Nutritional status, eating habits, and physical activity as predictors of English and Mathematics performances of 7th Graders

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Abstract

Mathematics and English are the two most important subjects that learners should prioritize. Mathematics enhances analytical reasoning, problem-solving, and critical thinking skills that are significant across various fields and real-life situations, while English fosters strong communication skills, which are vital for understanding instructions, expressing thoughts, and succeeding in almost every subject and career path. This study explored the predictive effects of nutritional status, eating habits, and physical activity on English and Mathematics performance among 565 seventh-grade students selected through stratified cluster random sampling from two schools in Cabuyao City, Laguna, Philippines, during the 2024–2025 school year. It addressed the gap by examining the mediating role of eating habits in the relationship between physical activity and academic performance in Mathematics and English. The study used valid and reliable instruments and applied multiple regression bootstrap technique, and mediated linear regression bootstrap technique to analysze data. The results showed that most respondents were underweight, had satisfactory English and Mathematics performance, and reported high perceived levels of eating habits and physical activity. Regression analysis revealed that poor eating habits negatively affect performance in both subjects, while increased physical activity improves English scores. Eating habits were found to mediate these effects more strongly in Mathematics (60.9%) than in English (40.1%) and acted as a suppressor variable between physical activity and academic performance. The results have significant implications for English and Mathematics teachers, parents and guardians, organizational supervisors, policymakers, and future researchers.

Keywords: *nutritional status, eating habits, physical activity, English, mathematics, academic performances*

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1. Introduction

Mathematics and English are two of the most important subjects that learners should prioritize. Mathematics enhances analytical reasoning, problem-solving, and critical thinking skills that are significant across various fields and real-life situations, while English fosters learners' strong communication skills, which are vital for understanding directions, expressing thoughts, and succeeding in almost every subject and career track. Wang and Abdullah (2024) indicated that mathematics cultivates analytical reasoning and problem-solving skills essential across disciplines and real-life contexts.

However, the current performance of Filipino learners in Mathematics and English is alarming, as the Philippines ranked among the lowest 10 out of 81 countries in reading comprehension, mathematics, and science. According to Hernando-Malipot (2023), the DepEd Forum centered on the 2022 PISA reported that the NCR, CAR, and Region IV-A had the highest percentage of learners who reached only the lowest level of expertise in reading comprehension, mathematics, and science. Furthermore, junior high school students in Cabuyao City scored below the mastery threshold in Mathematics (49%) and English (62%). Seventh graders averaged 56.96, eighth graders 60.1, ninth graders 65.72, and tenth graders 61.72 in 2019–2020. In 2023–2024, students at Gulod National High School (GNHS) and Mamatid National High School (MNHS) performed poorly in Mathematics and English, scoring below 55% in diagnostic tests and quarterly exams. This relates to the study of Munda et al. (2025), which found that mathematics performance became significant only through students' mastery of math-specific vocabulary. Given the consistently low performance of junior high school students in Cabuyao City in both Mathematics and English, there is a pressing need to investigate the underlying factors influencing academic performance.

Numerous studies have found associations between academic performance and nutritional status (Khan et al., 2022; López-Gil et al., 2022; Cristuta et al., 2019; Munda & Del Pilar, 2023; Doustmohammadian et al., 2022; Beredo & Aceron, 2019; Mukhamedzhanov et al., 2023), eating habits (Reuter et al., 2020; Alqahtani et al., 2020; Puciato et al., 2022; Olfert et al., 2022; James et al., 2023), and physical activity (Chacón-Cuberos et al., 2020; Resaland et al., 2021; Sember et al., 2020; Redondo-Flórez, 2023). Despite these findings, limited research exists on how these factors predict academic performance and the mediating role of eating habits between physical activity and academic achievement in English and

Mathematics, while also proposing an action plan to help educators enhance student performance in these subjects.

This study aligns with the DepEd's MATATAG agenda, which emphasizes student well-being and holistic education. By investigating non-academic predictors of learning success, the research aimed to inform targeted interventions, policies, and comprehensive support systems to enhance learning outcomes in English and Mathematics. The findings will help educators, administrators, and policymakers create programs that improve both academic achievement and overall student well-being in the Philippine educational context.

The general objective of this study was to determine whether nutritional status, eating habits, and physical activity predict English and Mathematics performance. Specifically, the study aimed to describe the nutritional status; the level of performance in English and Mathematics; the perceived level of eating habits in terms of healthy eating cognition, dietary restriction, diet superiority, and social impairment; and the level of physical activity of the respondents in terms of occupation, transportation, domestic activity, and leisure time. This study also explored the mediating effect of eating habits in the relationship between physical activity and academic performance in Mathematics and English among seventh graders in the Philippine junior high school context. Finally, the study aimed to propose an action plan to improve the English and Mathematics performance of seventh-grade students in the Philippine junior high school context.

2. Literature Review

2.1. Theoretical Framework

Various learning theories explain the effect of food on students' learning ability. Maslow's hierarchy describes the body's need for food to maintain homeostasis (Maiki, 2018). This aligns with the brain-based learning theory by Caine and Caine, cited by Cox (2020), emphasizing brain function, stress reduction, balanced diet, exercise, drug education, and health factors (Caine & Caine, 1990). Each student's learning is based on brain and physical development, making age an inappropriate sole basis for success. Jensen (2020) found that physical activity affects brain chemistry, enhancing learning by increasing attention, memory, and neurogenesis. Exercise boosts memory by increasing brain-derived neurotrophic factor (BDNF) and improves student behavior. Hence, this study hypothesizes that nutritional status, eating habits, and physical activity predict English and Mathematics performance.

2.2. Nutritional Status

Khan et al. (2022) discovered that academic performance is significantly and positively correlated with a healthy diet. Hence, implementing a healthy diet daily enhances the academic performance of students. Furthermore, López-Gil et al. (2022) found a significant positive correlation between academic achievement and dietary patterns wherein consumption of breakfast positively predicted academic achievement. Cristuta et al. (2019) also discovered that kids who ate a healthy diet were more likely to excel academically, implying that diet affected a Filipino child's intellectual achievement.

In another study, Munda and Del Pilar (2023) identified a correlation between nutrition literacy and dietary patterns, as well as dietary patterns and academic achievement in mathematics. Based on the positive correlation observed between dietary patterns and mathematical achievement, their research concludes that students' academic performance is substantially linked by their consumption of nourishing foods. Meanwhile, Doustmohammadian et al. (2022) claimed that the skills domain, which includes interactive food and nutrition literacy, food choice literacy, and food label literacy, is significant in predicting healthy eating behavior, academic success, and weight status in school-age children. Moreover, Beredo and Aceron (2019) evaluated the nutritional condition, underlying causes, and effects of malnutrition on the academic performance of grade 8 students with wasted and severely spent BMIs. The relationship between eating habits, illiteracy, and academic achievement could have been more beneficial. The children's eating habits and reading skills had a negative impact on their academic performance. Mukhamedzhanov et al. (2023) indicated that students who participated in the nutrition education program demonstrated favourable attitudes and behaviors toward nutrition, as well as superior athletic performance and attitudes, compared to the control group students who did not undergo any experimental procedures.

2.3. Eating Habits

Reuter et al. (2020) found a positive correlation between meal frequency and academic performance, noting that students who ate breakfast at least five times per week reported higher GPAs than those who ate breakfast less frequently. Alqahtani et al. (2020) also identified a strong association between eating habits and academic success, emphasizing that regular breakfast consumption was linked to improved performance, while frequent fast-food intake

had varying effects depending on other lifestyle factors. Puciato et al. (2022), through cross-national research, highlighted those students with regular consumption of fruits and vegetables reported better academic performance and engagement. In another study, Olfert et al. (2022) explored the impact of the pandemic on student lifestyles, revealing that increased food intake due to stress and boredom, combined with reduced physical activity, led to lower motivation and academic difficulties.

2.4. Physical Activity

A systematic literature review by James et al. (2023) found that academic performance increased with moderate-to-intense physical activity of 90 minutes or more per week. The results of the study provide evidence that engaging in physical activity does not have a negative impact on academic performance but rather has the potential to improve it. Additionally, Chacón-Cuberos et al. (2020) found that increased levels and intensity of physical activity among children and preadolescents were linked to better academic performance, especially in mathematics, due to improved cognitive functions like concentration and attention through gross motor activities. Resaland et al. (2021), showed that 120 minutes of weekly physical activity over nine months led to notable gains in reading and numeracy skills among 14-year-olds compared to a control group.

According to Sember et al. (2020), physical activity interventions significantly enhanced academic achievement, particularly when the activities were of moderate to high intensity and lasted over six weeks. The qualifications of those delivering the interventions also played a role, better outcomes were associated with more professionally trained staff. Redondo-Flórez (2023) reinforced these findings, concluding that physical activity supports brain development and overall health, and thus is a key factor in improving academic performance. Therefore, programs that integrate physical activity and proper sleep in educational settings are highly important.

2.5. Mediating Role of Eating Habits

Recent research highlights that eating habits may mediate the relationship between physical activity and academic performance. Physical activity not only benefits physical health but also promotes healthier dietary behaviors, which in turn support better academic outcomes. For instance, Joo et al. (2019) observed that students who began aerobic exercise programs,

even without dietary counseling, naturally adopted healthier eating patterns, such as increased consumption of fruits, vegetables, and reduced intake of fried and sugary foods. Improved eating behaviors contribute to the positive impact of physical activity on academic achievement (Visier-Alfonso et al., 2022). Food and nutrition literacy fosters healthier food choices, which are associated with stronger academic performance among children (Sadeghi et al., 2022). This is supported by López-Gil et al. (2022) who found that teens from countries who frequently ate fruits, vegetables, and shared family meals reported better academic performance. These students were often more physically active, reinforcing the idea that physical activity fosters healthy eating, which subsequently supports scholastic success.

Despite a full-bodied body of work connecting nutrition, diet, and exercise to academic performance, important gaps remain. First, much of the existing research treats nutritional status, eating habits, and physical activity in isolation rather than investigating their combined predictive power. Second, studies to date have largely focused on general measures of "academic performance" or on subjects like mathematics, reading, or numeracy in aggregate, few have disaggregated performance in key language and quantitative domains. Finally, there is scant evidence on how these lifestyle factors operate specifically among early adolescent learners, such as 7th grader students, whose developmental transitions may render them particularly sensitive to diet and activity patterns. To address these gaps, the present study investigates how nutritional status, eating habits, and physical activity jointly predict achievement in two foundational subjects, English and Mathematics, among 7th graders.

3. Methodology

3.1. Research Design

This study used a quantitative method of descriptive-correlational and explanatory designs. The descriptive design explained nutritional status, eating habits, and physical activity, while the correlational explanatory design tested the prediction of nutritional status, eating habits, and physical activity on English and Mathematics performances, and the mediating effect of eating habits between physical activity and academic performances. This research design is rooted in the brain-based learning theory (Caine & Caine, 1990), which stresses that health factors (i.e., nutritional status, eating habits, and physical activity) are important to students' learning experience.

3.2. Participants of the Study

The researchers ascertained the sample size using Power Analysis via the G Power application to ensure the study's statistical rigor. With a 0.05 probability of error, a 0.95 power, and a 0.15 slope (effect size), the computed minimum sample size was 565 individuals. This sample size supports adequate power to detect meaningful relationships among the variables in a multiple regression framework, enhancing the reliability of the findings. The schools were selected due to their large and diverse population of 7th grader students, which allowed for adequate representation of early adolescents from varying socioeconomic and demographic backgrounds. The selection also considered the schools' accessibility, administrative support for research activities, and their alignment with the DepEd curriculum, ensuring consistency in instructional delivery for English and Mathematics. Using stratified cluster random sampling methods, 332 and 233 7th grader students from two public schools in Laguna, Philippines were chosen as participants.

3.3. Instrumentation and Data Gathering Process

The instrument was composed of three parts. The first part gathered data on the respondents' demographic profile, specifically weight and height, which were used to determine Body Mass Index and Nutritional Status. It also included the participants' self-reported first-quarter grades in English and Mathematics. The second part gathered data eating habits, while the third part gathered data on their physical activity. The eating habits instrument was adapted from Mohammed Halim et al. (2020), and the physical activity instrument was adapted from Booth (2015) and Del Pilar (2023). A 4-point Likert scale was used to measure the respondents' perceived eating habits and physical activity. The instruments underwent convergent validity testing through Average Variance Extracted (AVE) and internal consistency testing through Cronbach's Alpha Analysis. Validation results showed that the instruments on eating habits and physical activity were valid with respect to convergent validity (AVE>0.50). Meanwhile, Cronbach's alpha revealed that eating habits (a=0.816, 21 items) and physical activity (a=0.749, 10 items) were reliable with respect to internal consistency.

The English and Mathematics performances were marked applying the following hierarchy: 90-100=Outstanding, 85-89=Very satisfactory, 80-84=Satisfactory, 75-79=Fairly satisfactory, and below 75=did not meet expectations. In addition, the reference scale on eating

habits and physical activity were categorized as follows: 3.26 - 4.00=Very High Level, 2.51 - 3.25=High Level, 1.76 - 2.50=Low Level, and 1.00 - 1.75=Very Low Level.

3.4. Data Analysis

The study used frequency and percentage to describe the nutritional status based on the body mass index of the students. Mean and standard deviation were used to describe the perceived eating habits, physical activity, and English and Mathematics performances of the respondents. Multiple linear regression bootstrap technique was used to evaluate if nutritional status, eating habits, and physical activity predict the level of English and Mathematics performances. Mediated linear regression bootstrap technique was used to test the mediating effect of eating habits in the relationship between physical activity and academic performances in Mathematics and English. The bootstrap technique is usually employed when the data are not normally distributed. According to University of Virginia Library (2025), it allows for more robust statistical inference without the need for normality if the residuals are non-normal, the bootstrap method can still provide valid estimates of standard errors and confidence intervals by resampling the observed data. A framework was presented after performing the mediated regression analyses. Lastly, the study utilized the Jamovi software version 2.5.4 (The Jamovi Project, 2024; R Core Team, 2023) in analyzing the data.

3.5. Research Ethics

The researcher asked permission from the superintendent and school head to conduct the survey. Upon endorsement, a request letter was sent to the school heads concerning data gathering. Informed consent was secured from parents and guardians, and an assent form was prepared for respondents, with participation being voluntary. All data were kept confidential to the full extent of the law and used only for this study's purpose, where all the responses were anonymized by removing any personally identifiable information before analysis. Using Google Forms, the survey link was sent through Facebook Messenger with the help of school heads and teacher-advisers, ensuring the correct implementation of the random sampling technique.

4. Findings and Discussion

Table 1 presents the nutritional status of students based on their Body Mass Index (BMI).

Table 1

The nutritional status of the students based on their Body Mass Index

Nutritional Status	Frequency	Percentage	Rank
Underweight	304	53.8	1
Normal	202	35.8	2
Overweight	37	6.5	3
Obese	22	3.9	4

The findings indicate that most students are categorized as either underweight or within the normal weight range. Notably, 53.8% of the respondents are identified as underweight. The next largest group, comprising 35.8%, falls within the normal weight range, which is typically regarded as healthy. A smaller segment, 6.5%, is classified as overweight, while 3.9% are categorized as obese.

The result suggests that a considerable number of students may not be achieving their ideal weight for optimal health. This information highlights that although most students are either underweight or of normal weight, there remains a concerning minority who are dealing with weight-related health issues, whether from being obese. It is similar to the study of Cristuta et al. (2019), who found that students with inadequate nutrition, particularly those who are underweight, tend to experience decreased cognitive function and lower academic achievement. Meanwhile, the study of Beredo and Aceron (2019) found that most of the students are categorized as wasted or underweight.

Table 2 shows the data of English and Mathematics performance levels of the respondents.

Table 2

The level of English and Mathematics performances

Academic Performance	Mean	SD	Verbal Interpretation
Performance in Math	83.3	5.93	Satisfactory
Performance in English	82.3	5.31	Satisfactory

Note: 75-79 Fairly Satisfactory; 80-84 Satisfactory; 85-89 Very Satisfactory; 90-100 Outstanding

It indicates that both subjects demonstrate satisfactory academic results. In Mathematics, the respondents' average score is 83.3 (SD=5.93), while the average score is slightly lower at 82.3 (SD=5.31) in English. Overall, both subjects exhibit similar patterns, with most respondents performing at a satisfactory level.

The results suggest that most students achieved reasonably well, with only minor differences in their scores in Mathematics, while the respondents have generally satisfactory performance with little variation in English. Their overall performance suggests a steady grasp of the learning in both disciplines. This result is aligned with Munda and Del Pilar (2023), who explored the high school students' level of eating habits, nutrition literacy, mathematics performance and the interplay among them. Also, Bordbar et al. (2025) support the results that academic performance was positively linked to academic identity, positive excitement, and enthusiasm, and negatively to negative excitement.

Table 3 illustrates data on the perceived eating habits of the respondents, highlighting various aspects of their eating behaviors.

Table 3

The level of students' eating habits

Variable	Mean	SD	Verbal Interpretation
Healthy Eating Cognitions	2.49	0.48	Low Level
Dietary Restriction	2.62	0.63	High Level
Diet Superiority	2.74	0.46	High Level
Social Impairment	2.57	0.53	High Level
Overall Eating Habits	2.61	0.40	High Level

*Note:*3.26-4.00 Very High Level; 2.51-3.25 High Level; 1.76-2.50 Low Level; 1.00-1.75 Very Low Level

The mean score for healthy eating cognitions is 2.49, (SD=0.48), indicating a low level of awareness among the students. In contrast, the scores for dietary restriction, diet superiority, and social impairment are higher, reflecting a more favorable perception in these areas. Specifically, dietary restriction has a mean of 2.62 (SD= 0.63), diet superiority has a mean of 2.74 (SD=0.46), and social impairment has a mean of 2.57 (SD=0.53), all categorized as high levels. Overall, the students show a high level of perceived eating habits, with an overall mean score of 2.61 (SD=0.40), suggesting that while they may not prioritize healthy eating cognition, they generally view their eating habits more positively.

The higher scores in dietary restriction, diet superiority, and social impairment imply that respondents recognize their dietary habits as systematic, properly or nutritionally greater, and slightly distracting to their social relations. This mirrors a cultural or psychological preference toward strict dietary control and positive self-assessment of eating behaviors. This result is also consistent with Munda and Del Pilar (2023) that the junior high school students' perceived eating habits reached high levels and there was a significant difference in the students' eating habits with respect to their age categories. Furthermore, Bordbar et al. (2025) found that academic identity, positive and negative academic excitement, and academic enthusiasm together significantly predict students' academic performance in a cross-sectional study in a developing country. In relation to this, the findings suggest that while respondents show low awareness of healthy eating, they perceive their dietary restrictions, diet superiority, and social eating habits positively, indicating an overall favorable view of their eating behaviors.

The respondents' physical activity levels, shown in Table 4, display a range of engagements across various activities.

Table 4

The level of students' physical activity

Variable	Mean	SD	Verbal Interpretation
School-related Occupation	3.05	0.56	High Level
Transportation	2.76	0.72	High Level
Domestic	2.79	0.60	High Level
Leisure Time	2.87	0.61	High Level
Overall Physical Activity	2.87	0.47	High Level

Note: 3.26-4.00 Very High Level; 2.51-3.25 High Level; 1.76-2.50 Low Level; 1.00-1.75 Very Low Level

For school-related occupation, the mean score is 3.05 (SD=0.56), indicating a high level of physical activity, which suggests that the school-related tasks of the students involve high physical movement. Also, the students got high levels of physical activity in the areas of transportation (2.76±0.72), domestic (2.79±0.60), and leisure time (2.87±0.61) reflect high levels of physical activity. Overall, the students exhibit a high level of physical activity, with an overall mean score of 2.87 (SD=0.47), interpreted as High Level. This indicates that their

physical activity is generally high in school-related occupations, transportation, domestic, and leisure contexts.

The high levels of physical activity observed in transportation, domestic, and leisure time domains indicate that the students involve in functional routines included into daily practices. These results emphasize that intermediations need not aim only on conventional exercise but can leverage existing habits across diverse life domains to develop population health outcomes. This emphasizes the significance of advocating multifaceted methods to physical activity in public health strategies. It contrasts with the result of the study of James et al. (2023) that examined how physical exercise affects children's academic performance. The review of 19 studies involved 6788 individuals. The study revealed that the participants of the studies fell into different categories such as moderate-intensity physical activity, high-intensity physical activity, and physical exercise lessons.

Table 5 displays the test of prediction of nutrition status, eating habits, and physical activity on the level of English performance of the respondents.

Table 5

Test of prediction of nutrition status, eating habits, and physical activity on the level of English performance

Predictor	B	SE	t	P-value
Intercept	87.074	1.87	46.540	< .001
Nutrition Status	-0.060	0.04	-1.370	0.170
Eating Habits	-2.916	0.58	-4.990	< .001
Physical Activity	1.370	0.51	2.710	0.007

Note: R^2=0.046, Significant if p<0.05, DV=English performance

Multiple Linear Regression bootstrap technique revealed that nutrition status, eating habits, and overall physical activity significantly predict students' English performance. The result showed eating habits as the most influential predictor of students' English performance *(β=-2.92, SE=0.58, p<0.001)*, followed by physical activity *(β=1.37, SE=0.51, p=0.007)*. Meanwhile, nutrition status had no significant effect *(p=1.70)*. The r^2 of 0.046 indicates that the predictors contributed a 4.6% variance to students' English performance, with a small effect size (0.048). This implies that nutritional status, eating habits, and physical activity collectively explain only a small portion of the variance in English performance, while other

unidentified factors likely play a larger role. In summary, the estimated regression model is as given below:

English performance = 87.07 - 0.06*Nutrition Status – 2.92*Eating Habits + 1.37*Physical Activity

The regression model sheds light on how nutrition status, eating habits, physical activity, and English performance are interconnected among students. With a negative coefficient of -2.92, this indicates that poor eating habits correlate with lower English performance. Specifically, for every unit increase in poor eating habits, the English performance score drops by 2.92 points, assuming other factors remain unchanged. The significance of this predictor ($p < 0.001$) highlights a very strong association. Additionally, physical activity also plays a significant role in predicting English performance. The positive coefficient of 1.37 suggests that greater levels of physical activity are linked to improved English performance. For each unit increase in physical activity, the English performance score rises by 1.37 points, while controlling for other variables. The p-value of 0.007 confirms that this relationship is statistically significant. Conversely, nutritional status does not significantly impact English performance. The coefficient of -0.06 is minimal, and the p-value greater than 0.05 indicates that this predictor does not meaningfully contribute to explaining variations in English performance. Thus, nutritional status seems to be less critical in predicting students' English performance according to this model.

The findings suggest that improving students' eating habits and promoting physical activity can enhance English performance, while nutrition status is less influential. This aligns with brain-based learning theory (Caine & Caine, 1990), highlighting the role of diet and exercise in learning. It also supports Doustmohammadian et al. (2022), who emphasized the importance of nutrition literacy for academic success, López-Gil et al. (2022), who linked breakfast consumption to better achievement, and James et al. (2023), who found physical activity can boost academic performance.

Table 6 demonstrates the test of prediction of nutrition status, eating habits, and physical activity on the level of Mathematics performance of the respondents.

Multiple Linear Regression bootstrap technique uncovered that eating habits were the only influential predictor *(β=-2.05, SE=0.66, p=0.002)*, while physical activity *(p=0.495)* and nutritional status *(p=0.871)* had no significant effect on students' Mathematics performance.

Table 6

Test of prediction of nutrition status, eating habits, and physical activity on the level of Mathematics performance

Predictor	B	SE	t	P-value
Intercept	87.33	2.12	41.230	< .001
Nutritional Status	0.01	0.05	0.162	0.871
Eating Habits	-2.05	0.66	-3.102	0.002
Physical Activity	0.39	0.57	0.683	0.495

Note: R^2=0.0175, Significant if $p<0.05$, DV=Mathematics performance

The r^2 of 0.017 implies that the predictors contributed a 1.8% variance to students' Mathematics performance, with a small effect size (0.017). In other words, the practical impact of eating habits is limited, and other unmeasured factors likely have a much greater influence. This means that interventions focused solely on improving eating habits may not result in substantial improvements in mathematics performance, although they may contribute modest benefits. In summary, the estimated regression model is as given below:

Mathematics performance = 87.33 + 0.01*Nutrition Status – 2.05*Eating Habits + 0.39*Physical Activity

The results from the multiple linear regression using the bootstrap technique to predict Mathematics performance reveal important insights into how nutrition status, eating habits, and physical activity relate to students' performance in Mathematics. Notably, eating habits stands out as the only significant predictor of Mathematics performance. The negative coefficient (-2.05) indicates that poor eating habits correlate with lower Mathematics scores. Specifically, for every unit increase in poor eating habits, students' Mathematics performance drops by 2.05 points, assuming other factors remain constant. The p-value (0.002) confirms that this relationship is statistically significant. In contrast, nutrition status shows a very small coefficient (0.01) and a p-value greater than 0.05, suggesting it does not significantly affect Mathematics performance. Similarly, physical activity also has a minimal coefficient (0.39) and a p-value above 0.05, indicating it does not play a significant role in predicting Mathematics performance in this analysis. This clearly highlights that eating habits is the most crucial factor affecting students' Mathematics performance. Enhancing students' eating habits could lead to improved performance in Mathematics. Given that nutrition status and physical activity do not significantly influence Mathematics performance in this model, prioritizing

improvements in eating habits appears to be the most effective strategy for enhancing academic outcomes in this area.

This outcome supports the brain-based learning theory (Caine & Caine, 1990), emphasizing the importance of students' eating habits for learning success. It also aligns with Beredo and Aceron (2019), who found that poor eating habits and literacy negatively affected academic performance among grade 8 students. However, it contrasts with Redondo-Flórez (2023), who highlighted physical activity as a key factor for brain development and academic achievement. Their findings stress the need for programs targeting sleep, physical activity, and nutrition to improve academic outcomes.

Figure 1 demonstrates the framework on the mediating effect of eating habits in the relationship between physical activity and academic performances in Mathematics and English, where broken line indicates non-significance while solid line represents significant effect.

Figure 1

Framework on the mediating effect of eating habits in the relationship between physical activity and academic performances in Mathematics and English
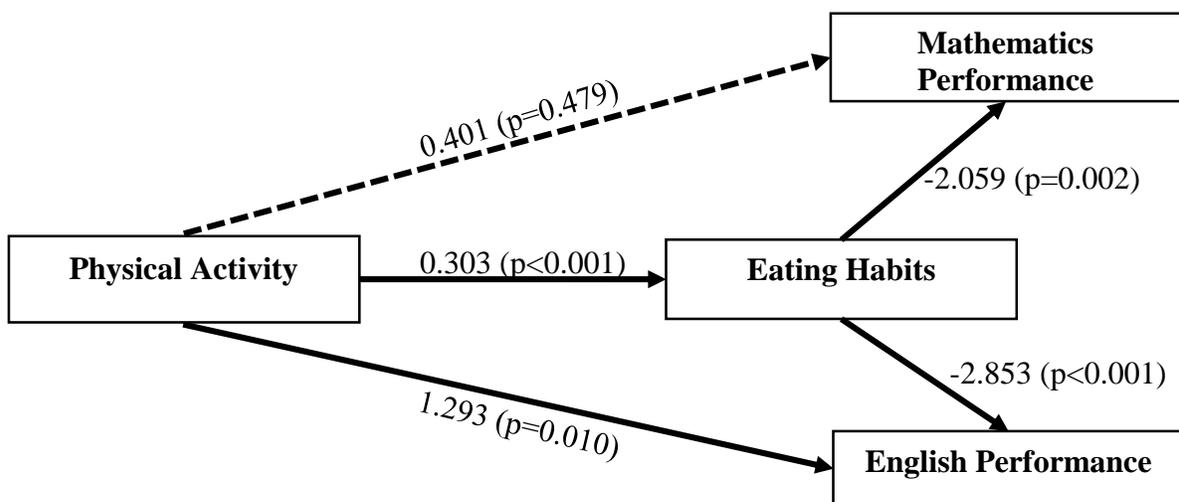
The outcomes of Mediated regression bootstrap technique display that the direct effect from eating habits on English *(β=-2.853, p<0.001)* and Mathematics *(β=-2.059, p=0.002)* performance was negative and significant suggesting that the respondents scoring lower on eating habits are more likely to obtain higher academic performance in Mathematics and English. The total effect appears that the combined influence of the direct effect of physical

activity on Mathematics *(p=0.676)* and English *(p=0.372)* performances and the indirect effect flowing through eating habits were non-significant.

Furthermore, when examining the indirect effect, eating habits were found to significantly mediate the relationship between physical activity and Mathematics performance *(β=-0.625, p=0.003)*. In simpler terms, the relationship progresses from physical activity to eating habits, and then to Mathematics performance. The model also indicated that eating habits accounted for a 60.9% mediation effect between physical activity and Mathematics performance. This suggests full mediation, as physical activity affects eating habits, which in turn affects Mathematics performance, while physical activity itself does not directly impact Mathematics performance. It also indicates indirect-only mediation, meaning that while an indirect effect exists, there is no direct effect of physical activity on Mathematics performance.

Likewise, when the indirect effect was analyzed, eating habits significantly mediated the relationship between physical activity and English performance *(β=-0.866, p<0.001)*. In other words, relationship is characterized by a flow from physical activity to eating habits, which then influences English performance. The model indicates that eating habits account for a 40.1% mediation effect between physical activity and English performance. It also demonstrates partial mediation, as physical activity impacts eating habits, which in turn affects English performance, while physical activity has a direct effect on English performance. Also, the model uncovers partial mediation because physical activity affects eating habits, eating habits affects English performance, and physical activity affects English performance. It also shows competitive mediation since the indirect effect and the direct effect are significant but point in opposite directions.

The study suggests a notable relationship between physical activity and English performance, with eating habits serving as a mediating factor. However, when considering eating habits, physical activity did not have a direct impact on Mathematics performance. The negative and significant effect of eating habits on both English and Mathematics performance suggests that poorer eating habits are linked to higher academic achievement. Moreover, the findings indicate full mediation, where eating habits mediate the relationship between physical activity and academic performance in both subjects, with a more pronounced mediation effect in Mathematics (60.9%) compared to English (40.1%).

Finally, this study discovered that eating habits is a suppressor variable in the link between physical activity and English performance and between physical activity and

Mathematics performance. Ludlow and Klein (2014) characterized that suppressor variables enhance regression accuracy by reducing irrelevant variance in other predictors. In this study, eating habits improves the relationship between physical activity and English performance and between physical activity and Mathematics performance. Without eating habits in the model, physical activity had no relationship with English and Mathematics performances. After adding eating habits in the model, physical activity had a significant relationship with English performance. While dietary choices may not directly enhance mathematical performance, they elucidate the relationship between physical activity and mathematical achievement. Physical exercise may affect dietary patterns. Consequently, eating habits may indirectly influence cognitive functions or concentration, notwithstanding a direct adverse impact on mathematical performance.

The framework suggests that physical activity enhances academic performance only when combined with healthy eating, which is a critical insight for schools aiming to merge health and education programs. It improves understanding of how health behaviors relate to shape learning. While physical activity alone is insufficient, its interaction with eating habits reveals actionable leverage points for teachers.

It is anchored with the study of López-Gil et al. (2022), which found a significant positive correlation between academic achievement and dietary patterns. The findings indicated that the consumption of breakfast positively predicted academic achievement. Furthermore, accomplishment motivation served as a partial mediator in the correlation between the consumption of breakfast and academic achievement. Also, Cristuta et al. (2019) discovered that learners who ate a healthy diet were more likely to excel academically. They concluded that diet affected a Filipino students' intellectual achievement.

5. Conclusions and Recommendations

This study features the essence of improving healthy eating behaviors and persuading physical activity among students, not only for their physical well-being but also as a pathway to improved academic performance, particularly in the Philippine public high school context. Eating habits play a crucial role in students' academic success, not only by directly influencing performance but also by enhancing the positive effects of physical activity on learning. Therefore, fostering healthy eating behaviors may be vital for improving academic outcomes and maximizing the benefits of physical activity among students. maintaining students' eating

habits should be a top priority for teachers and schools, as unhealthy eating negatively affects their performance in both English and Mathematics.

The suggested action plan aims to use targeted interventions to help 7th graders with their major academic problems, mainly in the areas of English language skills, Mathematics skills, and overall cognitive development. The researchers meticulously designed actions, methods, and resources to support each target, ensuring effective implementation and measurable outcomes. The action plan delineates weekly enhancement sessions aimed at improving students' English proficiency, focusing on grammar, reading comprehension, vocabulary, and writing skills. The initiative seeks to enhance student involvement and participation by integrating gamified and interactive teaching approaches into daily lessons. Monthly evaluations will monitor advancement, with comments facilitating enhancements in teaching methodologies. The results encompass improved proficiency in English and increased motivation for learning. The action plan prioritizes interactive problem-solving sessions, mathematical games, and practical application exercises biweekly to enhance mathematical proficiency, potentially addressing emerging learners' needs and concerns. The English and Mathematics teachers will employ monthly evaluations to measure progress and identify areas that require targeted interventions. Additionally, recognizing the significance of nutrition in academic achievement, the strategy implements a "Nutrition for Learning" initiative. This encompasses sessions conducted by health professionals to inform students and parents about the significance of nutritious eating. The provision of nutritious breakfasts and partnerships with local businesses or NGOs to finance the feeding program aims to enhance cognitive function and classroom preparedness. Nonetheless, the action plan cultivates a robust alliance among educators, parents, and community stakeholders by cooperatively tackling academic and nutritional difficulties. The involvement of local enterprises, healthcare practitioners, and non-governmental organizations enhances support for student developments.

This study has several limitations that should be addressed in future research. Nutritional status was measured solely by BMI, which may not fully capture students' nutritional health, while eating habits and physical activity were assessed through self-reported perceptions and routine activities, potentially introducing subjective bias. Academic performance was also based on self-reported English and Mathematics grades, which could be affected by recall or social desirability bias, limiting accuracy. Additionally, the online data collection method may have caused self-selection bias, reduced control over the survey

environment, and limited participation from students without reliable internet access, affecting the representativeness and generalizability of the findings. Future studies should consider using objective academic assessments, more comprehensive nutritional evaluations, and mixed data collection methods to enhance validity and inclusiveness, thereby providing a more robust understanding of how nutrition, physical activity, and academic performance interrelate. Future research should also explore additional factors like sleep and stress, test combined nutrition and activity interventions, and consider cultural and gender differences to better understand academic success.

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Institutional Review Board Statement

This study was conducted in accordance with the ethical guidelines set by the Schools Division Research Committee (SDRC) of the Department of Education Cabuyao City. The conduct of this study has been approved and given relative clearance(s) by SDRC - Department of Education Cabuyao City.

AI Declaration

The author declares the use of Artificial Intelligence (AI) in writing this paper. In particular, the author used ChatGPT and DeepSeek in summarizing key points and paraphrasing ideas. The authors take full responsibility in ensuring proper review and editing of contents generated using AI.

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