.0)	137 (67.2)	
Yes	48 (32.0)	67 (32.8)	
BMI classification, n (%)			0.62
Underweight	16 (11.9)	21 (10.8)	
Normal	95 (70.4)	147 (75.4)	
Overweight and Obese	24 (17.8)	27 (13.8)	
			0.77
Mean BMI ± SD	22.25 ± 3.34	22.36 ± 3.25	
GPA (capped at 4.0), n (%)			0.063
< 3.63	75 (61.5)	88 (50.6)	
≥ 3.63	47 (38.5)	86 (49.4)	
Mean GPA ± SD	3.43 ± 0.48	3.54 ± 0.40	**0.031**
Smoking status			0.36
Ever Smoker	30 (20.0)	33 (16.3)	
Never Smoker	120 (80.0)	170 (83.7)	

Perceived Vulnerability to Stress, n (%)			0.91
< 3			
≥ 3	34 (22.7)	45 (22.2)	
	116 (77.3)	158 (77.8)	
Amount of perceived stress, n (%)			0.35
< 3	5 (3.3)	11 (5.4)	
≥ 3	145 (96.7)	192 (94.6)	

† The Chi-square test and independent t-test were conducted to determine the association between nutrition-related BC prevention knowledge of the AUB female students and their characteristics.
[i] The knowledge scores were categorized as poor (scores < median score of 12.00) and good (scores ≥ median score of 12.00).
[*] Bolded numbers indicate statistical significance (p-value<0.05).

D. Attitudes

Table 4 shows the nutrition-related BC prevention attitudes in the sample of AUB female students. Interestingly, the great majority of students strongly agreed or agreed that nutrition can decrease the risk of BC (84.6%) and that they need to work on BC prevention even if they don't have a family history of BC (94.9%).

Most of the students (72.2%) believed that, despite the treatment modalities available for patients with BC, this disease can cause the death of these patients. Around two-thirds of the students disagreed with the statement: "food selection does not decrease the risk of BC". Slightly more than half of the students believe that it is necessary to follow a diet to prevent BC in people under the age of 25 (56.9%) and that adherence to a healthy diet by a person reduces the risk of developing BC in the next generation (62.6%). However, less than half (42.1%) of the students disagreed with the statement "I believe that I am young, so I have a lot of time to prevent BC".

Table 4: Nutrition-related BC prevention attitudes in the sample of AUB female students (n=356)

Attitude	Total n(%)
I believe that nutrition can decrease the risk of BC. (Agree[a])	301 (84.6)
I need to work on BC prevention even if I don't have a family history of BC. (Agree[a])	338 (94.9)
I believe that it is necessary to follow a diet to prevent BC in people under the age of 25. (Agree[a])	202 (56.9)
I believe that food selection does not decrease the risk of BC. (Disagree[b])	237 (66.8)
I believe that, despite the treatment modalities available for patients with BC, this disease can cause the death of these patients. (Agree[a])	257 (72.2)
I believe that adherence to a healthy diet by a person reduces the risk of developing BC in the next generation. (Agree[a])	223 (62.6)
I believe that I am young, so I have a lot of time to prevent BC. (Disagree[b])	150 (42.1)

[a] The answers of agree and strongly agree have been merged.
[b] The answers of disagree and strongly disagree have been merged.

As demonstrated in Figure 5, there was a significant association between enrolment in a certain major and attitude towards BC prevention, using Chi Square test. Students having positive attitudes were more likely to be pursuing health-related majors compared to those pursuing non-health-related majors (62.7% vs 41.1%, p-value<0.001).

Figure 5: Percent distribution of students according to nutrition-related BC prevention attitudes by major of study
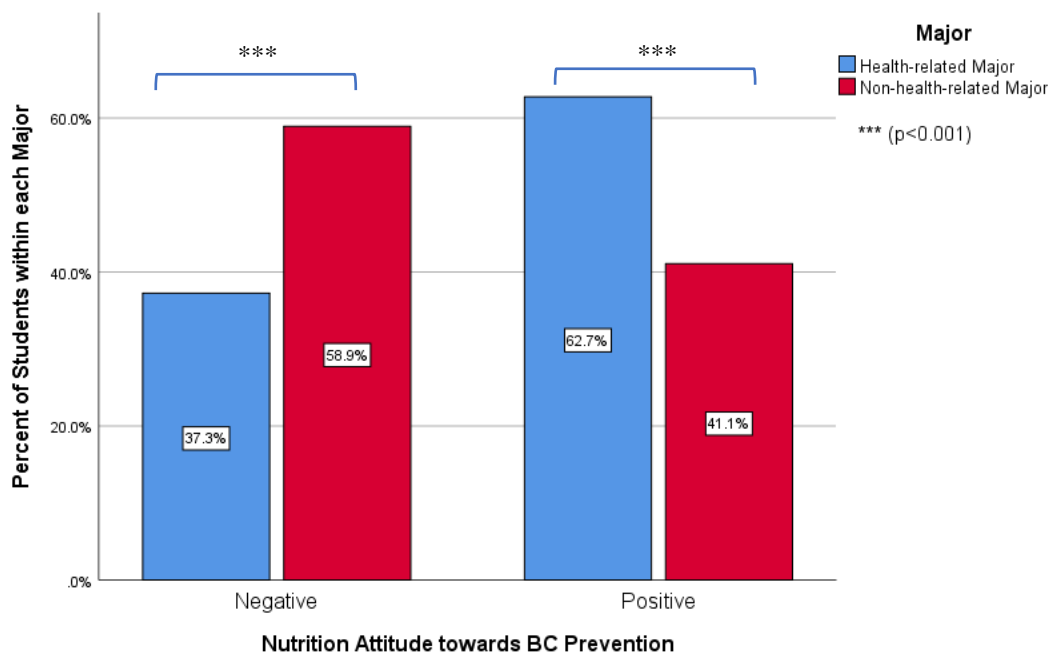
Table 5 illustrates the relationship between attitude towards nutrition-related BC prevention and sociodemographic, anthropometric, behavioral, and general characteristics in the study sample of AUB female students (n=356). The results show that, similar to knowledge, home faculty was significantly associated with nutrition-related BC prevention attitude (p-value=0.036). Moreover, there was a statistically significant difference in attitude according to the GPA distribution. Students having a positive attitude were more likely to have a GPA ≥3.63 compared to those having a negative attitude (51.6% vs 37.8%, p-value=0.017, respectively). Similarly, the mean

GPA of those having positive attitudes towards nutrition-related BC prevention was significantly higher than that of their negative attitude counterparts (3.57 ± 0.39 vs 3.41 ± 0.48, respectively, p-value=0.001). Furthermore, students having a positive attitude towards nutrition-related BC prevention were significantly less likely to report their "amount of perceived stress" as ≥ 3 compared to those having a negative attitude towards nutrition-related BC prevention (93.3% vs 97.7%, p-value= 0.047).

Using the Chi-square test and independent t-test, no statistically significant associations were found between attitude towards nutrition-related BC prevention and age, marital status, living situation, academic year, nationality, crowding index, family history of BC, BMI, smoking status, or perceived vulnerability to stress.

Table 5: Relation between nutrition-related BC prevention attitudes and sociodemographic, anthropometric, behavioral, and general characteristics in the sample of AUB female students (n=356) [†]

Characteristics	Attitude[ii]		P-value[*]
	Negative n (%)	Positive n (%)	
Age (years)			0.68
< 22	147 (85.0)	154 (86.5)	
≥ 22	26 (15.0)	24 (13.5)	
			0.43
Mean age ± SD	19.52 ± 1.72	19.66 ± 1.68	
Marital status			0.90
Married	2 (1.1)	1 (0.6)	
Engaged	3 (1.7)	4 (2.2)	
Single	171 (97.2)	174 (97.2)	
Living situation			0.23
Live alone	10 (5.6)	17 (9.5)	
Live with parents/relatives	144 (81.4)	133 (74.3)	
Live with friends/roommates	23 (13.0)	29 (16.2)	
Faculty of Education			**0.036**
FAFS	19 (10.7)	18 (10.1)	
FAS	85 (48.0)	84 (47.2)	
OSB	17 (9.6)	20 (11.2)	
MSFEA	41 (23.2)	22 (12.4)	
FHS	11 (6.2)	23 (12.9)	
HSON	3 (1.7)	8 (4.5)	
FM	1 (0.6)	3 (1.7)	

Academic year			0.13
Sophomore	66 (38.6)	64 (35.8)	
Junior	59 (34.5)	53 (29.6)	
Senior	24 (14.0)	30 (16.8)	
Fourth-year	8 (4.7)	8 (4.5)	
Master's	14 (8.2)	24 (13.4)	
Nationality			0.97
Lebanese	157 (88.7)	159 (88.8)	
Non-Lebanese	20 (11.3)	20 (11.2)	
Crowding index			0.35
<1	67 (39.6)	79 (44.6)	
≥1	102 (60.4)	98 (55.4)	
Family history of BC			0.97
No	118 (67.4)	121 (67.6)	
Yes	57 (32.6)	58 (32.4)	
BMI classification			0.197
Underweight	17 (10.4)	20 (12.0)	
Normal	117 (71.3)	125 (75.3)	
Overweight and Obese	30 (18.3)	21 (12.7)	
			0.097
Mean BMI ± SD	22.62 ± 3.32	22.02 ± 3.22	
GPA (capped at 4.0)			**0.017**
< 3.63	89 (62.2)	74 (48.4)	
≥ 3.63	54 (37.8)	79 (51.6)	
Mean GPA ± SD	3.41 ± 0.48	3.57 ± 0.39	**0.001**
Smoking status			0.54
Ever Smoker	29 (16.6)	34 (19.1)	
Never Smoker	146 (83.4)	144 (80.9)	

Perceived vulnerability to stress			0.44
< 3	42 (24.1)	37 (20.7)	
≥ 3	132 (75.9)	142 (79.3)	
Amount of perceived stress			**0.047**
< 3	4 (2.3)	12 (6.7)	
≥ 3	170 (97.7)	167 (93.3)	

†Chi-square test and independent t-test were conducted to determine the association between nutrition-related BC prevention attitudes of the AUB female students and their characteristics.

[ii] The attitude scores were categorized as negative (scores < median score of 20.00) and positive (scores ≥ median score of 20.00).

[*]Bolded numbers indicate statistical significance (p-value<0.05).

E. Practice

Table 6 shows the nutrition-related BC prevention practices in the sample of AUB female students. Only 3.1% of the students met the guideline of consuming at least 5 servings of fruits and vegetables per day. Around a quarter of the students (26.4%) followed the recommendation for red and processed meat consumption of ≤500g of red meat per week and <21g of processed meat per week.

Regarding fish consumption, 12.3% of the students consumed at least 2 servings of fish per week, and slightly more than a quarter of the students (28.6%) consumed at least 2 servings of dairy per day.

Table 6: Nutrition-related BC prevention practices in the sample of AUB female students (n=356)

Nutrition Practices	Total n (%)
Consumption of fruits and vegetables (at least 5 servings per day)	11 (3.1)
Consumption of red and processed meat (Red meat ≤500g/week (≤18 oz) and processed meat <21g/week (<0.75 oz))	93 (26.4)
Consumption of fish (at least 2 servings of fish per week)	43 (12.3)
Consumption of dairy (at least 2 servings of dairy per day)	100 (28.6)

There was no statistically significant difference in practice relevant to the to major of study as indicated in Figure 6 (p-value=0.66).

Figure 6: Percent distribution of students according to nutrition-related BC prevention practices by major of study
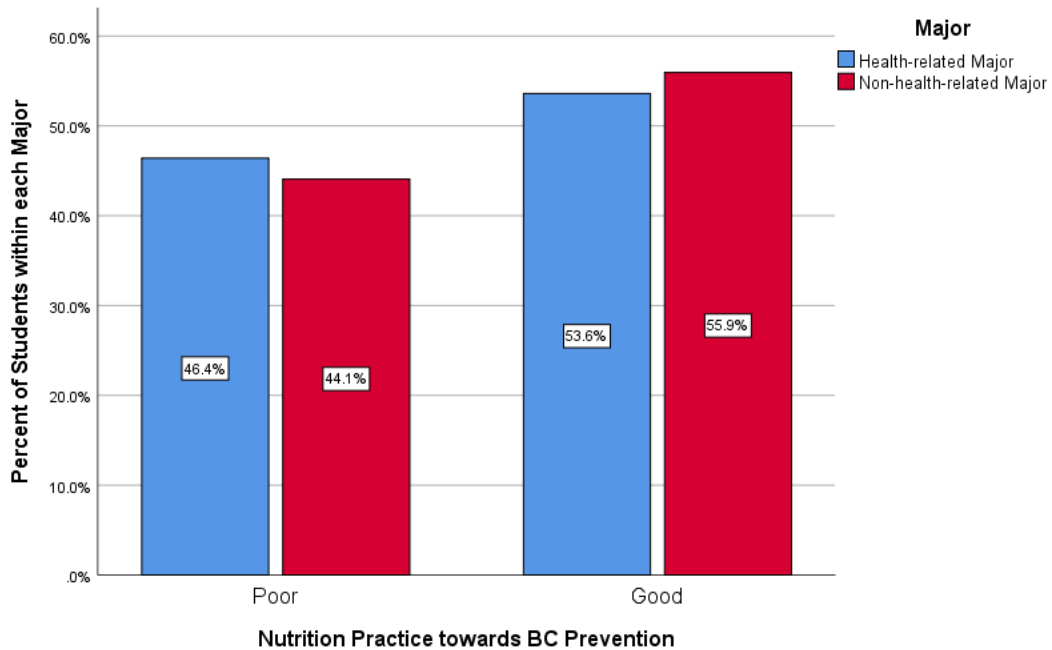
Note. The practice scores were categorized as poor (scores < median score of 10.00) and good (scores ≥ median score of 10.00)

Table 7 shows the relationship between nutrition-related BC prevention practices and sociodemographic, anthropometric, behavioral, and general characteristics in the study sample of AUB female students using Chi-square test and independent t-test. As indicated in the table, there was a statistically significant association between GPA and good nutritional practices. Specifically, those having good nutrition-related BC prevention practice scores were more likely to have a GPA ≥3.63 compared to those having poor practice (50.9% vs 37.8%, p-value=0.023). Moreover, the mean GPA of those having good BC prevention nutritional practices was significantly higher than that of those having poor practice (3.55 ± 0.40 vs 33.43 ± 0.47, respectively, p-value=0.017).

Furthermore, there was a statistically significant association between smoking status and nutritional practices, where those who never smoked were more likely to have good nutritional practices than those who reported as "never smoked" (87.7% vs 75.3%, p-value=0.003).

No statistically significant associations were found between nutritional practices and age, marital status, living situation, faculty of education, academic year, nationality, crowding index, family history of BC, BMI, perceived vulnerability to stress, or amount of perceived stress.

Table 7: Relation between nutrition-related BC prevention practice and sociodemographic, anthropometric, behavioral, and general characteristics in the sample of AUB female students (n=356) [†]

Characteristics	Practice[iii]		P-value[*]
	Poor n (%)	Good n (%)	
Age (years)			0.68
< 22	136 (86.6)	165 (85.1)	
≥ 22	21 (13.4)	29 (14.9)	
			0.57
Mean age ± SD	19.54 ± 1.69	19.64 ± 1.70	
Marital status			0.88
Married	2 (1.3)	1 (0.5)	
Engaged	3 (1.9)	4 (2.0)	
Single	154 (96.9)	191 (97.4)	
Living situation			0.25
Live alone	15 (9.4)	12 (6.1)	
Live with parents/relatives	126 (78.8)	151 (77.0)	
Live with friends/roommates	19 (11.9)	33 (16.8)	
Faculty of Education			0.90
FAFS	16 (10.0)	21 (10.8)	
FAS	79 (49.4)	90 (46.2)	
OSB	19 (11.9)	18 (9.2)	
MSFEA	24 (15.0)	39 (20.0)	
FHS	15 (9.4)	19 (9.7)	
HSON	5 (3.1)	6 (3.1)	
FM	2 (1.3)	2 (1.0)	
Academic year			0.69
Sophomore	63 (40.4)	67 (34.5)	

Junior	44 (28.2)	68 (35.1)	
Senior	24 (15.4)	30 (15.5)	
Fourth-year	8 (5.1)	8 (4.1)	
Master's	17 (10.9)	21 (10.8)	
Nationality			0.74
Lebanese	143 (89.4)	173 (88.3)	
Non-Lebanese	17 (10.6)	23 (11.7)	
Crowding index			0.31
<1	62 (39.2)	84 (44.7)	
≥1	96 (60.8)	104 (55.3)	
Family history of BC			0.13
No	114 (71.7)	125 (64.1)	
Yes	45 (28.3)	70 (35.9)	
BMI classification			0.96
Underweight	14 (9.5)	23 (12.6)	
Normal	113 (76.9)	129 (70.5)	
Overweight and Obese	20 (13.6)	31 (16.9)	
			0.44
Mean BMI ± SD	22.47 ± 3.43	22.19 ± 3.16	
GPA (capped at 4.0)			**0.023**
< 3.63	84 (62.2)	79 (49.1)	
≥ 3.63	51 (37.8)	82 (50.9)	
Mean GPA ± SD	3.43 ± 0.47	3.55 ± 0.40	**0.017**
Smoking status			**0.003**
Ever Smoker	39 (24.7)	24 (12.3)	
Never Smoker	119 (75.3)	171 (87.7)	
Perceived vulnerability to stress			0.68
< 3	34 (21.4)	45 (23.2)	
≥ 3	125 (78.6)	149 (76.8)	

Amount of perceived stress			0.68
< 3	8 (5.0)	8 (4.1)	
≥ 3	151 (95.0)	186 (95.9)	

†Chi-square test and independent t-test were conducted to determine the association between nutrition-related BC prevention practices of the AUB female students and their characteristics.

[iii]The practice scores were categorized as poor (scores < median score of 10.00) and good (scores ≥ median score of 10.00)

[*]Bolded numbers indicate statistical significance (p-value<0.05).

F. Knowledge, Attitudes, and Practice

Statistically significant differences were found between the mean scores of each of the knowledge and attitudes in both health and non-health-related majors (table 8). The mean knowledge score of students in the health-related majors was significantly higher than that of non-health-related majors (12.67 ± 2.97 vs 10.9 ± 3.35, $p<0.001$, respectively). Similarly, the mean attitude score of students majoring in health-related fields was statistically significantly higher than that of students who are majoring in non-health-related fields of study (20.46 ± 2.69 vs 19.00 ± 2.80, $p<0.001$, respectively). On the other hand, no significant differences in the mean practice scores were found between both types of majors ($p=0.51$).

Table 8: Comparison between each of the KAPs according to major (health-related vs non-health-related)[†]

Scores	Total (n=356)	Health-related major vs non-health-related major		
		Health-related (n=153)	Non-health-related (n=202)	P-value[*]
Mean knowledge score ± **SD:**	11.68 ± 3.30	12.67 ± 2.97	10.9 ± 3.35	**<0.001**
Mean attitude score ± **SD:**	19.62 ± 2.84	20.46 ± 2.69	19.00 ± 2.80	**<0.001**
Mean practice score ± **SD:**	9.40 ± 5.59	9.17 ± 4.93	9.55 ± 6.05	0.51

[†]Independent t-test was conducted to compare nutrition-related BC prevention KAP of the AUB female students according to their major.
[*]Bolded numbers indicate statistical significance (p-value<0.05).

In Table 9, the Pearson correlation between nutrition-related BC prevention knowledge, attitudes, and practice of AUB female students is presented. There was a statistically significant positive correlation between the overall knowledge and the overall attitude scores ($r=0.41$, $p<0.001$). However, there was no statistically significant

correlation between practice and each of the knowledge or attitudes scores (p-value>0.05).

Table 9: Pearson correlation between nutrition-related BC prevention knowledge, attitudes, and practice of AUB female students

	Overall Knowledge		Overall attitude		Overall practice	
	r-coefficient	P-value	r-coefficient	P-value	r-coefficient	P-value*
Overall knowledge	-		0.41	**<0.001**	0.03	0.56
Overall attitude	0.41	**<0.001**	-		-0.01	0.86
Overall practice	0.03	0.56	-0.01	0.86	-	

*Bolded numbers indicate statistical significance (p-value<0.05).

Table 10 shows the association of sociodemographic, anthropometric, behavioral, and general characteristics with good total nutrition-related BC prevention knowledge scores in the sample of AUB female students before and after adjusting for selected variables using simple and multiple logistic regression, repsectively. Poor knowledge in nutrition-related BC prevention was considered as the reference category. Model 1 was unadjusted, while Model 2 was adjusted for faculty of education, major (health-related or non-health-related), and GPA (capped at 4.0). In models 1 and 2, faculty of education, major (health-related vs non-health-related), and GPA were all significantly associated with good nutrition-related BC prevention knowledge scores. In model 1, taking FAFS as a reference, FAS (OR=0.41, 95% CI: 0.18-0.93, p-value=0.032), OSB (OR=0.31, 95% CI: 0.11-0.82, p-value=0.019), and MSFEA (OR=0.23, 95% CI: 0.09-0.56, p-value=0.001) were significantly negatively associated with good knowledge score. Similarly, in model 2, FAS (OR=0.31, 95% CI: 0.12-0.84, p-value=0.021) and MSFEA (OR=0.24, 95% CI: 0.08-0.74, p-value=0.013) remained significantly negatively

associated with good knowledge score, when compared to FAFS. However, OSB became no longer significantly associated with knowledge (p=0.09).

Taking a health-related major as a reference, following a non-health-related major was significantly negatively associated good knowledge score (OR=0.31, 95% CI: 0.20-0.48, p-value<0.001; OR=0.40, 95% CI: 0.21-0.76, p-value=0.006, in models 1 and 2 respectively). Moreover, GPA was significantly positively associated with good knowledge score (OR=1.78, 95% CI: 1.05-3.04, p-value=0.033; OR=1.89, 95% CI: 1.06-3.37, p-value=0.032, in models 1 and 2 respectively).

None of the other studied independent variables (age, marital status, living situation, academic year, nationality (Lebanese vs non-Lebanese), crowding index, family history of BC, BMI, smoking status, perceived vulnerability to stress, and amount of perceived stress) were significantly associated with good knowledge score (p>0.05).

Table 11 shows the association of sociodemographic, anthropometric, behavioral, and general characteristics with positive total nutrition-related BC prevention attitude scores in the study sample before and after adjusting for selected variables using simple and multiple logistic regression, repsectively. Negative nutrition-related BC prevention attitude scores were considered as the reference category. Model 1 was unadjusted, while Model 2 was adjusted for faculty of education, GPA (capped at 4.0), amount of perceived stress, and major of study (health or non-health). In both models, only the major of study and GPA were significantly associated with positive attitude scores (p-value<0.05). Compared to health-related majors, non-health-related majors were significantly negatively associated with positive nutritional attitudes toward BC prevention. This demonstrates that majoring in a health-related major predicts better nutrition-related BC

prevention knowledge and attitude. On the other hand, GPA was statistically significantly positively associated with a positive attitude (p<0.05).

None of the other studied independent variables (age, marital status, living situation, faculty of education, academic year, nationality (Lebanese vs non-Lebanese), crowding index, family history of BC, BMI, smoking status, perceived vulnerability to stress, and amount of perceived stress) were significantly associated with positive nutritional attitude towards BC prevention (p>0.05).

Table 12 shows the association of sociodemographic, anthropometric, behavioral, and general characteristics with good total nutrition-related BC prevention practice scores in the study sample, before and after adjusting for selected variables, using simple and multiple logistic regression, repsectively. Poor nutrition-related BC prevention practice was considered as the reference category. Model 1 was unadjusted, while Model 2 was adjusted for GPA (capped at 4.0) and smoking status. In both models, GPA was significantly positively associated with good nutritional practices toward BC prevention. In model 1, OR=1.90, 95% CI: 1.11-3.25 (p-value=0.019), while in model 2 OR=1.85, 95% CI: 1.08-3.19 (p-value=0.025). Smoking was statistically significantly negatively associated with good nutrition-related BC prevention practices. Compared to non-smokers, smokers were more likely to have poor nutrition practices. In model 1, OR=0.43, 95% CI: 0.25-0.75 (p-value=0.003), and in model 2, OR=0.42, 95% CI: 0.23-0.76 (p-value=0.005). GPA was shown to be a statistically significant predictor for knowledge, attitude, and practice.

None of the other studied independent variables (age, marital status, living situation, faculty of education, major (health-related vs non-health-related), academic year, nationality (Lebanese vs non-Lebanese), crowding index, family history of BC,

BMI, perceived vulnerability to stress, and amount of perceived stress) were significantly

associated with good nutritional practice towards BC prevention (p>0.05).

Table 10 Association of sociodemographic, anthropometric, behavioral, and general characteristics with good[iv] total nutrition-related BC prevention knowledge score in the sample of AUB female students (n=356).

	Good Knowledge[iv]					
	Model 1[a]			Model 2[b]		
	B	OR (95% CI)	P-value	B	OR (95% CI)	P-value[*]
Age (years)	0.04	1.04 (0.91-1.2)	0.58			
Marital status						
Married	-0.99	0.37 (0.03-4.13)	0.42			
Engaged	1.49	4.46 (0.53-37.40)	0.17			
Single		Ref				
Living situation						
Live alone		Ref				
Live with parents/relatives	-0.12	0.89 (0.40-1.98)	0.77			
Live with friends/roommates	0.18	1.19 (0.46-3.10)	0.72			
Faculty of Education						
FAFS		Ref			Ref	
FAS	-0.89	0.41 (0.18-0.93)	**0.032**	-1.16	0.31 (0.12-0.84)	**0.021**
OSB	-1.19	0.31 (0.11-0.82)	**0.019**	-1.08	0.34 (0.10-1.17)	0.09
MSFEA	-1.49	0.23 (0.09-0.56)	**0.001**	-1.42	0.24 (0.08-0.74)	**0.013**
FHS	0.04	1.05 (0.35-3.11)	0.94	-0.58	0.56 (0.15-2.14)	0.40
HSON	0.37	1.45 (0.26-7.97)	0.67	-0.34	0.72 (0.11-4.61)	0.72
FM	-0.04	0.96 (0.09-10.47)	0.98	-1.10	0.33 (0.03-3.98)	0.38

Major						
Health-related		Ref			Ref	
Non-health-related	-1.18	0.31 (0.20-0.48)	**<0.001**	-0.93	0.40 (0.21-0.76)	**0.006**
Academic year						
Sophomore		Ref				
Junior	0.11	1.12 (0.67-1.87)	0.66			
Senior	0.05	1.05 (0.55-2.00)	0.88			
Fourth-year	0.004	1.004 (0.35-2.86)	0.99			
Master's	0.18	1.20 (0.57-2.50)	0.63			
Nationality						
Lebanese		Ref				
Non-Lebanese	-0.004	0.996 (0.51-1.94)	0.99			
Crowding index						
<1		Ref				
≥1	-0.078	0.93 (0.60-1.43)	0.72			
Family history of BC						
No		Ref				
Yes	0.038	1.04 (0.66-1.63)	0.87			
BMI (kg/m^2)	0.01	1.01 (0.95-1.08)	0.77			
GPA (capped at 4.0)						
	0.58	1.78 (1.05-3.04)	**0.033**	0.64	1.89 (1.06-3.37)	**0.032**
Smoking status						
Ever Smoker	-0.25	0.78 (0.45-1.34)	0.37			
Never Smoker		Ref				
Perceived Vulnerability to Stress						
< 3		Ref				
≥ 3	0.03	1.03 (0.62-1.71)	0.91			

Amount of perceived stress			
< 3		Ref	
≥ 3	-0.51	0.60 (0.21-1.77)	0.36

Note. The reference category is poor knowledge.

[iv] Good knowledge was defined as a knowledge score ≥ 12, the median score.

[a] Model 1: Unadjusted (Crude) using binary logistic regression

[b] Model 2: Adjusted for faculty of education, major (health-related or non-health-related), and GPA (capped at 4.0)

[*] Bolded numbers indicate statistical significance (p-value<0.05).

Table 11 Association of sociodemographic, anthropometric, behavioral, and general characteristics with positive[v] total nutrition-related BC prevention attitude score in the sample of AUB female students (n=356).

	Positive Attitude[v]					
	Model 1[a]			Model 2[b]		
	B	OR (95% CI)	P-value	B	OR (95% CI)	P-value
Age (years)	0.05	1.05 (0.93-1.19)	0.43			
Marital status						
Married	-0.71	0.49 (0.04-5.47)	0.56			
Engaged	0.27	1.31 (0.29-5.94)	0.73			
Single		Ref				
Living situation						
Live alone		Ref				
Live with parents/relatives	-0.61	0.54 (0.24-1.23)	0.14			
Live with friends/roommates	-0.30	0.74 (0.29-1.93)	0.54			
Faculty of Education						
FAFS		Ref			Ref	
FAS	0.04	1.04 (0.51-2.13)	0.91	0.05	1.05 (0.45-2.45)	0.90
OSB	0.22	1.24 (0.50-3.09)	0.64	0.18	1.19 (0.38-3.78)	0.77
MSFEA	-0.57	0.57 (0.25-1.30)	0.18	-0.07	0.93 (0.33-2.61)	0.89
FHS	0.79	2.21 (0.84-5.80)	0.11	0.85	2.33 (0.69-7.94)	0.18
HSON	1.04	2.82 (0.64-12.31)	0.17	0.61	1.84 (0.35-9.58)	0.47
FM	1.15	3.17 (0.30-33.31)	0.34	-0.02	0.98 (0.08-11.41)	0.99
Major						
Health-related		Ref				
Non-health-related	-0.88	0.41 (0.27-0.64)	**<0.001**	-0.96	0.39 (0.20-0.73)	**0.003**

Academic year						
Sophomore		Ref				
Junior	-0.08	0.93 (0.56-1.54)	0.77			
Senior	0.25	1.29 (0.68-2.44)	0.44			
Fourth-year	0.03	1.03 (0.37-2.91)	0.95			
Master's	0.57	1.77 (0.84-3.72)	0.13			
Nationality						
Lebanese		Ref				
Non-Lebanese	-0.01	0.99 (0.51-1.91)	0.97			
Crowding index						
<1		Ref				
≥1	-0.21	0.82 (0.53-1.25)	0.35			
Family history of BC						
No		Ref				
Yes	-0.008	0.99 (0.64-1.55)	0.97			
BMI (kg/m²)	-0.06	0.95 (0.88-1.01)	0.099			
GPA (capped at 4.0)	0.89	2.44 (1.40-4.24)	**0.002**	0.89	2.43 (1.34-4.40)	**0.003**
Smoking status						
Ever Smoker	0.17	1.19 (0.69-2.05)	0.54			
Never Smoker		Ref				
Perceived Vulnerability to Stress						
< 3		Ref				
≥ 3	0.20	1.22 (0.74-2.02)	0.44			

Amount of perceived stress						
< 3		Ref			Ref	
≥ 3	-1.12	0.33 (0.10-1.04)	0.057	-1.59	0.21 (0.04-1.04)	0.055

Note. The reference category is negative attitude.

[v] Positive attitude was defined as attitude score ≥ 20, the median score.

[a] Model 1: Unadjusted (Crude) using binary logistic regression

[b] Model 2: Adjusted for faculty of education, GPA (capped at 4.0), amount of perceived stress, and major (health or non-health).

[*] Bolded numbers indicate statistical significance (p-value<0.05).

Table 12 Association of sociodemographic, anthropometric, behavioral, and general characteristics with good[vi] total nutrition-related BC prevention practice score in the sample of AUB female students (n=356).

| | Good Practice[vi] | | | | | |
| | Model 1[a] | | | Model 2[b] | | |
	B	OR (95% CI)	P-value	B	OR (95% CI)	P-value
Age (years)	0.04	1.04 (0.92-1.18)	0.57			
Marital status						
Married	-0.91	0.40 (0.04-4.49)	0.46			
Engaged	0.07	1.08 (0.24-4.88)	0.93			
Single		Ref				
Living situation						
Live alone		Ref				
Live with parents/relatives	0.40	1.50 (0.68-3.32)	0.32			
Live with friends/roommates	0.78	2.17 (0.84-5.59)	0.11			
Faculty of Education						
FAFS		Ref				
FAS	-0.14	0.87 (0.42-1.78)	0.70			
OSB	-0.33	0.72 (0.29-1.80)	0.49			
MSFEA	0.21	1.24 (0.54-2.83)	0.61			
FHS	-0.04	0.97 (0.38-2.47)	0.94			
HSON	-0.09	0.91 (0.24-3.54)	0.90			
FM	-0.27	0.76 (0.10-6.01)	0.80			
Major						
Health-related		Ref				
Non-health-related	0.10	1.10 (0.72-1.68)	0.66			

Academic year						
Sophomore		Ref				
Junior	0.37	1.45 (0.87-2.43)	0.15			
Senior	0.16	1.18 (0.62-2.22)	0.62			
Fourth year	-0.06	0.94 (0.33-2.66)	0.91			
Master's	0.15	1.16 (0.56-2.40)	0.69			
Nationality						
Lebanese		Ref				
Non-Lebanese	0.11	1.12 (0.58-2.17)	0.74			
Crowding index						
<1		Ref				
≥1	-0.22	0.80 (0.52-1.23)	0.31			
Family history of BC						
No		Ref				
Yes	0.35	1.42 (0.90-2.23)	0.13			
BMI (kg/m²)	-0.03	0.97 (0.91-1.04)	0.44			
GPA (capped at 4.0)	0.64	1.90 (1.11-3.25)	**0.019**	0.62	1.85 (1.08-3.19)	**0.025**
Smoking status						
Ever Smoker	-0.85	0.43 (0.25-0.75)	**0.003**	-0.88	0.42 (0.23-0.76)	**0.005**
Never Smoker		Ref			Ref	
Perceived Vulnerability to Stress						
< 3		Ref				
≥ 3	-0.11	0.90 (0.54-1.49)	0.68			

Amount of perceived stress			
< 3		Ref	
≥ 3	0.21	1.23 (0.45-3.36)	0.68

Note. The reference category is poor practice.

[vi] Good practice was defined as practice score ≥ 10, the median score.

[a]Model 1: Unadjusted (Crude) using binary logistic regression

[b]Model 2: Adjusted for GPA (capped at 4.0) and smoking status

[*]Bolded numbers indicate statistical significance (p-value<0.05).

Table 13 shows the stepwise multiple regression of total knowledge, attitude, and practice scores. Each of the total nutrition-related BC prevention knowledge, attitude, and practice scores was regressed using stepwise multiple regression on the following students' characteristics: age (years) used as a continuous variable, marital status (married, engaged, or single), living situation (live alone, live with parents/relatives, or live with friends/roommates), faculty of education (FAFS, FAS, OSB, MSFEA, FHS, HSON, or FM), academic year (sophomore, junior, senior, fourth year, or master's), nationality (Lebanese or non-Lebanese), crowding index (<1 or ≥ 1), family history of BC (no or yes), BMI (kg/m^2) used as a continuous variable, GPA (capped at 4.0) used as a continuous variable, smoking status (ever smoker vs never smoker), perceived vulnerability to stress (<3 or ≥ 3), amount of perceived stress (<3 or ≥ 3), and major (health-related vs non-health-related). Table 13 shows that both health-related and non-health-related majors of study and GPA (capped at 4.0) were significant predictors of both total knowledge and total attitude scores, while only GPA (capped at 4.0) was a significant predictor of total practice score (all p-values <0.05).

Table 13: Stepwise multiple regression of total knowledge, attitude, and practice scores

	Total Nutrition-related BC Prevention Knowledge Score				Total Nutrition-related BC Prevention Attitude Score				Total Nutrition-related BC Prevention Practice Score			
	B	SE	β	P-value[*]	B	SE	β	P-value[*]	B	SE	β	P-value[*]
Major (Health-related vs non-health-related)	-1.89	0.38	-0.29	**<0.001**	-1.62	0.34	-0.28	**<0.001**				
GPA (capped at 4.0)	0.96	0.43	0.13	**0.027**	1.10	0.38	0.17	**0.004**	2.55	0.75	0.20	**0.001**

[*]Bolded numbers indicate statistical significance (p-value<0.05).

CHAPTER IV

DISCUSSION

To our knowledge, this is the first study that investigated nutrition related KAP towards BC prevention and showed that the field of study as predictor of KAP in young university female students in Lebanon.

In this study, almost all the students were single (97.2%), and the majority were Lebanese (88.8%). Being single can be explained by data from the Central Administration of statistics in Lebanon which reported that the singulate mean age at marriage for women was 26.9 years in Beirut between 2018 and 2019, and that late marriage is becoming increasingly prevalent (Central Administration of Statistics, 2020). Recent data from the World Bank is not available on the mean age at first marriage in Lebanon.

This study showed that students pursuing health-related majors were more likely to report a GPA≥ 3.63 compared to those pursuing non-health-related majors (52.7% vs 38.9%). This might be partly attributed to the fact that some of the students pursuing health-related majors are pre-medical students and thus might be more concerned about their GPA than non-health-related majors. However, the mean GPA was not statistically significantly different between both majors. A study done on premedical and non-premedical undergraduate students, who attended a large public university in the U.S., found that the premedical students had significantly higher average GPA than the non-premedical one (Sevlever & Rice, 2010).

In this study, 95.5% of the total sample of AUB females reported their amount of perceived stress as at least 3, on a scale of 1 to 6. There might be several reasons behind that, including, but not limited to Lebanon's economic crisis. This is supported by data

from the country where a recent study reported that severe levels of distress were reprted among the people, in a country with minimal resources" (Farran, 2021). Another recent study assessed the psychological disturbances post-Beirut Port blast in 2020 in a cohort of patients who presented to the AUB Medical Center Emergency Department. This study found that two-thirds of the survivors of the Beirut Port blast had Post-Traumatic Stress Disorder, which was associated with being young, being female, and having depression and symptoms of concussion (Al Hariri et al., 2022). Another explanation for the perceived stress levels of the students lies in the fact that data collection took place between February and March 2023, when the strongest recent earthquake occurred near Lebanon on Feb 20, 2023 (*Lebanon Earthquake Report*, 2023). Midterm exams also took place during data collection. All these factors might have increased the students stress levels.

Moreover, this study demonstrated that students pursuing health-related majors were more likely to have good nutrition knowledge regarding BC prevention. This could be due to the fact that health-related majors include courses that teach the prevention and management of various diseases including dietary factors. Such courses are not necessarily required by non-health majors in AUB. A study conducted at King Faisal University (KFU), Saudi Arabia, reported that students who had a normal BMI were significantly "more aware of the concept of a healthy diet, studied medical and applied sciences, and were enrolled in nutrition courses" (Abdelhafez et al., 2020). Accordingly, Adbelhafez et al. proposed mandating the enrollment in healthy diet and food courses a requirement for all KFU educational programs.

Moreover, the present study showed that students pursuing health-related majors were more likely to report that scientific evidence has shown a relationship between diet

and BC, identify all the non-modifiable, and some of the modifiable risk factors of BC, and determine the relationship between certain foods and BC. This could be due to the fact that students following health-related majors learn the pathophysiology, risk factors, prevention, and management of several diseases.

This study highlighted several gaps in nutrition knowledge towards BC prevention among the students, regardless of their major. This could be explained by the fact that only few university courses highlight the relationship between nutrition and BC. Additionally, most of these courses are nutrition courses, which are not required by non-nutrition majors. Consequently, students pursuing health-related and non-health-related majors might not be familiar with nutrigenomics and other pertinent concepts of the relationship between diet and prevention of BC. Moreover, national public health awareness campaigns that emphasize the role of nutrition in BC prevention are scarce in the country , and this might contribute to the presence of such knowledge gaps. This might also explain why not all health-related major students had good knowledge. Although annual BC awareness and screening campaigns have been conducted by the health ministry since 2002, these campaigns focus on BC screening by providing free mammography tests for women 40 years and older with no family history of BC in all Lebanese public hospitals, and reduced-price mammography tests in most private medical institutions (Elias et al., 2021). Despite these awareness campaigns, efforts to downstage BC through mammography screening in Lebanon haven't succeeded. A recent campaign entitled "The Bread Exam" or "Khabazte" was executed by the Lebanese Breast Cancer Foundation in 2020. In this campaign a traditional female Lebanese baker demonstrated how to self-check breats through the act of kneading and pressing dough (Lebanese Breast

Cancer Foundation, 2020). Although such campaigns are very important, "Khabazte" also did not highlight the role of nutrition in BC prevention.

Gaps in nutrition knowledge of BC prevention identified by this study are similar to the ones reported by a study done in Iran on female medical university students (Raji Lahiji et al., 2019) and another done in Saudi Arabia on female medical and non-medical university students (Sindi et al., 2019). It is important to note that the study done by Sindi et al. (2019) did not focus on nutrition-related BC prevention KAP, but it assessed some of the items that were examined in this study.

Several studies have shown that medical and pre-medical students don't usually receive adequate nutrition education. A recent systematic review on nutrition in medical education demonstrated that "nutrition is insufficiently incorporated into medical education, regardless of country, setting, or year of medical education" (Crowley et al., 2019). It also suggested that "medical education will be enhanced by an institutional commitment to make nutrition education compulsory in training, the establishment of nutrition competencies to guide a benchmark for nutrition knowledge and skills to be included into curricula and supported by funding for innovative curriculum initiatives" (Crowley et al., 2019) . Moreover, a recent study done in Riyadh demonstrated that, although primary care physicians have good knowledge about nutrition-cancer relationship, their knowledge was "less than expected" (Arafa et al., 2022). Accordingly, they are advised to receive continuous nutrition educational training programs.

In the present study, there was a significant association between enrolment in a certain faculty and the nutrition-related BC prevention knowledge of the students. This might be explained by the significant differences in the results between health-related and

non-health-related majors and the inclusion of BC in the field of study or nationally through BC prevention campaigns.

This study reported absence of associations between age and BC prevention knowledge which might be explained by the fact that the inclusion criteria included only 18-25 years old students, whereas the literature reports

The study from Iran on medical students also showed that age and family history of BC were significantly associated with nutrition knowledge of BC prevention, where older students and students having a family history of BC had better knowledge about the topic (Raji Lahiji et al., 2019). However in this study the students' age range 18-25 is narrower than that of the Iranian study (18-40 years). The percentage of students who reported a family history of BC in the present study (32.5%) was also lower than that in the Iranian study (43%), which could be due to prevalence of inaccurate data on BC in Lebanon.

Similar to this study's findings, the presence of gaps in nutrition-related BC knowledge among different populations suggests appropriate and well-designed awareness campaigns about the topic should be executed. A study done by Bernard and Nicholson demonstrated that the percentages of American women citing dietary factors as protective against BC were 20% in 1991 and 23% in 1995 (Barnard & Nicholson, 1997). Moreover, a "multi-center survey on dietary knowledge and behavior among inpatients in the oncology department" showed that oncology patients had poor nutrition knowledge (Cong et al., 2018). A recent interventional study done in Iran demonstrated that participation in a nutrition education program, consisting of three 75-minute sessions based on the Health Belief Model (HBM), positively impacted the knowledge and nutritional practices linked to cancer prevention (Sasanfar et al., 2022).

In the Arab world, a recent study done in the UAE to assess the UAE university student's KAP toward the role of dietary and lifestyle behaviors in CRC found that the vast majority (92.7%) of the surveyed students had good knowledge about CRC risk factors (Hashim et al., 2022). In contrast, a study conducted among the Lebanese general population revealed a low awareness level of dietary and lifestyle risk factors of cancer (Kabalan et al., 2021). Although the present study did not assess the prevalence of low knowledge levels in the whole study sample, it revealed the presence of several knowledge gaps regarding nutrition and BC prevention among female university students.

This study showed several gaps in nutrition attitude towards BC prevention. Although the majority (84.6%) of students believe that nutrition can decrease the risk of BC and that the person should work on BC prevention despite the absence of a family history of BC (94.6%), only 56.9% agreed that it is necessary to follow a diet to prevent BC in people under the age of 25, and only 42.1% disagreed that being young means that there is a lot of time to prevent BC. This study also found a significant association between faculty of education and attitude. This might be partly explained by the fact that major was also significantly associated with attitude, where students having negative attitudes were more likely to be pursuing non-health-related majors compared to those pursuing health-related majors (67.6% vs 32.4%). All these findings might be explained by a correlation between knowledge and attitudes. In fact, the present study found a significant positive correlation between the overall knowledge and the overall attitude.

This study also demonstrated that students having a positive attitude were more likely to have a GPA ≥ 3.63 compared to those having a negative attitude. This might also be explained by the positive correlation between nutrition-related BC prevention knowledge and attitudes. Since GPA was associated with knowledge, it might also be

associated with attitudes. The mean GPA of those having positive attitudes was significantly higher than that of their negative attitude counterparts.

Students having a positive attitude were also significantly less likely to report their "amount of perceived stress" as ≥3. It is important to note that a "positive outlook enables the individual to cope better with stressful situations"(Mayo Clinic Staff, 2022). This association between stress and attitude can be perceived in 2 ways: being more stressed leads to more negative attitudes and having more negative attitudes towards a topic can lead to more stress. No statistically significant association was found between attitude and age, as opposed to that reported in the literature (Raji Lahiji et al., 2019). This might be because the inclusion criteria in the present study of 18-25 years old, which is a much narrower age range than that of the Iranian study (18-40 years).

Regarding practice, the present study showed that only 3.1% of the students met the guideline of having at least 5 servings of fruits and vegetables per day. Around a quarter of the students (26.4%) followed the recommendation of red and processed meat consumption: consuming ≤500g of red meat per week and <21g of processed meat per week. Only 12.3% of the students consumed at least 2 servings of fish per week. Slightly more than a quarter of the students (28.6%) consume at least 2 servings of dairy per day. This deviation from the dietary guidelines is alarming, especially since scientific evidence has shown that the consumption of fruits, vegetables, fish, and dairy products decreases the risk of BC, while the consumption of processed meat and excess consumption of red meat increase the risk of BC (Naja et al., 2019; World Cancer Research Fund/American Instiue for Cancer Research, 2018). In a study done among the Lebanese University students, half the students reported adequate adherence to the Mediterranean Diet (Karam et al., 2021). Although the present study did not assess the adherence of students to the

Mediterranean Diet, the findings demonstrate that, in line with other Lebanese studies, younger generations are more likely to adopt "Westernized" dietary habits (Nasreddine et al., 2019).

A study done at Universiti Brunei Darussalam (UBD) showed that the majority of university students had poor dietary practices, although most of them had good nutrition knowledge (Yun et al., 2018). In line with the present study, the findings of the study done in UBD suggest that there are several predictors of dietary practices, and that better good nutrition knowledge does not imply good nutrition practices.

In the present study, there was a significant difference in the distribution of GPA (3.63/4.0) according to practice. More specifically, those having good practice were more likely to have a higher GPA (GPA ≥3.63) compared to those having poor practices. Similarly, the mean GPA of those having good practice was statistically significantly higher than that of those having poor practice. This association does not imply causation. Accordingly, it cannot be inferred whether better dietary practices lead to a higher GPA (better performance) or whether a higher GPA causes better dietary practices. A study found that "healthy eating habits have a positive effect on students' academic performance" (Reuter et al., 2021). Nevertheless, Reuter et al. highlighted that there are other factors (e.g., sleep) that might be more prominent.

Moreover, the present study found a significant association between smoking status and practice, where it was more likely that those having good practice reported: "never smoked". Even after adjusting for GPA, being a smoker status was still significantly associated with poor nutrition practices towards BC prevention. Several studies have shown that smoking status is associated with poor diet quality (MacLean et al., 2018) and that "cigarette smokers may have greater difficulties in addressing food

craving and changing eating habits, particularly in the context of depression and stress" (Chao et al., 2017).

Although the present study found a significant positive correlation between the overall knowledge and the overall attitude, it did not find a significant association between practice and each of the knowledge or attitude scores. These findings suggest that the determinants of dietary practices are rather complex. Similarly, a study done in the UAE showed that there was a gap between the knowledge of university students and the implementation of protective dietary and lifestyle practices towards CRC prevention. (Hashim et al., 2022). Several previous studies have demonstrated that knowledge is not the only predictor of dietary practice (Deliens et al., 2014; Raji Lahiji et al., 2019). Although some previous studies have indicated that nutrition attitudes towards healthy eating were positively associated with dietary practices (Hearty et al., 2007; Raji Lahiji et al., 2019), it is clear that healthy dietary practices are influenced by several individual and collective cultural, social, economic, and environmental factors (Hashim et al., 2022). In fact, taste, cost, convenience play a major role in influencing food choices (Aggarwal et al., 2016). Food options provided by the cafeterias in AUB, those displayed in AUB's vending machines, and those offered in restaurants near AUB do not include many healthy options. The presence of several fast food restaurants on Bliss Street, and other surroundings of AUB, with limited access to healthy food outlets, could be one of the key features of the obesogenic environment (Guo et al., 2022).

This study has also demonstrated that enrolment in a certain faculty, health-related major, and GPA remained significant predictors of knowledge scores, even after inserting them in a multiple logistic regression model. Applying stepwise multiple regression, only health-related major and GPA remained significant determinants of knowledge scores. In

addition, only health-related major and GPA remained significant predictors of knowledge scores after adjusting for faculty of education in the multiple logistic regression model, and after adjusting for all other studied characteristics using stepwise multiple regression. Furthermore, although smoking and GPA remained significant predictors of practice after inserting them in a multiple logistic regression model, only GPA remained a significant predictor of total practice scores using stepwise multiple regression. All these findings suggest that health education and GPA might be good targets to improve the students' nutrition-related KAP.

A. Strengths

To our knowledge, this is the first study that addressed nutrition-related KAP related to BC prevention in Lebanon. The strength of the sudy is also through the use if culturally adapted FFQ , which was developed through a review of the literature with modifications to make it more culturally relevant. A committee of experts in different fields reviewed and evaluated the questionnaire. This ensured scientific rigor behind the study. Furthermore, the questionnaire was written in a way that allows the triangulation of KAP, while being concise. This decreased the chance of skipping questions.

Another strength of the study is the development a carefully prepared questionnaire, through conducting a pilot study and correcting the questions accordingly. Before the initiation of data collection, a pilot study was done. Any question that was reported as "unclear" was discussed with the committee of experts in nutrition, epidemiology, public health, biomedical sciences, and statistics, to enhance clarity and avoid confusion or misinterpretation. Additionally, the committee carefully re-read the items and reported their opinions about wording, grammar, and scoring. The strength in implementation was

also enforced through thorough explanation of the practice questionnaire although the survey was self administered. The training ensured that students were filling the survey correctly (e.g., writing the number of servings, instead of just ticking each frequency of consumption of food group). Moreover, a 2D portion published size guide was used in addition to the hand portion sizes to ensure the number of servings reported was as accurate as possible. All data was collected by a single researcher, and this ensures consistency across the results.

B. Limitations

Despite these strengths, the study had some limitations. The cross-sectional nature of the study prevented the inference of causation. Moreover, although the study's sample size was sufficient, the convenient sampling method used and the collection of data from one university may prevent the generalizability of results to other university female students who could have a different socioeconomic background and to the whole country (Hashim et al., 2022; Jager et al., 2017). The student population at AUB could be considered representative of the higher sociodemographic part of the population.

The study did not investigate the perceived barriers to good practice. Additionally, the practice questionnaire asked about a few food groups or items. It did not take into consideration the whole dietary pattern. Since cancer has a complex etiology, it is "unlikely that its development will be mediated by a single nutrient or food" (Hu, 2002; Jones-McLean et al., 2010; Kant, 2010; Newby & Tucker, 2004). Accordingly, it is better to focus on dietary patterns when evaluating diet-disease associations (Jankovic, 2018).

CONCLUSION

This study showed that pursuing a health-related major positively influenced the students' nutrition knowledge and attitude scores of BC prevention and that having a higher GPA predicted better nutrition KAP toward BC prevention. The amount of perceived stress negatively influenced nutrition attitude scores. These findings provide evidence for a relationship between health education and KAP and encourage further expansion in the Lebanese female population to develop evidence-based culture-specific awareness campaigns to mitigate the increasing trend of BC in the Lebanese female population. Enrollment in nutrition courses should be a requirement for all majors and could be a promising strategy to improve the students' nutrition knowledge and attitudes regarding BC prevention. Future studies are needed, on a larger scale, to unravel the predictors of nutrition-related BC prevention practices, in the Lebanese population.

APPENDIX I

Consent to Participate in a Research Study

"Nutrition Knowledge, Attitudes, and Practice towards Breast Cancer Prevention among Female Students at the American University of Beirut"

Principle Investigator:
Dr. Nahla Hwalla-Faculty of Agricultural and Food Sciences-AUB

Co-Principal-Investigator:
Dr. Lara Nasreddine-Faculty of Agricultural and Food Sciences-AUB

Co-Investigators:
Dr. Nadine Darwiche-Faculty of Medicine-AUB
Dr. Samer Kharroubi, Nour Deeb-Faculty of Agricultural and Food Sciences-AUB
Dr. Farah Naja- College of Health Sciences-University of Sharjah

Address:	American University of Beirut
	Bliss Street
	Beirut, Lebanon
Phone:	(01) 350000 Ext: 4443

Site Where the Study will be Conducted:
American University of Beirut, Faculty of Agricultural and Food Sciences, Department of Nutrition and Food Sciences.
You are being invited to participate in a study entitled: "Nutrition Knowledge, Attitudes, and Practice towards Breast Cancer Prevention among Female Students at the American University of Beirut", conducted at the American University of Beirut, and which will include 400 female university students recruited from the American University of Beirut (AUB), Lebanon.
Please take time to read the following information carefully before you decide whether you want to participate in this study or not. This information describes the objectives, procedures, benefits, risks, discomforts, and precautions related to the study. Your right to withdraw from the study at any time are also described. Please feel free to ask any questions if you need any clarification about what is stated in this form or if you need any additional information.

1) <u>**Purpose of the Research Study and Overview of Participation:**</u>

Breast Cancer (BC) incidence among Lebanese women has shown to be among the highest worldwide. The high prevalence of obesity and smoking in the Lebanese population might be contributing to this increased incidence.

The COVID-19 pandemic has caused delays in cancer diagnosis as well as disruptions in its treatment, globally, but especially in low- and middle-income countries. The economic and political crisis exacerbated this problem in Lebanon. While primary prevention is always very important, it is of particular importance during these harsh times. It has been shown that the global cancer burden can be reduced through diet and physical activity. Fortunately, these two factors are modifiable, emphasizing that efforts targeted at optimizing dietary patterns and physical activity as well as managing obesity should be spent.

There is lack of studies investigating nutrition-related BC prevention knowledge, attitudes, and practices (KAP) of female university students in Lebanon. The main objective of this study is to assess nutrition-related BC prevention KAP of female university students.

The secondary objective is to examine the relationship between demographic characteristics of students and their nutrition-related BC prevention KAP.

2) <u>**Recruiting strategy:**</u>

Participation in this study is completely voluntary and an informed consent will be sought from eligible adults who have the right to accept or decline participation on their own.

The recruitment methodology, approved by the ethical board, will be performed in two stages:

- *Stage 1* – Screening Stage: Flyers will be posted around AUB campus. Moreover, professors that teach courses having many students (>50 students) will be contacted and briefed about the study, its objectives, and methodology. Then, they will be asked if they can inform their students about the study. Subjects who are interested to participate in the study will be invited to visit the Department of Nutrition and Food Sciences at AUB, at a specific date and time. The subject will be briefed about the study, its objectives, and methodology, in private. Eligibility of the participant will be confirmed based on age and whether they were diagnosed with BC. After signing the informed consent, and ensuring your eligibility for participation, data collection will start right away after the screening stage, however if you prefer to meet later for data collection, you will then be contacted to set a date and time convenient for you to visit the Department. This screening stage will require around 5 minutes of your time. The screening stage will continue until a minimum of 500 adults have been recruited.

- *Stage 2* – Recruitment Stage: The recruitment stage requires a total of 400 students, that will be selected based on specific sampling and recruitment protocols.

3) <u>**Project Description and Duration:**</u>

If you decide to participate in this study, you will be invited to visit the Department of Nutrition and Food Sciences at AUB, on a date and time that is convenient for you. During your visit at AUB, you will be asked to fill a self-administered questionnaire that would take approximately 10 minutes for data collection. This questionnaire is used to collect information on socio-demographic characteristics and nutrition knowledge and attitudes towards prevention of BC as well as dietary practices. This questionnaire includes 31 items with 4 overall knowledge, 7 attitude, 6 practice, and 16 questions about sociodemographic, anthropometric, behavioural and general characteristics.

Note that in case meeting in-person is not possible, online responses will be solicited via Lime Survey (ID 843834). The consent will be collected in person and the survey link will then be provided to the interested participant.

4) **Risks and Discomforts:**

Although any study may be associated with any unforeseeable risk, this study has less than minimal risk and no major risks result from the participation in this study. None of the data collection measures bare any long-term or short-term hazards. The only possible concerns may include discomfort or stress when asked certain questions such as having a family history of BC or rating the amount of stress in your life. You can skip the questions if they make you feel uncomfortable. Moreover, all collected data and results will be kept strictly confidential and measures will be taken to ensure no breach of privacy. Furthermore, if you perceived any emotional disturbances while filling the questionnaire, don't hesitate to contact AUB counseling center
Tel: +961 1 350000
Ext: 3196 *(only during working hours)* Email:
counselingcenter@aub.edu.lb

5) **Potential Benefits:**

By participating in this study, you will be contributing to science. All findings will be conveyed to you by the end of the study.
The findings of this proposed study will fill an important knowledge gap about nutrition-related BC prevention KAP in Lebanon. Assessing KAP toward the role of nutrition in BC prevention in this population is essential for planning public health programs.
There are no anticipated expenses for you to pay if you participate in the study. On the other hand, you will not be paid for participating in the study.
If a participant no more wishes to take part in the study for a reason of his/her own, then the study investigators will terminate his/her participation.

6) **Other Way to Reach the Aim of the Study:**

There is no other way to reach the aim of the study.

7) **Confidentiality:**

The investigators are committed to preserve anonymity of the participants, to keep the results confidential, and to give them only to the participant involved. If you agree to

participate, all collected data will be kept strictly confidential and measures will be taken to ensure no breach of your privacy. Also, all participants will be assigned by random identifiers to further assure the confidentiality of records. A sheet will be prepared whereby each ID will be linked to the name of the participant. All data used for research purposes, however, will be based on the IDs only.

Only the members of the research group will have access to the data that will only be used for research purposes. Records will be monitored, without violating confidentiality. The data collection sheets will be locked in a cabinet at the principal investigator's office. Electronic versions of the data will also be secured and locked by a password. This data will be stored on the principal's investigator computer. Only the PI will have access to the complete data set.

Proper measures will be taken to keep the individually identifiable information confidential, only shared with the researchers listed in this IRB application, and only used for the purposes of this research project. All identifiers (name, phone number, etc.) will be de-identified once the data merging at the institution is complete. Your contact information will be securely stored at AUB for internal use during the study. The research data will not include your identifying information. Identifiers will be collected for study purposes; however, all data will be de-identified and identifiers will not be disclosed.

Please acknowledge that participation in this study is completely voluntary. Your decision not to participate will not influence your relationship with AUB in any possible way.

8) Participant Rights:

Participation in this study is completely voluntary and informed consent will be sought from eligible students who have the right to accept or decline participation on their own. Refusing to participate will not involve any loss of benefits offered in the future. Moreover, you are entitled to withdraw from the study at any time without any loss of benefits at any time.

A) **If you prefer to meet later for data collection, can we contact you to set a date and time convenient for you to visit the Department?**

> **Yes**   **No**

If your answer is yes, please provide us with your contact telephone number:

_____

We may store and use part or all of the collected data in the future. This might include sharing the collected data with other researchers. Before doing so, we will make sure to destroy all links between the identity and the data about you. Also, we would like to contact you to invite you to participate in future studies.

B) **I agree to allow the storage and use of the collected information with other researchers and/or in future research. I agree to share data with investigators at AUB or outside AUB.**

> **Yes**   **No**

C) **Can we contact you to invite you for future studies?**

> **Yes**   **No**

Investigator's Statement:

I have reviewed, in detail, the informed consent document for this research study with ---------------------------------- **(Name of the participant)**, the purpose of the study, and its risks and benefits. I have answered all the participant's questions clearly. I will inform the participant in case of any changes to the research study.

_____   _____

Name of Investigator or designee   **Signature of Investigator or designee**

_____

Date & Time

Participant's Consent:

I have read and understood all aspects of the research study and I had enough time to have all my questions answered. I voluntarily agree be a part of this research study and I know that I can contact Dr. Nahla Hwalla at 01-350000 Ext 4443 or any of her designee involved in the study in case of any questions at any time during and after the conduction of the study. If I felt that my questions have not been answered, I can contact the Institutional Review Board for human rights at 01-350000 Ext 5445. I understand that I am free to withdraw this consent and discontinue participation in this project at any time, even after signing this form, and it will not affect my care or benefits. I know that I will receive a copy of this signed informed consent.

_____   _____

Name of Participant   **Signature**

_____

Date & Time

APPENDIX II

Questionnaire: Assessing Nutrition Knowledge, Attitudes, and Practice for Breast Cancer Prevention among Female Students at the American University of Beirut

Section 1: Assessing Knowledge

1- Has scientific evidence shown a relationship between diet and breast cancer?

☐ Yes

☐ No

☐ I do not know

2- What is/ are the risk factors for breast cancer? (You can tick more than one)

☐ Being a female

☐ Being over 50 years old

☐ Having a family history of breast cancer

☐ None of the above

☐ I do not know

3- What is the impact of nutrition on breast cancer?

☐ Low (up to 5%)

☐ Intermediate (around 30%)

☐ High (around 100%)

☐ It does not have an impact

☐ I do not know

4- Does early diagnosis of breast cancer improve survival?

☐ Yes

☐ No

☐ I do not know

5- Do these factors increase the risk of developing breast cancer?

	Yes	No	I do not know
Contraceptive pills			
Smoking			
Weight Gain			
Being physically active			

6- Foods in relation to breast cancer prevention

	Protective	Harmful	Not related	I do not know
Green Vegetable intake				
Fruit intake				
Consumption of processed red meat (e.g., sausages, Mortadella, Makanik, hot dog, etc.)				
High consumption of red meat				
Consumption of fish (omega 3)				
Consumption of dairy products				
Alcohol consumption				
Foods containing carotenoids (e.g., bell peppers, broccoli, cantaloupe, carrots, kale, mangoes, oranges, spinach, tomatoes, etc.)				

Section 2: Attitude Questionnaire

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1- I believe that nutrition can decrease the risk of breast cancer.					
2- I need to work on breast cancer prevention even if I <u>don't</u> have a family history of breast cancer.					
3- I believe that it is necessary to follow a diet to prevent breast cancer in people under the age of 25.					
4- I believe that food selection does not decrease the risk of breast cancer.					
5- I believe that, despite the treatment modalities available for patients with breast cancer, this disease can cause the death of these patients.					
6- I believe that adherence to a healthy diet by a person reduces the risk of developing breast cancer in the next generation.					
7- I believe that I am young, so I have a lot of time to prevent breast cancer.					

Section 3: Practice Questionnaire

Please indicate your usual intake of each of the following food items per Day, Week, or Month.

Food item	Serving size	Day	Week	Month	Rarely / Never
Vegetables (raw and cooked)	**1 cup of raw or cooked vegetables or 2 cups of raw green leafy vegetables**				
Fruits	**1 fruit or 1 cup of fruits**				
Processed Meat (Sausages, Makanik, Basterma, and Mortadella)	**90g**				
Red meat (mutton, beef, minced)	**90g**				
Fish	**90g**				
Low fat dairy products (milk, yogurt, natural cheese)	**1 cup milk or yogurt or 45g of natural cheese**				

Palm of hand or deck of cards = 90g of meat or fish

Fist = 1 cup of fruit or vegetables

Four dice or 1/3 cup shredded cheese = 45g cheese

Section 4: Anthropometric, Behavioral, Sociodemographic, and General Characteristics Questionnaire

1- Age (years) _____

2- Faculty of Education

- o FAFS
- o FAS
- o OSB
- o MSFEA
- o FHS
- o HSON
- o FM

3- Major _____

4- Academic year

- o Sophomore
- o Junior
- o Senior
- o Fourth year
- o Master's

5- Marital status

- o Married
- o Engaged
- o Single

6- Nationality: --------------

7- Which statement best describes your living situation?

a. Live alone
b. Live with parents/relatives
c. Live with friends/roommates

8- How many rooms are in your house, i.e. your permanent residence? (Excluding the kitchen and bathrooms) _____

9- How many members (including yourself) are co-residents in your house?

_____

10- Do you have any family history of breast cancer?

- o No
- o Yes

If Yes: please specify

- o First degree relatives (parents and siblings)

- o Second degree relatives (uncles – aunts - grandparents)

11- Height (cm) _____

12- Weight (kg) _____

13- GPA (capped at 4.0) _____

14- Do you smoke (any kinds of smoking, cigarettes, shisha, e-cigarettes, IQOS, or vape)?
- o Everyday
- o 3 times per week
- o 3 times per month
- o Never

15- On a scale of 1 to 6, how would you rate your ability to handle stress? (from 1 for "I can shake off stress" to 6 for "stress eats away at me") _____

16- In the past year, how would you rate the amount of stress in your life (at your residence and at university)? (from 1 for "no stress" to 6 for "extreme stress") _____

If you perceived any emotional disturbances while filling the questionnaire, don't hesitate to contact AUB counseling center:
Tel: +961 1 350000
Ext: 3196 *(only during working hours)*
Email: counselingcenter@aub.edu.lb

APPENDIX III

2D FOOD PORTION VISUAL

REFERENCES

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