Nutrient Adequacy and Body Mass Index of Working College Students

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ABSTRACT

Proper nutrition is essential for human growth, development, and overall well-being, yet working college students often face unique challenges that can lead to inadequate dietary intake. This descriptive study assesses the nutrient adequacy and Body Mass Index (BMI) of 42 working students from a university in Cavite, Philippines. Nutrient adequacy, focusing on carbohydrates, proteins, and fats, was evaluated using a 3-day dietary record, while BMI was calculated based on anthropometric measurements. The results showed that most students had inadequate intakes of carbohydrates and proteins, with only fat intake meeting recommended levels. BMI analysis revealed that 74% of participants had normal weight, 14% were underweight, and 12% were overweight or obese. While no significant differences in nutrient adequacy were observed based on sex or boarding type, significant differences were found across physical activity levels, with those engaging in heavier activities exhibiting lower nutrient adequacy. These findings underscore the need for nutritional interventions tailored to the needs of working students, particularly those with high physical activity demands.

Keywords: Nutrient Adequacy, BMI, Working College Students, Physical Activity, Boarding Type

INTRODUCTION

Proper nutrition is essential for human growth, development, and overall well-being. Nutritional adequacy and Body Mass Index (BMI) are crucial measures of an individual's health status, particularly among working students who face unique challenges. Working students often struggle to balance their academic responsibilities with the demands of employment, which can lead to inadequate dietary intake and suboptimal nutritional status (Abraham, Noriega, & Shin, 2018). The pressure of juggling multiple roles can cause students to prioritize convenience and affordability over nutrition, often resulting in poor dietary choices (Patton-Lopez, Lopez-Cevallos, Cancel-Tirado, & Vazquez, 2014).

In the Philippines, malnutrition remains a significant issue. According to the 8th National Nutrition Survey conducted by the Food and Nutrition Research Institute (FNRI, 2013), approximately 10% of Filipino adults are underweight, and 30% are overweight or obese. This double burden of malnutrition reflects the global trend described by the World Health Organization (WHO, 2017), where undernutrition and overnutrition coexist, affecting millions of people worldwide. For students, especially those who work, the risk of poor nutrition is

compounded by time constraints, limited access to healthy foods, and economic factors (Das & Evans, 2014).

Despite the importance of nutrition for this population, few studies have focused on the dietary habits and nutritional status of working students. Most research on student nutrition is conducted in developed countries, with little attention paid to working students in low- and middle-income countries like the Philippines (Gorgulho et al., 2012). This study aims to address this gap by evaluating the nutrient adequacy and BMI of working students, examining differences based on sex, physical activity levels, and boarding type.

LITERATURE REVIEW

Nutrient Adequacy

Nutrient adequacy refers to the appropriate consumption of essential nutrients in sufficient amounts to meet an individual's dietary needs for optimal health (Bier et al., 2015). The nutrient adequacy of macronutrients—carbohydrates, proteins, and fats—is crucial for maintaining energy balance and supporting bodily functions. The Food and Nutrition Research Institute (FNRI, 2015) sets recommended dietary allowances for these macronutrients based on age, sex, and activity level. Carbohydrates, which provide the primary energy source for the body, should make up 55-75% of total energy intake, while proteins and fats should account for 10-15% and 15-30%, respectively (FNRI, 2015).

Inadequate intake of these macronutrients can lead to malnutrition, affecting both underweight and overweight individuals. For example, insufficient carbohydrate intake can result in fatigue and reduced cognitive function, while inadequate protein intake impairs muscle maintenance and immune function (British Nutrition Foundation, 2012). On the other hand, excessive intake of fats, particularly saturated fats, increases the risk of cardiovascular diseases (Harvard School of Public Health, 2018).

Body Mass Index (BMI)

BMI is a widely used anthropometric measure to assess nutritional status by calculating the ratio of weight to height (WHO, 2006). It provides a simple means of categorizing individuals as underweight, normal weight, overweight, or obese. BMI is commonly used in public health assessments to monitor trends in malnutrition across populations. However, it has limitations in distinguishing between body fat and muscle mass, which may lead to misclassification in certain populations, particularly athletes or individuals with high muscle mass (Centers for Disease Control and Prevention [CDC], 2017).

Globally, the prevalence of obesity has increased dramatically over the past few decades, particularly among young adults. University students are particularly vulnerable to unhealthy weight gain due to poor dietary habits, reduced physical activity, and stress associated with academic life (Peltzer et al., 2014). In contrast, some students, particularly those from low-income backgrounds or those working part-time, may face undernutrition due to limited access to food or inadequate dietary intake (Patton-Lopez et al., 2014).

Physical Activity and Nutritional Needs

Physical activity plays a critical role in maintaining a healthy body weight and supporting overall health. The World Health Organization (WHO, 2018) recommends that adults engage in at least 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity physical activity per week to maintain optimal health. However, for individuals with high physical activity levels, such as those in labor-intensive jobs, the energy and nutrient demands are significantly higher.

Yan et al. (2016) found that individuals with higher physical activity levels often have increased energy requirements, which must be met through a higher intake of carbohydrates, proteins, and fats. Failure to adjust dietary intake according to physical activity levels can lead to nutrient deficiencies and impair physical performance. This is particularly important for working students, who may not have the time or resources to properly manage their nutritional needs.

METHODS

Study Design

This research utilized a descriptive cross-sectional study design to assess the nutrient adequacy and Body Mass Index (BMI) of working college students. The study aimed to describe the dietary intake, physical activity levels, and BMI of the participants at a single point in time. The design enabled the comparison of nutrient adequacy across various groups, such as sex, boarding type (self-cook or cafeteria), and physical activity levels.

Population and Sampling

The study population consisted of 42 working students from a university in Cavite, Philippines. Participants were selected using systematic sampling from the official list of working students provided by the university's registrar's office. The inclusion criteria required that participants be at least 18 years old, currently employed while studying, and residing on campus in either self-cook or cafeteria-based dormitories. The sample included 52% females and 48% males, with a mean age of 22.1 ± 3.1 years. Exclusion criteria included students with medical conditions that could affect dietary intake or physical activity.

Data Collection and Instruments

Dietary Assessment

A 3-day dietary record was used to assess the nutrient intake of participants. This included recording all food and beverages consumed over two weekdays and one weekend day. The nutrient content of the foods consumed was calculated using the Philippine Food Composition Tables and the Food Exchange List (FNRI, 2015).

Anthropometric Assessment

Participants' weight was measured using a bio-impedance analyzer, and height was measured using a stadiometer, both calibrated to ensure accuracy. Body Mass Index (BMI) was calculated using the formula:

$$BMI = \text{Weight(kg)} / \text{Height } (m^2)$$

The BMI classification was based on World Health Organization (WHO) standards:

- **Underweight**: <18.50 kg/m²
- **Normal weight**: 18.50 – 24.99 kg/m²
- **Overweight**: 25.00 – 29.99 kg/m²
- **Obese**: ≥30.00 kg/m²

Physical Activity Assessment

Physical activity levels were assessed using the Global Physical Activity Questionnaire (GPAQ) developed by the World Health Organization (WHO, 2018). Physical activity levels were classified into sedentary (<600 MET−minutes/week), light (600–2999 MET−minutes/week), and heavy (≥3000 MET−minutes/week)

Nutrient Adequacy Calculation

Nutrient adequacy for energy, carbohydrates, proteins, and fats was assessed by calculating the percentage of the participant's intake relative to the recommended daily intake (Acceptable Macronutrient Distribution Ranges - AMDR). The formula used was:

% Nutrient Adequacy = Actual intake/required intake x 100

The resulting adequacy percentages were classified as insufficient, adequate, or excessive, based on the following ranges:

- **Carbohydrates:** 55-75% of total energy
- **Protein:** 10-15% of total energy
- **Fats:** 15-30% of total energy

Data Analysis

Data were analyzed using SPSS software. T-tests and ANOVA were employed to compare nutrient adequacy across variables such as sex, boarding type, and physical activity level. Significance was set at $p < 0.05$ for all analyses.

RESULTS AND DISCUSSION

Nutrient Adequacy of Energy-Giving Macronutrients

The nutrient adequacy for carbohydrates, proteins, and fats was assessed based on the participants' 3-day dietary records. The results, as presented in Table 1, show that the majority of students had inadequate intakes of carbohydrates and proteins. The mean adequacy for carbohydrates was 53.41%, while protein intake was 9.75%—both below the recommended levels. Fats were within the acceptable range, with a mean adequacy of 15.74%.

These findings are consistent with global research on student populations. Gan et al. (2011) reported that 77% of Malaysian university students had lower-than-recommended energy intakes, with carbohydrates being the most commonly deficient macronutrient. Similarly, inadequate protein intake has been observed in U.S. college students, with Abraham,

Noriega, and Shin (2018) highlighting the negative impact of poor dietary habits on overall academic and physical performance. Insufficient intake of carbohydrates and proteins can result in fatigue, reduced cognitive function, and impaired muscle maintenance, which are crucial for both physical health and academic success (Jéquier, 1994; British Nutrition Foundation, 2012).

Table 1

Mean Nutrient Adequacy of Working Students

Nutrient	Mean Adequacy (%)	AMDR (%)	Remarks
Energy	78.89	100	Below the RNI
CHO	53.41	55-75	Inadequate
PRO	9.75	10-15	Inadequate
FAT	15.74	15-30	Adequate

Body Mass Index (BMI) Classification

The Body Mass Index (BMI) of participants was calculated, and the classifications are presented in Figure 1. The majority of the students (74%) had a normal BMI, while 14% were underweight, and 12% were classified as overweight or obese.

This distribution reflects the "double burden of malnutrition" commonly observed in low- and middle-income countries, where both undernutrition and overnutrition are prevalent. The results align with the findings of the 8th National Nutrition Survey in the Philippines, which reported that 10% of Filipino adults were underweight and 30% were overweight or obese (FNRI-DOST, 2013). Peltzer et al. (2014) noted a similar pattern in university students across 22 countries, indicating that both underweight and overweight individuals face distinct health risks.

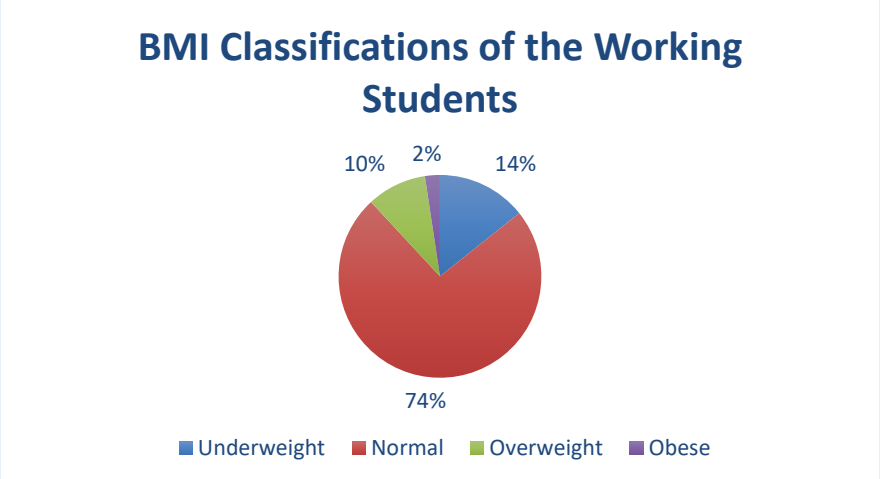

Figure 1. **BMI Classifications of Working Students**

Note: 74% were classified as normal weight, 14% as underweight, 10% as overweight, and 2% as obese.

Nutrient Adequacy and Physical Activity Levels

The nutrient adequacy of participants was also analyzed based on their physical activity levels. As shown in Table 2, students with heavier physical activity demonstrated significantly lower nutrient adequacy compared to those with sedentary or light physical activity levels. For instance, students with heavy physical activity met only 70.62% of their required energy intake, while sedentary students exceeded their energy needs, consuming 106.46%.

These results are consistent with findings by Yan et al. (2016), who observed that individuals engaged in high physical activity often fail to adjust their dietary intake to meet their energy expenditure, resulting in energy deficiency. Students with heavy physical activity likely require more energy and nutrients to support their physical demands, yet the data suggests they are not consuming adequate amounts of carbohydrates and proteins to sustain their activity levels. This mismatch between physical activity and nutrient intake could lead to fatigue, impaired physical performance, and reduced academic productivity.

Table 2
Nutrient Adequacy as Associated with Physical Activity Level

Nutrients	**Adequacy (%)**			***p* value**	***Remarks***
	Sedentary Mean±SD	Light Mean±SD	Heavy Mean±SD		
Energy % RNI	106.46±23.43	85.92±22.26	70.62±18.99	**.002**	**s**
CHO % of TER	69.86±13.64	58.87±16.84	53.41±16.45	**.008**	**s**
PRO % of TER	13.07±3.60	10.44±2.89	8.82±3.00	.018	**s**
Fats % of TER	23.54±8.00	16.61±5.96	13.87±5.12	**.005**	**s**

s = significant, **bold** = Significant differences were measured by the t-test wherein $p < 0.01$

Nutrient Adequacy and Boarding Type

When comparing students based on boarding type (self-cook versus cafeteria), the study found no significant difference in nutrient adequacy between the two groups. However, self-cook students tended to have a slightly higher intake of carbohydrates and fats, while cafeteria students had higher protein adequacy. Table 3 presents the nutrient adequacy based on boarding type.

Table 3
Nutrient Adequacy of the Working Students When Associated with Boarding Type

Nutrients	**Adequacy (%)**		***p value***	**Remarks**
	Cafeterian Mean±SD	Self-Cook Mean±SD		
Energy				
% RNI	76.15±24.20	81.16±22.85	.495	ns
Carbohydrates				
% of TEA	49.66±16.53	56.50±16.08	.183	ns
Protein				
% of TEA	10.12±3.38	9.44±3.26	.512	ns
Fats				
% of TEA	16.37±6.35	15.22±6.50	.568	ns

ns = not significant

Both groups had overall inadequate intakes for most macronutrients, but the differences between them were not statistically significant. This finding suggests that the choice of boarding type may not significantly affect nutrient adequacy, though the limited access to diverse foods, particularly protein-rich foods, may be a contributing factor in both groups.

The findings of this study reveal that working students face significant challenges in meeting their daily nutritional needs, particularly for carbohydrates and proteins. This is consistent with the literature, which suggests that college students, particularly those balancing work and study, often make poor dietary choices due to time constraints, economic limitations, and lack of access to healthy food options (Patton-Lopez et al., 2014).

The significant differences in nutrient adequacy between physical activity levels underscore the importance of tailoring nutritional interventions to meet the needs of more physically active students. Those with heavy physical activity require greater energy intake but are currently not meeting their needs, which could impact both their physical performance and overall health (WHO, 2018). Additionally, while BMI results show that the majority of students fall within the normal weight range, the presence of underweight and overweight individuals points to the need for targeted interventions to address both undernutrition and overnutrition.

Comparison with Global Trends

The results of this study reflect global trends in student nutrition. Numerous studies across various countries have documented the inadequate intake of macronutrients among university students, particularly among those balancing work and academic commitments. For example, Gorgulho et al. (2012) reported similar nutrient deficiencies in Brazilian students, while Abraham et al. (2018) found that U.S. college students often struggle to meet their daily nutritional requirements due to busy schedules and limited access to healthy food.

The findings of this study add to the growing body of literature on the nutritional challenges faced by university students in low- and middle-income countries. Given the importance of proper nutrition for academic success, physical health, and overall well-being, these results underscore the need for universities to provide more support for working students, particularly in ensuring access to affordable, nutritious food.

CONCLUSION, IMPLICATION, SUGGESTION, AND LIMITATIONS

Conclusion

This study has provided valuable insights into the nutrient adequacy and Body Mass Index (BMI) of working college students, a population that faces unique nutritional challenges due to the combined demands of work and academic life. The results indicated that the majority of students have inadequate intake of carbohydrates and proteins, although their fat intake is within the recommended range. The BMI classifications revealed a predominance of normal weight students, but also a notable presence of both underweight and overweight individuals, reflecting the double burden of malnutrition. Moreover, students with higher physical activity levels demonstrated significantly lower nutrient adequacy, underscoring the need for tailored dietary interventions.

Implications

The findings of this study have several important implications for public health and university policies. First, the inadequate nutrient intake observed in working students, particularly in carbohydrates and proteins, suggests a risk of energy deficiency that could negatively affect their academic performance, physical health, and overall well-being. This highlights the need for universities to provide more accessible nutritional education and support services for students, especially those balancing work and study.

For students with higher physical activity levels, there is a clear need for increased dietary support to ensure that their energy needs are being met. Universities could implement targeted interventions, such as personalized meal plans or nutrition counseling, to help these students maintain a balanced diet that supports both their physical and academic demands.

Additionally, the presence of both underweight and overweight students reflects a need for a dual approach to address the double burden of malnutrition. Public health initiatives should aim to ensure that all students, regardless of their weight status, have access to the resources and education needed to achieve and maintain a healthy nutritional status.

Suggestions

Based on the study's findings, several suggestions are offered for future action:

1. Nutritional Education Programs: Universities should develop comprehensive nutrition education programs that teach students about balanced diets, meal planning, and the importance of meeting macronutrient requirements, especially for those with higher physical activity levels.

2. Improved Access to Healthy Food: Universities can improve access to affordable, healthy food options on campus, especially for students living in dormitories who may rely on cafeteria meals. Partnerships with local food providers or initiatives like student-run co-op kitchens could help students make healthier food choices.
3. Targeted Nutritional Support for Working Students: Universities could provide specific support for working students, such as flexible dining plans or take-home meal options, to accommodate their schedules and ensure they are able to meet their nutritional needs despite time constraints.
4. Health Monitoring Programs: Regular health assessments, including BMI measurements and dietary intake evaluations, could help identify students at risk of malnutrition, whether due to undernutrition or overnutrition. Early interventions could then be offered to address these risks.
5. Research Expansion: Future research should include larger, more diverse populations across multiple universities to provide a broader understanding of the nutritional challenges faced by working students. Investigating the relationship between specific types of employment and nutrient intake could also provide more detailed insights.

Limitations

This study had several limitations that should be considered when interpreting the results. First, the small sample size of 42 students limits the generalizability of the findings. A larger sample across multiple universities would provide a more comprehensive view of the nutritional status of working students.

Second, the reliance on self-reported dietary intake through a 3-day food record introduces the potential for recall bias, where participants may underreport or overreport their food consumption. Future studies could benefit from using more objective measures of dietary intake, such as mobile apps or direct observation.

Third, the study was conducted at a single point in time, providing a snapshot of the participants' nutritional status. A longitudinal study that tracks changes in dietary intake and BMI over time would offer more insights into how these factors evolve throughout the school year, particularly during periods of high academic or work-related stress.

Finally, while this study focused on working students, future research could explore the differences between students working in physically demanding jobs versus sedentary employment, which may have varying impacts on their dietary needs and nutritional status.

REFERENCES

Abraham, S., Noriega, B. R., & Shin, J. Y. (2018). *College students eating habits and knowledge of nutritional requirements*. Journal of Nutrition and Human Health, 2(1), 13-17. https://doi.org/10.35841/nutrition-human-health.2.1.13-17

Bier, D. M., Derelian, D., German, J. B., Katz, D. L., & Maughan, R. J. (2015). *Nutritional issues in college students: A call for nutrition awareness and guidance in higher education*. Nutrition Today, 50(1), 14-21. https://doi.org/10.1097/NT.0000000000000072

British Nutrition Foundation. (2012). *Nutrient requirements*. https://www.nutrition.org.uk/attachments/article/234/Nutrient_requirements.pdf

Centers for Disease Control and Prevention. (2017). *About adult BMI*. https://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html

Das, M., & Evans, R. (2014). *The role of employment in student diet and health*. Public Health Reports, 129(1), 35-44. https://doi.org/10.1177/003335491412900106

Food and Nutrition Research Institute - Department of Science and Technology (FNRI-DOST). (2013). *8th National Nutrition Survey: Philippines*. https://www.fnri.dost.gov.ph/images/sources/NutritionFactsandFigures2013.pdf

Food and Nutrition Research Institute - Department of Science and Technology (FNRI-DOST). (2015). *Philippine Dietary Reference Intakes 2015*. https://www.fnri.dost.gov.ph/images/images/philippine_dietary_reference_intakes_pdr.pdf

Gan, W. Y., Mohd Nasir, M. T., Zalilah, M. S., & Hazizi, A. S. (2011). Disordered eating behaviors, depression, anxiety and stress among Malaysian university students. College Student Journal, 45(2), 296-310.

Gorgulho, B., Marchioni, D. M., Conceição, A. B., Steluti, J., Mussi, M. H., & Fischer, F. M. (2012). *Quality of diet of working college students*. Work, 41(1), 5806-5808. https://doi.org/10.3233/WOR-2012-0958-5806

Harvard School of Public Health. (2018). *The nutrition source: Fats and cholesterol*. https://www.hsph.harvard.edu/nutritionsource/what-should-you-eat/fats-and-cholesterol/

Jéquier, E. (1994). *Carbohydrates as a source of energy*. The American Journal of Clinical Nutrition, 59(3), 682S-685S. https://doi.org/10.1093/ajcn/59.3.682S

Patton-Lopez, M. M., Lopez-Cevallos, D. F., Cancel-Tirado, D. I., & Vazquez, L. (2014). *Prevalence and correlates of food insecurity among students attending a midsize rural university in Oregon*. Journal of Nutrition Education and Behavior, 46(3), 209-214. https://doi.org/10.1016/j.jneb.2013.10.007

Peltzer, K., Pengpid, S., Samuels, T. A., Ozcan, N. K., Mantilla, C., Rahamefy, O. H., Gasparishvili, A., & Gasparishvili, A. (2014). *Prevalence of overweight/obesity and its associated factors among university students from 22 countries*. International Journal of

Environmental Research and Public Health, 11(7), 7425-7441. https://doi.org/10.3390/ijerph110707425

World Health Organization (WHO). (2006). *BMI classification*. http://apps.who.int/bmi/index.jsp?introPage=intro_3.html

World Health Organization (WHO). (2017). *Double burden of malnutrition.* https://www.who.int/nutrition/double-burden-malnutrition/en/

World Health Organization (WHO). (2018). *Global Physical Activity Questionnaire (GPAQ)*. https://www.who.int/ncds/surveillance/steps/GPAQ_EN.pdf

Yan, Y., Drenowatz, C., Hand, G. A., Shook, R. P., Hurley, T. G., Hébert, J. R., & Blair, S. N. (2016). *Is nutrient intake associated with physical activity levels in healthy young adults?* Public Health Nutrition, 19(11), 1983-1989. https://doi.org/10.1017/S1368980015003717