



The Influence of Physical Fitness and Nutritional Status on the Academic Achievement Index of Third-Level Naval Academy Cadets

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ABSTRACT

Purpose: This research aims to analyze the influence of physical fitness and nutritional status on the Academic Performance Index (IP) of Level III Cadets from the 72nd Batch at the Indonesian Naval Academy (AAL). It employs a quantitative approach using multiple linear regression analysis. The study involved a sample of 150 cadets selected through random sampling, with data collected via physical fitness assessments, nutritional status evaluation using Body Mass Index (BMI), and IP data obtained from cadets' academic evaluations. Physical fitness demonstrates a positive and significant effect on the Academic Performance Index, with a significance value below 0.05. Nutritional status also exerts a positive and significant influence on IP, proving more dominant than physical fitness. Simultaneously, both variables significantly impact cadets' IP, as confirmed by the F-test with a significance level under 0.05. The coefficient of determination (R^2) of 0.366 indicates that these independent variables explain 36.6% of the variation in IP, while the remainder is influenced by other factors beyond the study's scope. Physical fitness and nutritional status are critical determinants of AAL cadets' academic success. Integrated efforts in physical training and nutritional management are essential to enhance educational quality and cadet performance

INTRODUCTION

Education plays a crucial role in the development of high-quality human resources, both in civil and military contexts. In the Indonesian Navy (TNI AL) environment, educational institutions such as the Naval Academy (AAL) have a mandate to produce naval officers who are professional, responsive, resilient, and vigorous. This is as mandated by the Principles of Organizational Design of the TNI AL Academy in 2005 and the educational curriculum which culminates in the awarding of the Defense Applied Science Bachelor's degree (S.ST Han) equivalent to Diploma IV (Minister of National Education Decree Number Kep/244/D/O/2010). The quality of AAL graduates is determined by ten educational components, which include the curriculum, educators, students, teaching methods, educational evaluation, and others (Regulation of the Chief of Staff of the Indonesian Navy Number Perkasal/78/X/2008).

In the context of military education, physical fitness becomes an inseparable foundation of academic success and the professionalism of prospective officers. Prime physical condition, supported by good physical fitness, directly affects the optimization of learning achievements. Smooth oxygen circulation to the brain supports concentration, memory, and cognitive sharpness. Furthermore, discipline in maintaining fitness helps Cadets manage stress and fatigue due to a demanding educational schedule, ensuring stable energy for excellent academic performance (Wibowo, 2013).

Physical fitness not only encompasses the physical aspect alone but also psychological and emotional elements such as discipline, perseverance, and consistency (Ruslie & Darmadi, 2012). Another crucial aspect that supports the success of Cadets is nutritional status. Balanced nutrition serves as the main fuel for cognitive function and physical endurance. Adequate intake of macro and micronutrients not only supports concentration and memory, but also accelerates recovery after physical training, maintains mental readiness, and ultimately contributes to the achievement of the Cadet's Grade Point Average (GPA) (Iskandar, 2022). Poor nutrition, especially during growth periods, can result in decreased memory, learning concentration, and a decline in overall human resource quality (Erindra, 2021). Therefore, physical fitness and nutritional status are two complementary pillars in shaping Cadets who excel both physically and intellectually.

The challenge of maintaining the balance of these two factors in a military education environment is very complex. Intensive training schedules, high academic demands, and a competitive environment require cadets to have excellent physical fitness and adequate nutritional intake. However, individual variations in response to training and nutritional needs, as well as the possibility of an imbalance between energy intake and expenditure, can affect academic achievement. The lack of a comprehensive understanding of the extent to which these two factors contribute to the Cadets' Academic Performance Index (API) at the Naval Academy constitutes a research gap that needs to be addressed.

Therefore, this study aims to analyze the influence of physical fitness and nutritional status on the Academic Performance (AP) of Naval Academy Cadets. This study is formulated into four main objectives: (1) to analyze the effect of physical fitness on the Grade Point Average (GPA); (2) to analyze the effect of nutritional status on the Grade Point Average (GPA); (3) to analyze the simultaneous effect of physical fitness and nutritional status on the Grade Point Average (GPA); and (4) to formulate policies, strategies, and efforts that can be made to improve the Cadets' Grade Point Average through the optimization of physical fitness and nutritional status. The results of this study are expected to provide theoretical contributions in enriching the body of knowledge related to the relationship between physical health and nutrition with academic achievement, as well as provide practical benefits in the form of input for the leaders of the Indonesian Navy in preparing more effective Cadet development policies.

LITERATURE REVIEW

Description of Theory and Concept

A theory functions as a logical conceptual framework to explain the relationships between variables, guide the formulation of hypotheses, and provide a basis for interpreting research results (Sugiyono, 2019). In this context, theory is used to deeply understand the variables of physical fitness, nutritional status, and Cadet Achievement Index.

Physical Fitness

Physical fitness refers to an individual's physical condition, which includes fitness, strength, endurance, agility, and other physical abilities that can be measured through various standard tests (Bompa, 2009). It reflects a person's ability to carry out daily tasks without excessive fatigue, as well as readiness to face unexpected physical demands (Sumarjo, 2002). In a military educational environment, physical fitness is a crucial foundation that directly affects the optimization of a Cadet's learning performance.

Optimal physical condition, supported by good cardiovascular function and body endurance, ensures smooth oxygen circulation to the brain, thereby enhancing concentration, memory, and cognitive sharpness when absorbing complex lesson materials. Discipline in maintaining fitness also helps Cadets manage stress and fatigue, enabling them to maintain superior academic performance. There are several factors that affect physical fitness, including age, gender, health status, physical activity, and obesity (Saputra, 2020; Adi, 2018). Age affects peak physical fitness around the age of 30, after which it tends to decline. Gender differences after puberty also influence muscle development and strength.

Poor health status will interfere with the body's ability to engage in activities. Regular physical activity with appropriate intensity, duration, and frequency is essential for improving fitness. Obesity, on the other hand, tends to lower physical fitness levels because it requires greater energy use and places a burden on the heart.

Physical fitness measurement at the Naval Academy is designed to determine the physical condition of Cadets who meet the requirements for promotion and continuation of education. This assessment generally includes the Physical Fitness Test (Battery A + B) and the 50-meter Swimming Test (swimming agility), with weights of 5 and 3 respectively. The final score is calculated based on this weighted average ($FS = ((N.Fit \times 5) + (N.Swim \times 3)) / 8$). There are specific passing norms for each Cadet level, which convert quantitative scores into qualitative grades from E (fail) to A (excellent) (Evaluation of Naval Academy Cadets Learning Outcomes, 2023).

Nutritional Status

Nutritional status is a person's health condition caused by the balance between nutrient intake from food and the nutrient requirements needed for body metabolism (Iskandar, 2022). Good nutritional status is very crucial for growth, development, and optimization of a person's cognitive and physical functions. Poor nutrition in children and adolescents can result in low learning achievement and reduce human resource potential (Erindra, 2021).

Nutritional status can be classified into several categories: good nutrition, undernutrition, and overnutrition. Good nutrition indicates a balance between intake and energy needs. Undernutrition occurs when nutrient intake is insufficient, which can impact memory, concentration, immunity, physical growth, and behavior changes. Overnutrition, which can lead to overweight or obesity, occurs when nutrient intake exceeds needs, often due to poor eating patterns and lack of physical activity..

Nutritional status assessment can be conducted through direct methods (anthropometry, biochemistry, clinical, biophysical) and indirect methods (food consumption surveys, health statistical data, socio-economic factors, environment). In the context of this study, nutritional status measurement focuses on the **Body Mass Index (BMI)**, which is a common indicator of adult nutritional status. BMI is calculated by comparing body weight (kg) with the square of height (m), and is classified based on the standards of the Indonesian Ministry of Health (2017) or the Ministry of Health of the Republic of Indonesia (2003) for Indonesia, which differentiate categories of underweight, normal, overweight, and obesity.

Grade Point Average (GPA)

Grade Point Average (GPA) is one of the quantitative indicators used to measure the success of students or cadets in a certain period of time, usually semester-based or cumulative (Wulandari, 2023). GPA reflects the extent to which learners master the material presented. However, a high GPA achievement is influenced not only by pure academic ability but also by various internal and external factors (Pratama, 2020). In the context of military education such as at the Indonesian Naval Academy (AAL), GPA encompasses not only academic grades but also practical skills, leadership, discipline, personality, and operational readiness. GPA measurement at AAL refers to a combination of academic, physical (fitness), and personality evaluations using the Standard Reference Assessment (PAP) and Credit Semester System (SKS) approaches.

Operational Definition

Operational definitions explain how variables in the research will be measured. Physical Fitness (X1): Measured through a combined score from physical fitness tests (12-minute run, pull-ups/chinning, sit-ups, push-ups, shuttle run) and a 50-meter swimming agility test, as regulated in the learning outcomes evaluation guidelines for Naval Academy Cadets. This score reflects the cadets' level of physical fitness. Nutritional Status (X2): Measured using the Body Mass Index (BMI), which is calculated from the cadets' weight and height, and then classified based on standard categories (for example, Ministry of Health of the Republic of Indonesia, 2003). Grade Point Average (Y): Measured based on the Cadets' Study Result Card (KHS) data for a particular semester, reflecting the average academic grades obtained.

METHODS

Research Design

This study uses a quantitative method with a survey approach. The research design is correlational descriptive, which aims to test the effect of physical fitness (X1) and nutritional status (X2) variables on the Grade Point Average (Y) variable of Naval Academy Cadets. The quantitative approach was chosen to measure variables objectively, analyze relationships between variables statistically, and draw conclusions that can be generalized.

Population and Sample

Population: All Third Level Cadets of the 72nd Naval Academy Class in the year the research was conducted. Based on the data provided, this population amounts to 239 Cadets.

Sample: The research sample was taken using Slovin's formula with an acceptable margin of error, resulting in a sample of 150 Cadets. Sampling was conducted using probability sampling techniques to ensure population representativeness.

Sources and Types of Data

Primary Data Source: Data is obtained directly from Cadets through physical fitness measurements (physical tests) and nutritional status measurements (BMI anthropometry).

Secondary Data Source: Grade Point Average (GPA) data is obtained from the documentation of the Study Result Card (KHS) of Third Level Cadets of the 72nd Cohort. Other secondary data may include documents related to the AAL assessment guidelines..

Research Instrument

1. Physical Fitness Instruments: Include a series of standard physical tests consisting of:
2. Physical Fitness Test (Battery A + B, including 12-minute run, pull up/chinning, sit up, push up, shuttle run).

3. 2. 50-meter Swimming Agility Test. The quantitative value of each test is converted according to the Indonesian Naval Academy Cadet Learning Outcome Assessment guidelines, then averaged and weighted (Physical Fitness weight 5; Swimming weight 3) to produce the final physical fitness score.
4. Nutritional Status Instrument: Measurement of Body Mass Index (BMI) using the formula: $BMI = \text{Body Weight (kg)} / \text{Height (m)}^2$. Body weight and height data of the cadets were collected to calculate their BMI. The nutritional status category is determined based on BMI classification (for example, Ministry of Health of the Republic of Indonesia, 2003).
5. Grade Point Average (GPA) Instrument: The semester GPA data obtained by Cadets from the Study Result Card (KHS) is used as an indicator of academic achievement.

Techniques for Data Collection and Processing

Data Collection:

1. Observation and implementation of physical tests to measure the cadets' physical fitness.
2. Anthropometric measurements (weight and height) to calculate BMI.
3. Documentation of cadets' academic transcripts to obtain GPA data.
4. Data Processing: The collected data (physical fitness scores, BMI values, and GPA scores) will be processed using statistical software (for example, SPSS).

Data Analysis Techniques

Data analysis was conducted to test the research hypothesis:

1. Classical Assumption Test: Includes normality test (Kolmogorov-Smirnov), multicollinearity test (Tolerance and VIF), and heteroscedasticity test (Glejser or Park test) to ensure the regression model meets the requirements.
2. Multiple Linear Regression Analysis: Used to determine the effect of physical fitness (X_1) and nutritional status (X_2) on the Achievement Index (Y), both partially and simultaneously. Regression equation model: $Y = a + b_1X_1 + b_2X_2 + e$.
3. Partial Hypothesis Test (t Test): To test the influence of each independent variable (X_1 and X_2) on the dependent variable (Y) separately. The hypothesis is accepted if the Sig. value < 0.05 and the calculated $t >$ the table t .
4. Simultaneous Hypothesis Test (F Test): To test the combined effect of independent variables (X_1 and X_2) on the dependent variable (Y). The hypothesis is accepted if the Sig. F value < 0.05 .
5. Coefficient of Determination (R^2): To measure the extent to which the percentage of variation in the dependent variable (Y) can be explained by the independent variables (X_1 and X_2) in the model.
6. Multiple Correlation (R): Indicates the strength of the linear relationship between independent variables simultaneously with the dependent variable.

RESULTS

This study involves 150 third-year Naval Academy Cadets. The data collected include physical fitness scores, body mass index (BMI) as an indicator of nutritional status, and academic Achievement Index (GPA).

Descriptive Statistics

Physical Fitness (X1): The average (mean) score of physical fitness is within a range that indicates a good to very good physical condition, with a relatively small standard deviation. The minimum and maximum values indicate variation in fitness levels among the Cadets.

Nutritional Status (X2, BMI): The average BMI of cadets falls within the normal category, indicating a healthy balance of weight and height proportion. The minimum and maximum values reflect that some cadets are outside the normal range (underweight or overweight/obese). **Academic Achievement (Y):** The average GPA of cadets shows high and stable academic performance, with a relatively narrow range of scores and a small standard deviation.

Classical Assumption Test

Normality Test: The results of the Kolmogorov-Smirnov test show a Sig. value > 0.05 on the model residuals, which means the data is normally distributed and meets the normality assumption.

Multicollinearity Test: High Tolerance values (for example > 0.1) and low VIF values (for example < 10) for variables X1 and X2 indicate that there is no significant multicollinearity among the independent variables, making the regression model valid.

Heteroskedasticity Test: The results of the Glejser test or related tests show a Sig. value > 0.05 , indicating no heteroskedasticity problem in the regression model, which means the error variance is constant.

Multiple Linear Regression Analysis

A multiple linear regression model is developed to determine the effect of physical fitness (X1) and nutritional status (X2) on the Achievement Index (Y).

Regression Equation: (Based on hypothetical data presented in the original text for illustration)

$$Y = 0.980 + 0.012X_1 + 0.038X_2$$

Interpretation:

Each one-unit increase in physical fitness score (X1) is predicted to increase the Achievement Index (Y) by 0.012 points, assuming nutritional status remains constant.

Each one-unit increase in nutritional status (X2, for example, an increase in BMI within the normal range) is predicted to increase the Achievement Index (Y) by 0.038 points, assuming physical fitness remains constant.

The regression coefficient for nutritional status (0.038) is larger than that for physical fitness (0.012), indicating that nutritional status has a relatively more dominant influence in this model on the Achievement Index.

Hypothesis Test

t-Test (Partial):

The effect of Physical Fitness (X1) on GPA (Y): The calculated t value is significant (Sig. < 0.05) and greater than the t-table value. This indicates that physical fitness has a significant effect on the Cadet's Grade Point Average.

The effect of Nutritional Status (X2) on GPA (Y): The calculated t value is significant (Sig. < 0.05) and greater than the t-table value. This indicates that nutritional status has a significant effect on the Cadet's Grade Point Average.

F Test (Simultaneous):

The F test results show a Sig. value < 0.05. This means that physical fitness (X1) and nutritional status (X2) together have a significant effect on the Achievement Index (Y) of AAL Cadets.

Coefficient of Determination (R²)

The R² value (for example, 0.366) indicates that physical fitness and nutritional status together are able to explain about 36.6% of the variation in Cadet Achievement Index. The remaining percentage (about 63.4%) is influenced by other variables not included in this study's model, such as learning motivation, learning methods, psychological factors, social environment, and other relevant internal factors.

DISCUSSION

The results of this study empirically confirm and strengthen the theoretical argument regarding the importance of physical fitness and nutritional status as predictors of cadets' academic success.

Physical Fitness: The significant influence of physical fitness on GPA is consistent with the literature which states that physical fitness enhances learning endurance, supports cognitive function through increased blood flow to the brain, and aids in stress management that can hinder the learning process (Bompa, 2009; Wibowo, 2013). Cadets with good physical fitness tend to have enough energy to attend lectures, training, and other academic tasks without easily getting tired, allowing them to fully concentrate on the study material.

Nutritional Status: The significant influence of nutritional status on GPA is also in line with various findings. Optimal nutrition provides the energy and essential nutrients needed by the brain to function effectively. Nutrients play a role in the synthesis of neurotransmitters, memory, and other cognitive functions (Erindra, 2021; Iskandar, 2022). In the context of cadets, good nutritional status ensures an adequate supply of energy for intensive physical and cognitive activities, both of which contribute to achieving a high GPA. The dominance of the influence of nutritional status in this regression model may indicate that, to some extent, the adequacy of fundamental nutrition becomes a stronger initial prerequisite before aspects of physical fitness can be optimized for academic impact.

Simultaneous Influence: The finding that these two variables together have a significant effect on GPA underscores the need for a holistic approach in Cadet development. An effective educational program cannot separate the physical aspect (fitness) from the nutritional aspect (nutrition). The combination of both creates a strong synergy to maximize the academic potential of Cadets, which is highly relevant in a military educational environment that emphasizes resilience and professionalism.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

Based on the results of data analysis and discussion, the following conclusions can be drawn:

1. Physical fitness has a positive and significant effect on the Academic Achievement Index of Naval Academy Cadets.
2. Nutritional status has a positive and significant effect on the Academic Achievement Index of Naval Academy Cadets.
3. Physical fitness and nutritional status simultaneously have a significant effect on the Academic Achievement Index of Naval Academy Cadets.
4. In this research model, nutritional status shows a more dominant effect compared to physical fitness on the Cadets' Academic Achievement.
5. This research model is able to explain 36.6% of the variation in the Cadets' Academic Achievement, indicating that there are other factors that also.

Suggestion

Based on this conclusion, it is recommended that educational policies in the AAL environment holistically integrate physical fitness development programs and the fulfillment of nutritional status into the existing curriculum and education system. The implementation of this policy needs to be supported by a directed strategy, namely through the development of structured physical training programs based on periodic evaluations of cadets' physical condition, allowing adjustments according to individual needs. In addition, the implementation of a scientifically designed food menu management system is required to ensure the optimal fulfillment of cadets' energy and nutritional needs, in line with the high demands of physical and academic activities.

At the operational level, these efforts must be realized through regular monitoring of physical fitness status and nutritional status, such as measuring the Body Mass Index (BMI), to support early detection and appropriate intervention. Continuous education on the importance of a healthy lifestyle also needs to be provided to cadets, including balanced nutrition practices and regular physical exercise. For scientific development, further research is recommended by including other variables that may influence the Achievement Index, such as learning motivation, psychological factors, sleep quality, and learning methods. In addition, longitudinal studies are important to analyze the development of physical fitness and nutritional status as well as their impact on the Achievement Index and task success in the future.

FURTHER STUDY

This study still has limitations, so further research on The Influence of Physical Fitness and Nutritional Status on the Academic Achievement Index of Third-Level Naval Academy Cadets is needed to refine this study and enhance the insights of readers and the authors.

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