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Exploring physical fitness, physical activity, nutritional status, and diet among female nutrition students

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ABSTRACT

Background Problem: Nutrition plays an important role in fitness, yet there is limited understanding of how nu-sporting students, particularly nutrition students, manage their fitness. This study fills the gap by exploring the relationship between physical activity, dietary habits, and fitness in this group. **Research objective**: This study aims to examine the fitness profile of female undergraduate nutrition students and explore the factors associated with fitness such as physical activity level (PAL), nutritional status, and diet. **Method**: To answer the research objective, a cross-sectional design was conducted, involving 114 healthy female students, aged 18-20 years old. Respondents were selected by using proportional random sampling, which enabled equal representation of each class in the study. Exclusion criteria: students have chronic disease or condition affecting physical fitness. Physical fitness was assessed using the Harvard Step Test, PAL was measured via an online self-administered IPAQ, nutritional status was assessed using a body mass index (BMI) calculation, and dietary data (energy and iron intakes) was assessed using 2x24 non-consecutive food records. Chi-squares or Fisher Exact tests were done to analyse the association between physical fitness and other variables. **Finding and Result**: We found that almost all of our respondents were at poor levels of physical fitness. There was no significant association between physical fitness and other variables such as PAL, BMI, and diet. **Conclusion**: This research supported previous findings that college students in health majors have poor fitness. Future studies should explore additional factors such as physiological stress, sleep pattern, or socio-economic status that may impact the fitness level of health-major students.

Keywords: Physical fitness; physical activity; nutritional status; diet; female college student

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INTRODUCTION

Physical fitness defined as the ability to perform daily tasks with vigor and alertness (Leso et al., 2024), is crucial for reducing the risk of metabolic disease (Myers et al., 2019). Among university students, physical fitness has been linked to academic performance and attendance, suggesting that fitter students may have better academic outcomes (Alhazmi et al., 2021; Zhai et al., 2022). It is suggested that students who have good physical fitness generally have a desirable cardiovascular profile, lower fat percentage, healthier bone, and

lower risk of depression or anxiety which turns to increase their academic performance (Redondo-Flórez et al., 2022; Velou et al., 2020).

While it is known that unmodifiable factor such as epigenetic can play a role in physical fitness (Marioni et al., 2015), this study focuses on modifiable factors such as anemia (Tsai et al., 2019), nutritional intake, BMI, and physical activity (Koehler & Drenowatz, 2019). A link between physical fitness and anemia condition, a decline in haemoglobin or red cell numbers, could be explained by the reduction capacity of blood cell to uptake peripheral oxygen and to transport oxygen. Anemia can be accompanied with iron deficiency and known as Iron Deficiency Anemia (IDA). At the cellular level, iron depletion could limit mitochondrial respiratory chain activity and reduce the capability of hemoglobin and myoglobin to carry oxygen. Altogether, these conditions can reduce exercise capacity and impair fitness (Tsai et al., 2019; Wyart et al., 2022). Woman in reproductive age is prone to suffer from anemia due to menstrual bleeding (Solberg & Reikvam, 2023). Improving iron intake both from diet and supplementation is known to have a beneficial effect on physical performance (Pasricha et al., 2014).

In addition to anemia, energy availability is also important to maintain basal metabolic function and keep the homeostatic balance. The insufficiency in energy intake coul impair physical performance and affect body composition by reducing skeletal muscle synthesis (Oxfeldt et al., 2023). Although primarily studied in athletes, the relationship between energy intake and physical fitness may also be relevant among college students (Kuswari et al., 2019). Another factor linked to physical fitness is BMI. It is generally used to assess nutritional status among population by dividing body weight (in kilogram) by the square of height (in meters). BMI classifies subjects into several categories from underweight, normal, overweight, and obesity (WHO, 2000). Among athlete population, BMI and physical fitness is suggested to have a U relationship, where those with BMI under and over the normal category have a worse fitness level compared to the subjects with normal BMI (Chen et al., 2022; Chen et al., 2020). However, study investigating the association between BMI and fitness among student population is still limited currently.

Recent studies reported that Indonesian college students majored in health and medical science are less active (sedentary) and surprisingly its prevalences were above 60% (Riskawati et al., 2018; Setiawan & Lontoh, 2023; Wungow et al., 2021). Physical activity is associated with cardiometabolic endurance. Both physical activity and fitness are important to improve and to maintain health (Chen et al., 2018). In this present study, female subjects were chosen since obesity is more prevalent among this group, compared to male group (Purnell, 2023). For instance, from the Indonesian National Health Surveillance involving 10,575 adults, it has been known that women group has the highest prevalence of obesity based on BMI-cut off, which was 58.2% (Sigit et al., 2020).

Studies show a disparity in physical fitness level between students from sports and non-sport programmes. Students from sport programme generally exhibit better physical fitness levels, ranging from 18% (Fahrizqi et al., 2020) to 60%, having good and excellent levels (Rumpoko et al., 2022). In contrast, non-sport programme students, especially those in health-related fields, are found to have lower physical fitness levels (Akbar et al., 2019; Kusumawati, 2016). Also, when comparing handgrip strength and muscle percentage, students from sport programmes performed significant better parameters that those from non-sport programme. This discrepancy between sport- and non-sport programme students could be caused by the difference in taking physical activity. It has been known that non-sport programme students might exhibit lower motivation and resource to do exercise (Silva et al., 2022; Szmodis et al., 2022). Taking account from aforementioned conditions, more attention is needed to examine the physical fitness among students enrolling health program study, since the lower physical fitness is associated with higher stress level in university students (Szmodis et al., 2022).

Despite the critical role of health-related fields like nutrition in promoting fitness, there is a gap in understanding how the non-sporting college students manage their own fitness. Current research has not deeply explored the relationship between physical activity, nutritional habits, and fitness among female nutrition students, a group that might face unique challenges. This study aims to fill this gap by focussing specifically on female nutrition students, addressing an area of research that has received little attention.

Moreover, understanding the fitness profile of this population can offer new insights into how health education impacts personal fitness outcomes, which is a novel contribution to the existing literature.

METHOD

Study Design and Participants

A cross-sectional design was applied in this present study. A total of 117 female students majoring in nutrition program at Universitas Negeri Surabaya were involved in this study. The sample size was based on a calculation for a cross-sectional study formula, using a margin error of 5% to detect 12% of students who are not fit physically according to the Mustakim study (Mustakim & Surury, 2018), and considering the total population of the students in the program study, which is 400. Recruitment was based on cluster randomisation, considering students' batch (first and second-year students) and class. Each batch consisted of 5 classes, resulting in 10 clusters for student allocation.

Research Procedure and Instrument

Physical fitness was measured using the Harvard Step Test (HST) for female participants (Khurde et al., 2021; Tkachenko, 2019). The participants were advised to warm up prior to the test and then asked to step up onto a bench with a standard height of 40 cm continuously for 5 minutes or until the respondent can no longer maintain the test. A metronome was used to maintain the respondents' stepping rate at 30 steps per minute. Respondents' pulse rate was measured using a digital tensimeter at rest, after 1.5, 2, 5, and 3,5 after HST. Fitness score was calculated using the formula: (Test duration in seconds) x 100 / (2 x sum of the pulse rates from the three time measurements). Fitness score was then classified into poor (< 50), below average (50.0-60.9), average (61-75.9), above average (76.0-86), and excellent (> 86). Physical activity level (PAL) was collected using a self-reported IPAQ, which was based on a Google Form. The PAL result then is categorised into low (< 600 METs/min/week), moderate (600-3000 METs/min/week), and high (> 3000 METs/min/week). All respondents were weighed using calibrated digital scales and measured for their height using a microtome. The respondents were asked to wear light clothes and be barefoot. BMI was calculated by dividing the weight and the height and categorised using the WHO classification for the Asia Pacific population. Nutritional intakes (energy and Fe) were assessed using a 2x24-hour non-consecutive food record or food diary, reported in household measures, which were then analysed using Nutrisurvey software using the Indonesian Food Database. Energy and Fe intakes were categorised based on the minimal cut-off point from RDA for the Indonesian population.

Data Analysis

Data was analysed using SPSS software and presented descriptively. The association between physical fitness and other variables was analysed statistically using chi square. When the assumption of chi-square is violated, the Fischer exact test is used. A p-value of less than 0.05 is considered significant. The strength of association was calculated based on the odds ratio (OR) value. The OR value of < 1 indicates that the independent variable becomes the risk factor of the independent variable, whereas the OR < 1 indicates that the independent variable has the protective association with the dependent variable.

Ethical Approval

All participants provided written informed consent, and data confidentiality was assured in accordance with the guidelines of the Ethical Committee. This study protocol was approved by the Ethical Committee of Politeknik Kesehatan Kemenkes Surabaya, number EA/2209/KEPK-Poltekkes_Sby/V/2024.

RESULTS AND DISCUSSION

A total of 114 female students from undergraduate program of Nutrition (aged 18-20 years old) were participated in this study. As depicted from table 1, the majority of the respondents have a poor level in physical fitness (90.4%) and only 9.6% whose level at good. This finding supports other previous studies which suggested that the physical fitness among college students in health majors tend to be poor, both in

Indonesian population (Akbar et al., 2019; Mustakim & Surury, 2018) and among foreign population (Fadul et al., 2023; Kumar et al., 2021).

Furthermore, if we look at the PAL distribution among our respondents, the most of them were at medium and low level (50.9% and 33.3% in respectively). The prevalence of sedentary lifestyles may contribute to the low physical fitness observed in this group. Various factors have been identified as potential barriers to increased physical activity among university students. These include time constraints due to heavy study schedules, limited understanding of the benefits of exercise, lack of support and resources, low motivation, and fear of injury (Silva et al., 2022). In addition, all of the respondent in this present study is female. Prior researches indicate that female students generally engage in lower levels of physical activity compared to their male counterparts (Fadul et al., 2023; Kumar et al., 2021).

The majority (accounting for 48.2%) of our respondents was underweight according to WHO classification for Asia Pacific population. Proportions of respondents having normal BMI and overweight were similar, accounting for 21.1% whereas the rest of it (9.6%) was obese. With regard to energy intake, the majority (98%) of them consumed less energy than the Indonesian Recommended Dietary Allowance (RDA), which is 2250 kcal/day suitable for the respondents' age. RDA is the level of the intake of essential nutrients to be adequate to meet the needs of healthy persons (National Research Council, 1989). The energy intake less than the RDA, could lead into an imbalance condition resulting in weight loss or undernutrition (Brinksma et al., 2015). Reflecting from our data, it was not surprising that the majority of our respondents was underweight due to their energy intake which was inadequate.

With regard to iron intake, it is reported that as many as 17.5% of our respondents meet the Indonesian RDA, which is 9 mg/day. This result indicates that the majority of the respondents consume dietary iron less than the RDA value and the anemia rate in might be high. Studies indicate that iron and energy intakes are associated (Gibson-Smith et al., 2020). Thus, in our study, the lower intake of iron could be contributed by the lower intake of energy, considering only a 1.8% of the respondent meet the daily need.

Table 1. Description of Physical Fitness Level, Physical Activity Level, BMI, Energy Intake, and Fe Intakes

Variables	n (%)
Physical Fitness Level	
Poor	103 (90.4)
Low Average	0 (0)
Average	0 (0)
Good	11 (9.6)
Excellent	0 (0)
Physical Activity Level (PAL)	
Low	38 (33.3)
Medium	58 (50.9)
High	18 (15.9)
Body Mass Index (kg/m^2)	
Underweight	55 (48.2)
Normal	24 (21.1)
Overweight	24 (21.1)
Obese	11 (9.6)
Energy Intake (kcal)	
Less than RDA (< 2250 kcal/d)	112 (98.2)
Equal or more than RDA (≥ 2250 kcal/d)	2 (1.8)
Iron Intake (mg/d)	
Less than RDA (< 9 mg/d)	94 (82.5)
Equal or more than RDA (≥ 9 mg/d)	20 (17.5)

In our analysis, we aimed to explore any potential connections between physical fitness and other variables among our female participants. The physical fitness data was categorized into two levels: below and equal, or more than means value due to the non-normal distribution and left-skewed data. Surprisingly, our results (refer to table 2) indicate that there is no significant association between physical fitness and factors such as physical activity, BMI, energy intake, and iron intake. This finding contrasts with previous studies (Hutajulu et al.,

2022; Cornia & Adriani, 2018; Salamah et al., 2019; Martin et al., 2019) which reported positive correlations between physical fitness and PAL, BMI, energy intake, and iron intake, respectively.

Table 2. Association between Physical Activity Level, BMI, Energy Intake, Fe Intakes, and Physical Fitness

Variables	Physical Fitness (n)		OR (95% CI)	P-value
	Less than mean	Equal/ more than mean		
Physical Activity				
Less than mean (< 600 METs)	39	31	0.7 (0.3;1.6)	0.4
Equal or more than mean (≥ 600 METs)	28	16		
Body Mass Index (kg/m^2)				
Less than mean (< 21.18)	29	36	0.6 (0.2;1.3)	0.2
Equal or more than mean (≥ 21.18)	28	21		
Energy Intake (kcal)				
Less than mean (< 1479 kcal/d)	35	21	1.4 (0.6;2.9)	0.4
Equal or more than mean (≥ 1479 kcal/d)	32	26		
Iron Intake (mg/d)				
Less than mean (< 7.02 mg/d)	34	27	0.8 (0.4;1.6)	0.5
Equal or more than mean (≥ 7.02 mg/d)	33	20		

The difference we observed between our study and previous ones could be attributed to the specific population we focussed on. Our current research primarily involved female participants, as the majority of students in our Nutrition Program were female. This gender-specific approach might have influenced our results. In fact, other studies that concentrated on female populations have yielded similar outcomes. For example, a report examining 25 female high school students in Ponorogo, Indonesia, concluded that there was no correlation between dietary iron sufficiency and physical fitness (Safitri & Wirjatmadi, 2020).

Physical fitness is defined as the ability to achieve certain performance standards for physical activity (Myers et al., 2019). Physical fitness includes several approaches, namely cardiovascular endurance, body composition, and muscular strength and flexibility. In this present study, the fitness assessment is based on Harvard Step Test (HST). HST has been widely used to assess cardiovascular endurance since it has a good correlation with VO_2 Max. However, in this study, the majority of our students failed to complete the HST because of the premature fatigue. HST also depends on respondents' motivation to finish the test. Another technique known as "Queen College Step Test" is more preferrable to be used in the sedentary population rather than HST because of its higher completeness rate (Kesavachandra & Reddy, 2015). Therefore, it is advisable to utilize this alternative method in future studies involving sedentary populations.

The findings from our study highlight the widespread issue of poor physical fitness among female students enrolled in health-related programmes, particularly those in the Nutrition Programme. Our results underscores the need for targeted health promotion programmes, such as fitness education and structured physical activity initiatives, to enhance physical fitness in this population. University administrators and policymakers should prioritize the development and implementation of these programmes to foster better health outcomes among female students. Future research should explore additional factors that may be related to physical fitness, such as mental health, sleep patterns, and socio-economic status, to better understand and address the root causes of poor fitness levels.

CONCLUSION

The findings in our present study provide valuable insight related to the importance of improving physical fitness among female students enrolled in health program studies. We demonstrate that almost all of our respondents, who were college students in the Nutrition Programme, exhibited poor levels of physical fitness. Any promotional health program is needed to improve the physical fitness in the particular population. Future studies attempted to explore other variables that may be related to fitness are warranted. In conclusion, our study reveals that poor physical fitness is prevalent among female students in the Nutrition Programme, indicating a critical need for interventions to address this issue.

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CONFLICT OF INTEREST

We declared no conflict of interest.

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