ORIGINAL RESEARCH

# Evaluation of nutritional literacy among undergraduate nursing students

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## ABSTRACT

**Background/Objective:** It is difficult to describe or quantify the extensiveness and importance of the nurses' role in direct patient care. Although Registered Dietitian Nutritionists (RDN) are available, it is often the nurse who is tasked with monitoring a patient's nutritional status and carrying out nutrition interventions to optimize oral intake such as providing meals and oral supplements, as well as administering enteral and parenteral nutrition. Therefore, it is critical that nurses have an understanding of nutrition to promote good health. Although fundamental nursing courses stress the nurse's role in promoting healthy nutrition as a means to prevent disease and assist patients in sustaining wellness, there is no standardized nursing curriculum enforcing an independent nutrition course within nursing programs.

**Methods:** A quantitative methodology was used to explore the level of nutritional awareness as measured by the Nutritional Literacy Assessment Instrument (NLit) among BSN nursing students in a public, 4-year institution in the Mid-West of the United States. Nutritional literacy, as defined by Gibbs et al., students' knowledge of food and associated impact on nutrition was evaluated.

**Results:** The data indicated that 70% of participants had completed an undergraduate nutrition course, with the highest performance on the Nutritional Literacy Survey within the understanding of food groups. Over 80% of respondents were found to have a likelihood of good nutrition literacy. Although no statistical significance was found between a pre-requisite Nutrition course and/or an integrated Nursing Nutrition course and Nutritional Literacy, statistical significance was found when examining student classification (sophomores versus seniors) impact on Nutritional Literacy scores.

**Conclusions:** Promoting the integration of nutrition concepts across a variety of courses within the nursing curriculum will assist the student to utilize clinical judgment in the application and synthesis of nutritional concepts in relation to patient health and wellness.

**Key Words:** Nutritional literacy, Undergraduate nursing student, Wellness promotion

## 1. INTRODUCTION

According to the Clinical Nutrition Management practice group of the Academy of Nutrition and Dietetics, there is one inpatient Registered Dietitian (RD) or Registered Dietitian Nutritionist (RDN) per sixty-five to seventy-five patients for medical nutrition therapy.[1] Conversely, the recommended safe nurse-to-patient staffing ratio is one to four, according to National Nurses United.[2] It is difficult to describe or quantify the extensiveness and importance of the nurses' role in direct patient care, specifically as it relates to the

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nutritional impact on patient wellness. Although RDNs are available, it is often the nurse who is tasked with monitoring a patient's nutritional status and carrying out nutrition interventions to optimize oral intake such as providing meals and oral supplements, as well as administering enteral and parenteral nutrition.[3] Therefore, it is critical that nurses have an understanding of nutrition to promote good health.

## 2. Background

### 2.1 Importance of nutrition in positive health outcomes

Nutritional status is a major determinant of length of inpatients' hospital stay (LOS), clinical outcomes, and overall mortality.[4–6] Malnutrition is not uncommon in the clinical setting with 12.7% to 33.3% of patients experiencing it, with the highest prevalence of malnutrition in critical care units. LOS was four to five days longer in patients with severe malnutrition and mortality risk was significantly higher.[5] Correia found malnourished patients LOS was over six days longer and mortality increased from 4.7% among well-nourished patients to 12.4% among those malnourished.[4] Furthermore, malnourished patients were more likely to be readmitted within 15 days, and healthcare costs were significantly higher.[6] Malnutrition has been found to be an independent risk factor associated with increased complications, longer LOS, increased mortality, and increased costs.[4,6]

On the other hand, hospital-based early nutrition therapy programs designed for at-risk and/or malnourished patients have resulted in better health outcomes as well as a reduction in healthcare costs.[7–11] A nutrition-focused quality improvement program resulted in a reduction in 30-day readmissions, shorter LOS, and a savings per patient of $3858.[9] Comparable results have been found through a number of similar studies.[7–9,11] It is most often the dietitians' responsibility to identify nutrition problems, assess nutritional status, design individualized medical nutrition therapy (MNT) interventions, and make nutritional recommendations. However, implementation and monitoring of interventions requires a multidisciplinary approach. As such, it is recommended that clinical healthcare professionals receive education and training to understand the importance of nutrition, and the ability to identify, treat, and monitor patients at nutritional risk.[9]

### 2.2 Role of nursing in nutrition care

Nurses play a key multidisciplinary role. They have the most patient contact, and are indispensable in all aspects of direct patient care including identifying and reducing the prevalence of at-risk and/or malnourished patients.[12] Nurses are often responsible for conducting a nutrition screening within 24 hours of admission and referral, while the RDNs are primarily responsibility for the nutrition assessment.[13] and designing an MNT intervention. Then, once again, the nurses are largely responsible for carrying out nutrition intervention recommendations, as well as monitoring patients' nutritional status, evaluating patient intake and output and intervening as needed, providing patient nutrition through tube feedings and parenteral nutrition, and even providing nutrition information/advice to patients.[12] Furthermore, nutrition topics including nutritional assessment and monitoring, diet therapy, and enteral and parenteral nutrition have been integrated into the National Council Licensure Examination for Registered Nurses.[14] Although fundamental nursing courses stress the nurse's role in promoting healthy nutrition as a means to prevent disease and assist patient's in sustaining wellness, there is no standardized nursing curriculum enforcing an independent nutrition course within nursing programs.[15] Nutrition courses are commonly integrated into nursing programs as a pre-requisite course, with nursing applications taught across curriculum.

### 2.3 Nutritional knowledge among nurses

There are limited studies within the past decade in the United States focusing on nurses' and nursing students' nutritional knowledge. However, in 2020, Zeldman and Andrade conducted a meta-analysis of research investigating physicians' and nurses' nutrition knowledge. Upon reviewing thirty-three articles, they found that mean nutrition knowledge varied greatly from 32.5% to 72% correct responses. Physicians and nurses had greater nutrition knowledge on topics including nutrition for critical care patients, nutrition during the life span, the role of vitamins and minerals, and the role of macronutrients, good food sources, and health impact. Nutrition knowledge was lowest on topics such as nutrition management of chronic diseases/medical nutrition therapy, and the process of digestion, absorption, and metabolism of foods, and macronutrient composition of foods.[16] Results suggest that nutrition knowledge could be improved among physicians and nurses in certain areas.

### 2.4 Nutrition literacy

Nutrition literacy is slightly different from nutrition knowledge, and has emerged as a form of health literacy. Health literacy is an important mediator of health outcomes, as nearly half of Americans struggle with understanding and using commonly provided types of health information.[17] In fact, health literacy is a stronger predictor of health than age, race, education, income and employment.[18] Nutrition literacy, on the other hand, is defined as "an individual's capacity to obtain, process, and understand basic nutritional information necessary to make appropriate dietary decisions".[19,20] It is well established that diet and nutrition play a fundamen-

tal role as a risk factor for chronic diseases such as obesity, cardiovascular disease, hypertension, stroke, type 2 diabetes, metabolic syndrome, some cancers, and even some neurological diseases.[21] From a public health perspective, it is important that healthcare providers have high health and nutrition literacy.

Research supports the need for improving nutritional knowledge among nurses and that more nutrition education is needed within undergraduate nursing education programs.[22] Previous research also suggests there is an association between nutritional literacy and eating behaviors among nursing students.[23]

The purpose of this study was to assess the extent to which a stand-alone nutrition course improves nutrition literacy in addition to nutrition knowledge among Bachelor of Science in Nursing (BSN) students. The determination of nutritional literacy among nursing students will assist nursing programs in evaluating the content of their curriculum to ensure effectiveness and alignment with state and national nursing standards. Additionally, exploring nutritional literacy can impact program attention on patient outcomes. To explore the purpose of this research, the following questions were utilized for data analysis: 1) Is there a significant difference on Nutritional Literacy scores based on completion of a prerequisite Nutrition Course? 2) Is there a significant difference on nutritional literacy based on completion of a pre-requisite Nutrition Course, Nursing Application to Therapeutic Nutrition Course, or an interaction between the two? 3) Is there a correlation between age and Nutritional Literacy?

## 3. METHODS

### 3.1 Study design

A quantitative methodology was used to explore the level of nutritional awareness as measured by the Nutritional Literacy Assessment Instrument (NLit) among BSN nursing students in a public, 4-year institution in the Mid-West of the United States. Validity and reliability for the NLit is demonstrated at 0.97 with a confidence interval of 0.96-0.98 as well as a test-retest reliability of .88 with a confidence interval of 0.85-0.90. Nutritional literacy, as defined by Gibbs et al., students' knowledge of food and associated impact on nutrition was evaluated.[19] The NLit uses six subscales of nutrition and health, energy sources found in food, food labels, household food measurements, food groups and consumer skills to provide a nutritional literacy score.[19] An example question from the subscale of Nutrition and Health included a multiple-choice question ("An example of energy-dense beverage is .") Knowledge of the subscale Energy Sources in Food ("Which group of foods provides the most carbohydrates?") required the participant to select from four multiple choices. The Household Measurement subscale provided visual demonstrations, requiring the student to select the picture that best matched the description (such as "Using the photos above, choose the right portion for a hamburger patty."). Similarly, the Food Label and Numeracy subscale provided visual representation of food labels to examine in order to provide a response ("If you eat 1/2 cup of this macaroni and cheese, how many grams of total fat would you eat?"). Eight questions were contained within the Food Groups subscale, requiring the respondent to select the correct food group ("In which food group do noodles belong?"). Finally, Consumer Skills were assessed using nine questions with visual prompts ("Which type of salad greens provides the most nutrition?").

The quantitative method approach was appropriate for this study because it provided quantitative findings that allowed descriptive statistics among variables to be evaluated, as well as providing the ability to assess correlations between variables.

Participants for this study were solicited via emails from currently enrolled BSN nursing students at a Mid-West, 4-year, public university. The use of emails facilitated the easy navigation to the survey instrument via an embedded SurveyMonkey hyperlink and QR code. By distributing the survey via email, BSN nursing students were allowed to complete independently, regardless of receipt time.

### 3.2 Sample and setting

A convenience sample was used by sending emails to all currently enrolled students within the BSN nursing program in the School of Health Sciences via their school email address during August and September of 2023 [n = 157]. A reminder email was sent in September. The average time needed to complete the survey was 16 minutes. Of the sent emails, 60 individuals completed the survey (38%). Eligibility criteria included being a currently enrolled BSN nursing student at the parent institution.

### 3.3 Data collection

Approval for use of the NLit was obtained via purchasing of the measurement tool. Approval for this study was obtained by the Institutional Review Board (IRB) prior to the email push. The email contained a cover letter that introduced the study, clearly stating the voluntary nature of survey completion, and indicating that submission provided consent. All anonymous responses were evaluated by researchers via password-protected SurveyMonkey account of the principal researcher. Upon receipt of the data from SurveyMonkey, the confidential and anonymous data was shared with the co-principal researcher. Participant confidentiality was main-

tained as no personal identifying information was obtained.

### 3.4 Data analysis

Using SurveyMonkey, all data was exported into a Microsoft Excel spreadsheet to facilitate analysis. Upon organization, data was further entered into Jamovi 2.4.8 for descriptive and inferential analysis. The principal researcher evaluated the data via descriptive statistics, developing a platform of those findings. The Applied Research Consultants at the public university were employed to provide inferential statistic results, using Jamovi 2.4.8 to run a factorial ANOVA, post hoc comparisons and a correlational matrix. Both principal researchers verified all statistical analysis.

## 4. RESULTS

Of the eligible 157 students with 60 study respondents, a 38% response rate was noted. Of the 60 study respondents, 85% identified as white, with age ranges between 19 and 46, with an average age of 22. All students were undergraduate, with 70% replying they have successfully completed an undergraduate nutrition course. Levels of education included all undergraduate ranks from freshmen to seniors. See Table 1 as it depicts participant demographics, with ethnicity data obtained by student self-identification.

**Table 1.** Participant demographics (n = 60 or 38% of sampling pool)

| Variables | n | % |
|---|---|---|
| *Ethnicity* | | |
| White | 51 | 85 |
| Hispanic or Latino | 3 | ~5 |
| Black or African American | 4 | ~6 |
| Asian or Asian American | 1 | ~1 |
| Multiracial | 1 | ~1 |
| *Ages* | | |
| 18-20 | 22 | 36 |
| 21-22 | 21 | 35 |
| 23-25 | 7 | 12 |
| 26-30 | 5 | 8 |
| 31-40 | 3 | 5 |
| 41-50 | 2 | 3 |
| Completion of UG nutrition course | 48 | 80 |

### 4.1 Subscales

The researchers were able to examine the mean percentage correct on each of the NLit subscales of Nutrition and Health, Energy Sources in Food, Household Food Measurements, Food Label and Numeracy, Food Groups, and Consumer Skills.

Student scores on seven questions determined individual understanding of nutrition and health. These questions required knowledge of food groups and the types of foods generally found in each food group. The average score for this subscale was 67%. Student scores on six questions determined individual understanding of energy sources in food. These questions required knowledge of macro nutrition and types of food considered macronutrients. The average score for this subscale was 78%. Individual understanding of household food measurements was determined by six questions. These questions required the individual to identify portion sizes in relation to common household food measurements, such as one cup, displayed in pictures. The average score for this subscale was 68%. Individual understanding of food label and numeracy was determined by six questions. These questions required the individual to view a food label and answer questions regarding that label. The average score for this subscale was 70%. Individual understanding of food groups was determined by eight questions. These questions required the individual to identify in which food group a specific food belonged. The average score for this subscale was 91%. And finally, individual understanding of consumer skills was determined by nine questions. These questions required the individual to identify which available items most closely meet the macronutrient or food group described. The average score for this subscale was 81%. See Table 2 as it depicts participant scores on the subscales of the Nutritional Literacy Survey.

**Table 2.** Nutritional literacy survey subscales (n = 60)

| Subscale | % correct |
|---|---|
| Nutrition and Health | 67 |
| Energy Sources in Food | 78 |
| Household Food Measurements | 68 |
| Food Label and Numeracy | 70 |
| Food Groups | 91 |
| Consumer Skills | 81 |

### 4.2 Scoring interpretation

Scoring Interpretation was provided to indicate nutritional literacy. Scores less than or equal to 28 indicated the likelihood of poor nutritional literacy. Scores between 29 and 38 indicate the possibility of poor nutritional literacy. Scores equal to or above 39 indicate the likelihood of good nutritional literacy. The majority of students indicated the likelihood of good nutritional literacy. Scoring interpretation of the Nutritional Literacy Survey is depicted in Table 3.

**Table 3.** Scoring Interpretation (n = 60)

| Items | n | % |
|---|---|---|
| ≤ 28: Likelihood of poor nutrition literacy | 8 | 13 |
| 29-38: Possibility of poor nutrition literacy | 3 | 5 |
| ≥ 39: Likelihood of good nutrition literacy | 49 | 81.6 |

### 4.3 Pre-requisite nutrition course and nutritional literacy

An ANOVA was completed to compare the pre-requisite nutrition course on nutrition literacy scores. This same ANOVA also compared the nursing nutrition course on nutrition literacy scores. Lastly, this ANOVA also looked at the interaction between the pre-requisite nutrition course and the nursing nutrition course on nutritional literacy scores. There was no significant difference between the nutritional literacy scores when a student had completed either a pre-requisite nutrition course or nursing nutrition course. Moreover, a student who had taken both courses were no more likely to score differently than those who had not. This finding, demonstrated in Figure 1, indicates the completion of a pre-requisite nutrition course or nursing nutrition course does not imply greater nutritional literacy.


**Figure 1.** Is there a difference between those who took a prerequisite Nutrition course and those who did not (main effect)?

### 4.4 Integrated nursing nutrition course and nutritional literacy

When evaluating the difference between students that completed a nursing nutrition course within the nursing curriculum and their literacy scores, the findings, provided in Figure 2, indicate the completion of a nursing nutrition course does not imply greater nutritional literacy scores.

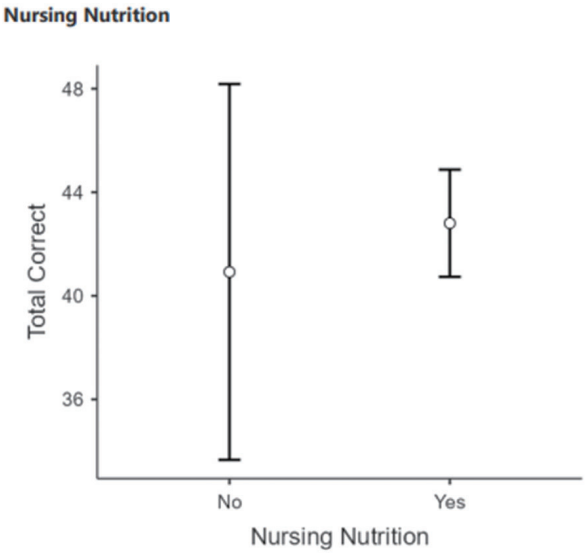


**Figure 2.** Is there a difference between those who took Nursing Nutrition course and those who did not (main effect)?

### 4.5 Pre-requisite nutrition course, nursing nutrition course and nutritional literacy

Reviewing the data to determine if there is a difference with a combination of those who took prerequisite nutrition course and nursing nutrition course compared to others yielded findings that indicate the completion of a pre-requisite nutrition course and a nursing nutritional course does not imply greater nutritional literacy scores, as demonstrated in Table 4.

**Table 4.** Is there a difference unique combination of those who took prerequisite Nutrition course (BL) and Nursing Nutrition course (BJ) compared to others (interaction)

| **ANOVA- Total Correct** | | | | | | |
|---|---|---|---|---|---|---|
| | **Sum of Squares** | **df** | **Mean Square** | **F** | ***p*** | **$n^2p$** |
| Nutrition Pre-Req Course | 37.877 | 1 | 37.877 | 0.777 | .382 | 0.014 |
| Nursing Nutrition | 12.150 | 1 | 12.150 | 0.249 | .620 | 0.004 |
| Nursing Nutrition Pre-Req Course + Nursing Nutrition | 2.384 | 1 | 2.384 | 2.384 | .826 | 0.001 |
| Residuals | 2728.805 | 56 | 48.729 | 48.729 | | |

### 4.6 Age and nutritional literacy

Correlation between age and nutritional literacy, provided in Table 5, was measured by running a correlational matrix. There was no significant relationship found between age and nutritional literacy. This finding indicates that the age of an individual does not influence nutritional literacy.

### 4.7 Student classification and nutritional literacy scores

Researchers finally explored the relationship between student classification (year in school) and nutritional literacy scores. The ANOVA indicated that there was a statistically significant result when comparing nutritional literacy scores and student classification. This discovery led to a Post Hoc Comparison with Tukey. This comparison, provided in Table 6, indicated that the nutrition literacy scores between senior students and sophomore students significantly differed. Students at the sophomore level scores statistically significantly lower than senior students.

**Table 5.** Is there a correlation between age and Nutritional Literacy scores?

| **Correlational Matrix** | | | |
|---|---|---|---|
| | | **Age** | **(NLS) Nutritional Literacy Score** |
| Age | Pearson's *r* | - | |
| | df | - | |
| | *p*-value | - | |
| (NLS) Nutritional Literacy Score | Pearson's *r* | 0.228 | - |
| | df | 58 | - |
| | *p*-value | 0.080 | - |

**Table 6.** Is there a correlation between student classification and Nutritional Literacy scores?

| **ANOVA- Total Correct** | | | | | | |
|---|---|---|---|---|---|---|
| | **Sum of Squares** | **df** | **Mean Square** | **F** | ***p*** | **$n^2$** |
| Student Classification | 371.249 | 2 | 185.625 | 4.102 | .022 | 0.126 |
| Residuals | 2579.684 | 57 | 45.258 | | | |
| **Post Hoc Comparisons – Student Classifications** | | | | | | |
| **Comparison** | | | | | | |
| **Student Classification** | **Student Classification** | **Mean Difference** | **SE** | **Df** | ***T*** | **Ptukey** |
| Senior | Junior | 1.000 | 2.107 | 57.000 | 0.475 | 0.883 |
| | Sophomore | 5.737 | 2.107 | 57.00 | 2.723 | 0.023 |
| Junior | Sophomore | 4.737 | 2.183 | 57.00 | 2.170 | 0.085 |

## 5. DISCUSSION

When reviewing the data, some salient features are noted. The average time to complete the survey was 16 minutes. This amount of time could have negatively impacted the persistence of individuals to complete the exam and/or provide full/thoughtful responses. Additionally, gender information was not requested/obtained on the survey. Future analysis could be beneficial when examining the relationship between self-identification of gender and ethnicity with nutritional literacy.

The majority of responding students demonstrated the likelihood of good nutritional literacy (81.6%), with 5% demonstrating the possibility of poor nutritional literacy and 13% presenting with the likelihood of poor nutritional literacy. As nurses play a critical role with patient teaching and reinforcement of nutritional goals proposed by Registered Dietitians, it is imperative that nurses attain and demonstrate nutritional literacy.

Examining the subsets measured on the survey, students perform better in the subset identifying food groups. The overall performance score on this area demonstrates knowledge of which foods are associated with specific food groups. Prerequisite nutrition courses cover this content at a knowledge, comprehension and application level well. This information should provide the nursing student with baseline knowledge of foods that impact health and wellness.

Students scored the lowest in the subset identifying nutrition and health. This information is covered in the nursing nutrition course, but acquisition of that knowledge was not demonstrated via student responses. Failure to apply this knowledge could ultimately impact the student's ability to provide robust nutritional teaching to patients.

Examining the data that provided statistical significance, it appears as if the integration of nutrition concepts in courses at the junior and senior level play a distinct role in impacting nutritional literacy. Students in this particular nursing program begin clinical rotations in the junior year and continue throughout the senior year. The researchers propose that exposure to nutrition concepts across the curriculum, especially within the clinical site, positively impacts the nursing students' ability to apply these concepts to patients in the care setting. To foster the integration of nutritional concepts across the curriculum, dedicated nutrition lessons should be identified and utilized in courses at the sophomore, junior, and senior levels.

### Limitations

Limitations of the study include the time needed to complete the survey, timing of the survey email at the beginning of the semester, visual representation of the survey on mobile devices, and the return of responses from self-identified, Caucasian females. The time needed to complete the survey as well as the timing the survey was sent could have potentially lowered the response rate. Additionally, the visual representation of the survey on a mobile device could have made selecting an answer in relation to a picture challenging. Survey results may pose difficulty when trying to relate the findings to other ethnicities and genders as the respondents were predominantly Caucasian females. Partially completed surveys were not noted, although some responses were more detailed and robust than others.

## 6. Conclusions

Given the impact of nutrition on wellness and disease prevention, it is essential that nursing students demonstrate an acceptable level of nutritional literacy. Although many nursing programs require nutrition as a prerequisite course, reinforcing that material through the lens of clinical judgment within an integrated nursing nutrition course fosters the best nutritional literacy for nursing students. This finding, along with nutritional concept exposure in the clinical setting, enforces the need to enhance nutritional literacy to best impact patient outcomes.

While nursing students have typically been exposed to nutritional concepts in both a pre-requisite nutrition course and a nursing nutrition course, additional reinforcement of these concepts across nursing curriculum is vital. Promoting the integration of nutrition concepts within a variety of courses within the nursing curriculum will assist the student to utilize clinical judgment in the application and synthesis of nutritional concepts in relation to patient health and wellness.

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## Authors contributions

Dr. Whittington and Dr. Null were responsible for study design, data collection and revision. All authors read and approved the final manuscript. Both authors contributed equally to the study.

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## Conflicts of Interest Disclosure

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Informed consent

Obtained.

## Ethics approval

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## Provenance and peer review

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## Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

## Data sharing statement

No additional data are available.



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