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Physical activity and nutritional status among prospective brides: a cross-sectional study

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Abstract:
Preconception nutritional status shapes fertility, pregnancy outcomes, and child health, yet the role of physical activity among prospective brides in Indonesia is poorly understood. This study aimed to examine the relationship between physical activity and nutritional status among prospective brides. An analytical cross-sectional study was conducted at Kedungkandang Public Health Center, Malang City, Indonesia, from June to August 2024. All 32 eligible prospective brides attending premarital health screening were enrolled through total sampling. Physical activity was assessed using the Physical Activity Level (PAL) questionnaire, and nutritional status was determined from measured body mass index (BMI). Data were analyzed using Pearson correlation and rank-based sensitivity analyses. More than half of the participants (53.1%) engaged in heavy physical activity, and nearly half (46.9%) were underweight. Physical activity was strongly and inversely correlated with BMI ($r = -0.785$; $p < 0.001$). Thirteen of the 15 underweight women reported heavy activity, whereas all overweight or obese women reported light activity. Rank-based analyses confirmed this association (Spearman's $\rho = -0.763$; $p < 0.001$). Higher physical activity was associated with lower nutritional status among prospective brides. Premarital health services should combine physical activity assessment with energy-adequate nutrition counselling to prepare women for a healthy pregnancy.

Keywords:
body mass index; nutritional status; physical activity; preconception care; prospective brides

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INTRODUCTION

The preconception period is now recognized as a critical window for maternal and child health. A woman's nutritional status before conception influences fertility, placental development, fetal growth, and the long-term health of her child (Fleming et al., 2018; Stephenson et al., 2018). Women who enter pregnancy underweight face higher risks of preterm birth and low birth weight (Han et al., 2011), whereas women who are overweight or obese face higher risks of gestational diabetes, hypertensive disorders, and cesarean delivery (Goldstein et al., 2017; Poston et al., 2016). For these reasons, international guidance recommends that nutritional assessment and counseling begin before pregnancy rather than at the first antenatal visit (Dean et al., 2014; Hanson et al., 2015).

Volume 02 Number 01 (May 2026)
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Indonesia, like many low- and middle-income countries, faces a double burden of malnutrition, in which undernutrition and overweight coexist within the same communities (Popkin et al., 2020; Rachmi et al., 2017). Among women of reproductive age, chronic energy deficiency (CED) remains common and is an established driver of low birth weight and childhood stunting (Black et al., 2013; Victora et al., 2021). At the same time, overweight is rising, driven by dietary changes and declining physical activity (Purnomo et al., 2024; Rachmi et al., 2017). Indonesian preconception women show poor diet quality together with a mix of underweight, overweight, and anemia in both rural and urban areas (Fariski et al., 2020).

Prospective brides are a strategic group for preconception care. In Indonesia, couples planning to marry are encouraged to attend premarital health screening at a public health center (Puskesmas). For many young women, this visit is their first structured contact with the health system before pregnancy. However, the screening has traditionally focused on anemia, immunization, and infectious diseases, and pays less attention to modifiable lifestyle factors that shape nutritional status before conception.

Physical activity is one such factor. Body weight is governed by the balance between energy intake and energy expenditure, and physical activity is the most variable component of daily expenditure (Hall et al., 2012; Westerterp, 2013). Regular moderate activity protects health and is recommended for all adults (Bull et al., 2020). However, when high energy expenditure from occupational, domestic, or commuting activities is not matched by sufficient dietary intake, low energy availability develops. This leads to weight loss and can disturb reproductive and metabolic function (Loucks et al., 2011; Mountjoy et al., 2023). Conversely, low activity combined with energy-dense diets promotes weight gain (Hill et al., 2012). Many young Indonesian women combine paid work with household tasks, and physically demanding work remains common in informal and agricultural sectors (Lestari et al., 2021).

Importantly, physical activity among women of reproductive age should be understood beyond participation in structured exercise. Occupational duties, household responsibilities, and daily mobility may collectively contribute to substantial energy expenditure, but these activities are not always recognized or reported as exercise. Consequently, assessing physical activity only through exercise frequency may underestimate the actual demands of women's daily routines. The interaction between energy expenditure and dietary intake is particularly relevant during the preconception period, when inadequate energy availability may affect nutritional status and reproductive function (Hall et al., 2012; Westerterp, 2013; Loucks et al., 2011). A broader assessment of daily physical activity may therefore help identify women whose nutritional needs are not adequately met before pregnancy.

Most evidence on activity and energy balance comes from athletes or high-income settings. Few studies have examined physical activity and nutritional status among prospective brides in Indonesian primary care. A preliminary survey at Kedungkandang Public Health Center, Malang City, on 30 May 2024 found that of 40 prospective brides examined, 53% were underweight, 30% were normal, 10% were overweight, and 7% were obese. This two-sided pattern suggests a substantial nutritional problem in this population, but its relationship with daily physical activity has not been studied.

Volume 02 Number 01 (May 2026)
e-ISSN: 3164-8835; p-ISSN: 3164-8827

The coexistence of undernutrition and excess body weight highlights the need for a more differentiated approach to nutritional assessment among prospective brides. Women with high physical activity may require greater energy and nutrient intake to maintain adequate nutritional status, whereas those with low activity may be more vulnerable to excess weight when energy intake consistently exceeds expenditure. These contrasting pathways suggest that physical activity should be interpreted in relation to individual nutritional status rather than treated as a uniform health indicator (Hill et al., 2012; Bull et al., 2020). Identifying these patterns during premarital screening could help nurses and midwives provide more targeted nutritional counseling to address both energy inadequacy and excess weight before conception. Therefore, this study aimed to examine the relationship between physical activity and nutritional status among prospective brides attending premarital health screenings at the Kedungkandang Public Health Center in Malang City, Indonesia. We hypothesized that higher physical activity would be associated with lower body mass index.

METHODS

This analytical observational study used a cross-sectional design and is reported in accordance with the STROBE statement (von Elm et al., 2007). The study was conducted at the Kedungkandang Public Health Center in Malang City, East Java, Indonesia, from June to August 2024. This center was selected because it records the highest number of premarital health screening registrations in Malang City. The study population comprised all prospective brides who attended premarital health screening at the center during the study period. A total sampling technique was used, and every eligible woman was invited to participate, resulting in 32 participants. Inclusion criteria were registration for premarital health screening, age 19 years or older, and willingness to participate. Women who were pregnant or had a medical condition that prevented accurate anthropometric measurement were excluded.

Physical activity was assessed using the Physical Activity Level (PAL) questionnaire, administered through a face-to-face interview by a trained researcher. Participants recalled the type and duration of all activities performed over a typical 24-hour period, including sleep, occupational, domestic, transport, and leisure activities. The duration of each activity was multiplied by its physical activity ratio, summed over 24 hours, and divided by 24 to obtain the PAL value (Westerterp, 2013). PAL values were classified as light (1.40–1.69), moderate (1.70–1.99), or heavy (2.00–2.40), following the FAO/WHO/UNU energy requirement categories.

Body weight was measured with a calibrated digital scale to the nearest 0.1 kg, with participants wearing light clothing and no footwear. Height was measured with a wall-mounted stadiometer to the nearest 0.1 cm. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared. BMI was classified using the Indonesian Ministry of Health cut-off points: underweight (<18.5 kg/m²), normal (18.5–25.0 kg/m²), overweight (>25.0–27.0 kg/m²), and obese (>27.0 kg/m²). These national cut-off points are lower than the international ones, reflecting the higher cardiometabolic risk at a given BMI among Asian populations (WHO Expert Consultation, 2004). Age, education level, and occupation were recorded using a structured form.

Volume 02 Number 01 (May 2026)
e-ISSN: 3164-8835; p-ISSN: 3164-8827

Categorical variables were summarized as frequencies and percentages. The distributions of continuous PAL and BMI values were assessed before analysis. The relationship between PAL and BMI was tested using Pearson's product–moment correlation, and the coefficient was interpreted as weak (<0.40), moderate (0.40–0.59), strong (0.60–0.79), or very strong (≥0.80). A 95% confidence interval (CI) for Pearson's r was obtained using Fisher's z transformation. Because both variables were also analyzed as ordered categories, a sensitivity analysis was performed using Spearman's rank correlation (ϱ), Kendall's tau-b (τb), and the Goodman–Kruskal gamma (γ), with 95% CIs estimated by percentile bootstrapping (5,000 resamples). The chi-square test was not used because more than 20% of cells had expected counts below five. Statistical significance was set at a two-sided $p < 0.05$. All participants received verbal and written information about the study and provided written informed consent before data collection. Participation was voluntary, data were anonymized, and the study adhered to the principles of the Declaration of Helsinki.

RESULTS

A total of 32 prospective brides participated, giving a response rate of 100%. All participants were aged 20–35 years. As shown in Table 1, the most common education level was senior high school (37.5%), followed by higher education (34.4%) and junior high school (28.1%). Nearly half of the participants worked as private employees (43.8%), followed by civil servants (28.1%) and self-employed workers (18.8%). Most participants were 155–160 cm tall (84.4%), and slightly more than half weighed 40–60 kg (53.1%), while 28.1% weighed less than 40 kg.

Table 1. Characteristics of prospective brides (n = 32)

Characteristics	Category	Frequency	Percentage
Age (years)	20–35	32	100.0
Education Level	Junior High School	9	28.1
	Senior High School	12	37.5
	Higher Education	11	34.4
Occupation	Unemployed	2	6.3
	Self-employed	6	18.8
	Private Employee	14	43.8
	Civil Servant	9	28.1
	Others	1	3.1
Height	<155 cm	3	9.4
	155–160 cm	27	84.4
	>160 cm	2	6.3
Body Weight	<40 kg	9	28.1
	40–60 kg	17	53.1
	>60 kg	6	18.8

Table 2 shows that more than half of the participants engaged in heavy physical activity (53.1%), followed by light (31.3%) and moderate activity (15.6%). Nearly half were underweight (46.9%), whereas 34.4% had a normal BMI, 15.6% were overweight, and 3.1% were obese. Overall, almost two-thirds of the participants (65.6%) had a BMI outside the normal range.

Volume 02 Number 01 (May 2026)
e-ISSN: 3164-8835; p-ISSN: 3164-8827

Table 2. Distribution of physical activity and nutritional status among prospective brides (n = 32)

Variables	Category	Frequency	Percentage
Physical Activity	Light	10	31.3
	Moderate	5	15.6
	Heavy	17	53.1
Nutritional Status	Underweight	15	46.9
	Normal	11	34.4
	Overweight	5	15.6
	Obese	1	3.1

The cross-tabulation in Table 3 shows a clear gradient. Of the 17 women with heavy activity, 13 (76.5%) were underweight, and none were overweight or obese. In contrast, none of the 10 women with light activity were underweight, while six (60.0%) were overweight or obese. Pearson's correlation showed a strong, significant, and negative relationship between PAL and BMI ($r = -0.785$; 95% CI −0.890 to −0.601; $p < 0.001$). The coefficient of determination ($r^2 = 0.616$) indicates that physical activity accounted for about 62% of the variation in BMI in this sample.

Table 3. Cross-tabulation of physical activity and nutritional status among prospective brides (n = 32)

Nutritional Status	Physical Activity				p-value	r
	Light n (%)	Moderate n (%)	Heavy n (%)	Total n (%)		
Underweight	0 (0.0)	2 (6.3)	13 (40.6)	15 (46.9)	<0.001	-0.785
Normal	4 (12.5)	3 (9.4)	4 (12.5)	11 (34.4)		
Overweight	5 (15.6)	0 (0.0)	0 (0.0)	5 (15.6)		
Obese	1 (3.1)	0 (0.0)	0 (0.0)	1 (3.1)		

The sensitivity analysis using ordered categories produced consistent results (Table 4). All rank-based coefficients were negative, strong, and statistically significant, and none of the confidence intervals included zero. The gamma coefficient ($\gamma = -0.933$) indicates that almost all pairs of participants were ranked in opposite directions on physical activity and nutritional status.

Table 4. Correlation between physical activity and nutritional status: main and sensitivity analyses (n = 32)

Measure	Data analysed	Coefficient (95% CI)	p-value
Pearson's r	Continuous PAL and BMI	−0.785 (−0.890 to −0.601)	<0.001
Spearman's ϱ	Ordered categories	−0.763 (−0.897 to −0.552)	<0.001
Kendall's τb	Ordered categories	−0.707 (−0.849 to −0.515)	<0.001
Goodman–Kruskal γ	Ordered categories	−0.933 (−1.000 to −0.764)	<0.001

Note: PAL = physical activity level; BMI = body mass index; CI = confidence interval. The CI for Pearson's r was obtained with Fisher's z transformation; CIs for rank-based coefficients were obtained by percentile bootstrapping (5,000 resamples).

DISCUSSION

This study found that more than half of the prospective brides engaged in heavy physical activity and nearly half were underweight. Physical activity was strongly and inversely related to nutritional status: women with heavy activity were mostly underweight, whereas women with light activity were more often overweight or obese. The association was robust across parametric and

Volume 02 Number 01 (May 2026)
e-ISSN: 3164-8835; p-ISSN: 3164-8827

rank-based analyses. These findings support our hypothesis and suggest that physical activity is an important, and often overlooked, factor in the nutritional profile of women preparing for marriage and pregnancy.

The most likely explanation is an imbalance between energy expenditure and energy intake. Body weight remains stable only when intake matches expenditure, and physical activity is the most variable part of total daily expenditure (Hall et al., 2012; Westerterp, 2013). A woman with a PAL of 2.0 or more spends substantially more energy each day than a sedentary woman of the same size. If her food intake does not rise accordingly, the deficit accumulates over weeks and months and appears as weight loss and a low BMI. Studies of low energy availability show that such a deficit affects more than body weight. It can suppress reproductive hormones, disturb menstrual function, and reduce bone and metabolic health (Loucks et al., 2011; Mountjoy et al., 2023). Although these consequences have mainly been described in athletes, the same physiology applies to women whose daily work is physically demanding. In prospective brides, this is particularly relevant because conception may follow soon after marriage.

Nevertheless, the relationship between physical activity and nutritional status should not be interpreted as direct or uniform. The nutritional consequences of physical activity depend on the interaction between energy expenditure, dietary intake, body composition, and individual physiological requirements. Women with similarly high activity levels may therefore have different nutritional outcomes depending on whether their energy and nutrient needs are adequately met. Moreover, BMI provides an overall indication of nutritional status but does not directly reflect energy availability or distinguish between fat and lean body mass. These considerations highlight the importance of interpreting physical activity alongside dietary patterns and other nutritional indicators when assessing women before pregnancy (Hall et al., 2012; Westerterp, 2013; Loucks et al., 2011).

The high proportion of underweight women in this study (46.9%) is in line with the preliminary survey at the same center and confirms that undernutrition remains a major issue among Indonesian women of reproductive age. National and regional analyses have repeatedly identified chronic energy deficiency as a persistent problem that contributes to low birth weight and stunting (Black et al., 2013; Victora et al., 2021). Fariski et al. (2020) similarly reported poor diet quality and a high burden of malnutrition among preconception women in both rural and urban Indonesia. Our findings add that, in a primary care population, a high level of daily physical activity may be one pathway through which energy deficiency develops.

The occupational profile of the participants helps explain why heavy activity was so common. Most participants worked as private employees or civil servants, and many likely combined paid work with household tasks, commuting, and wedding preparations. These activities are rarely considered “exercise”, yet they add up to a high daily energy cost. Studies of Indonesian workers have shown that physically demanding work and prolonged working postures are common, especially in informal and agricultural sectors (Lestari et al., 2021). A further possible explanation is intentional weight control before the wedding. Some brides may increase activity and reduce food intake to achieve a desired appearance. Our study did not measure dietary intake or body image, so this explanation remains speculative; however, it warrants attention in future research.

Volume 02 Number 01 (May 2026)
e-ISSN: 3164-8835; p-ISSN: 3164-8827

An important distinction is that physical activity in daily life does not always reflect planned exercise or health-promoting behavior. Occupational activities, household responsibilities, and other routine tasks may contribute substantially to total daily energy expenditure without being recognized by individuals as physical activity. Consequently, women with physically demanding daily routines may have greater nutritional requirements than those with predominantly sedentary activities. When these additional energy demands are not accompanied by adequate food intake, prolonged energy imbalance may contribute to undernutrition and potentially compromise reproductive health (Hall et al., 2012; Westerterp, 2013; Loucks et al., 2011). This highlights the importance of assessing activity in the broader daily context, rather than focusing exclusively on exercise frequency or duration, when evaluating the nutritional status of prospective brides.

The finding that all overweight and obese women reported light activity shows the other side of the same energy balance. Low expenditure combined with an energy-dense diet favors weight gain (Hill et al., 2012). Purnomo et al. (2024) reported that unhealthy eating patterns and low physical activity were the main factors linked to obesity among Indonesian adolescents, a group that soon becomes the population of prospective brides. The coexistence of underweight and overweight in a single small sample reflects the double burden of malnutrition described for Indonesia and other countries in nutrition transition (Popkin et al., 2020; Rachmi et al., 2017). It also shows that a single message, such as "be more active" or "eat less", will not fit all prospective brides.

These results should not be read as evidence that physical activity is harmful. Regular activity protects cardiometabolic and mental health and is recommended for all adults, including women planning pregnancy (Bull et al., 2020). The key message is balance: physical activity must be matched by adequate energy and nutrient intake. For highly active women, the priority is to increase energy intake; for inactive women with excess weight, the priority is to increase activity and improve diet quality. Both strategies aim to bring women into the normal BMI range before conception, which is associated with better pregnancy outcomes (Goldstein et al., 2017; Han et al., 2011; Poston et al., 2016).

The findings have practical implications for premarital health services. The premarital screening visit offers a valuable opportunity to identify women at nutritional risk before pregnancy. We recommend that nurses and midwives add a brief assessment of daily physical activity to the routine measurement of weight, height, BMI, and mid-upper arm circumference. Counseling can then be tailored: women with heavy activity and low BMI should receive advice on energy-dense, nutrient-rich meals and regular eating, while women with light activity and high BMI should receive support for safe increases in activity and healthier food choices. This approach is consistent with international recommendations to "think nutrition first" before pregnancy (Hanson et al., 2015) and with evidence that preconception interventions are most effective when they combine individual counseling with supportive health services (Barker et al., 2018; Dean et al., 2014). Because nutritional status before conception affects the health of the next generation (Fleming et al., 2018; Stephenson et al., 2018), such low-cost actions at the primary care level may have long-term benefits.

Importantly, preconception nutritional interventions should address both ends of the malnutrition spectrum rather than prioritize weight reduction alone. Underweight and overweight

Volume 02 Number 01 (May 2026)
e-ISSN: 3164-8835; p-ISSN: 3164-8827

women may require different, and sometimes opposing, nutritional and behavioral strategies. For women with low BMI, counseling should emphasize adequate energy intake, dietary diversity, and sufficient nutrient consumption to support physiological needs, whereas women with excess body weight may benefit from gradual improvements in dietary quality and physical activity. This individualized approach is particularly relevant in populations experiencing a double burden of malnutrition, where uniform dietary recommendations may not adequately address different nutritional risks (Popkin et al., 2020; Rachmi et al., 2017). Integrating nutritional assessment with tailored counseling during premarital services may therefore provide a more comprehensive foundation for maternal health before conception (Hanson et al., 2015; Barker et al., 2018; Dean et al., 2014).

This study has several strengths. All eligible prospective brides attending screening during the study period were included, weight and height were measured directly rather than self-reported, and the main result was confirmed by several sensitivity analyses. However, some limitations should be considered. First, the sample was small and drawn from a single public health center, which limits the precision of estimates and the generalizability of the findings. Second, the cross-sectional design does not allow causal inference; reverse causation is possible, as women with higher body weight may find vigorous activity more difficult. Third, physical activity was self-reported and may be affected by recall and social desirability bias, since self-report measures often differ from objective measures (Prince et al., 2008). Fourth, dietary intake, micronutrient status, and hemoglobin were not assessed, so the energy imbalance could not be quantified directly. Fifth, BMI does not distinguish between fat and lean mass. Finally, the small sample did not allow adjustment for potential confounders such as occupation and socioeconomic status.

Future studies should use larger, multicenter samples, objective activity measures such as accelerometers, and detailed dietary assessment. Longitudinal designs that follow prospective brides into pregnancy would clarify whether the activity–nutrition imbalance identified here translates into adverse maternal and neonatal outcomes. Intervention studies are also needed to test whether tailored activity and nutrition counseling during premarital screening improves preconception nutritional status.

CONCLUSION

Physical activity was strongly and inversely related to nutritional status among prospective brides at Kedungkandang Public Health Center, Malang City. Women with heavy physical activity were more likely to be underweight, while those with light activity were more likely to be overweight or obese. Premarital health screening should therefore include a simple assessment of physical activity, followed by nutrition counseling that matches energy intake to each woman's activity level, so that women enter pregnancy with a healthy nutritional status.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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