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RESEARCH ARTICLE

NUTRITIONAL STATUS AND SUPPLEMENT USE IN PARALYMPIC ATHLETES IN YOGYAKARTA:
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ABSTRACT

Background: Athletes with disabilities face unique physiological and nutritional challenges that can affect performance, recovery, and overall health. However, limited data exist on dietary intake and nutritional status of Paralympic athletes in low- and middle-income countries, including Indonesia. This study aimed to assess nutritional status, dietary intake, and supplement use among Paralympic athletes in Yogyakarta.

Methods: A cross-sectional descriptive study was conducted among 99 athletes participating in 2024 regional training programme under National Paralympic Committee Yogyakarta. Data were collected through anthropometric measurements, vital sign assessments, structured dietary recall (three-day method), and questionnaires on supplement use and health history. Descriptive statistics and cross-tabulations were used to analyse dietary patterns and nutritional status.

Results: Mean daily energy intake was 1,950.6 kcal (SD ±866.3), with wide inter-individual variation. Carbohydrates contributed most to total energy intake. Micronutrient analysis revealed frequent deficiencies in vitamins A, C, and E, while some athletes exceeded recommended sodium and cholesterol levels. Mean BMI was 23.6 kg/m², with 18.9% classified as underweight and 31.6% as overweight or obese. Supplement use was inconsistent, with multivitamins and vitamin C being the most common. Sport-specific trends indicated both under- and overnutrition risks.

Conclusion: Paralympic athletes in Yogyakarta exhibit diverse and often suboptimal nutritional patterns. Nutritional monitoring, personalised dietary planning, and structured supplement guidance are recommended to optimise performance and health outcomes. Further longitudinal studies are warranted to evaluate long-term effects of targeted nutritional interventions in this population.

Keywords: Paralympic athletes, nutritional status, dietary intake, supplement use, disability.

1. INTRODUCTION

Inclusion of persons with disabilities in health promotion and healthcare services is an essential component of Sustainable Development Goals (SDGs), particularly goal three, which targets good health and well-being for all.¹ Sport plays a multifaceted role in lives of individuals with disabilities, serving not only as a means of physical rehabilitation and social integration but also as pathway to high-performance athletic achievement through paralympic competition.² Adequate nutrition is foundational element in development and performance of athletes, including those with disabilities, who may face unique physiological and metabolic challenges.^{3,4} Paralympic athletes often require tailored nutritional strategies due to differences in muscle mass, energy expenditure, and disability-specific needs. For instance, athletes with spinal cord injuries may have reduced energy expenditure due to lower muscle mass, whereas amputee athletes may have altered energy demands related to gait or prosthesis use.⁵ Despite these distinct considerations, research on nutritional status and dietary practices of athletes with disabilities remains limited, especially in low- and middle-income countries.^{6,7} Most existing data on sports nutrition come from Western populations and are rarely specific to paralympic athletes. Studies have shown that even among elite paralympic athletes, micronutrient deficiencies particularly in vitamins D, E, iron, calcium, and folate are common and may impact performance and recovery.^{8,9} Korean study using 24-hour recall and nutrition quotient scoring revealed that disabled athletes preparing for Tokyo Paralympics had significantly inadequate intake of vitamin C, E, and potassium.¹⁰ In Indonesia, study of disabled athletes in Jakarta reported that 14.4% were undernourished and 26.6% were either overweight or obese, with imbalanced intake of macronutrients, carbohydrate deficits and protein/fat excesses were frequently observed.¹¹ Given physiological variability among Paralympic athletes and lack of locally contextualised dietary data, routine nutritional assessments are essential. Comprehensive evaluation should include dietary recall, anthropometric measurements, clinical assessment, and biochemical tests where possible, as outlined by current guidelines from American Society for Parenteral and Enteral Nutrition (ASPEN).¹² Moreover, dietary supplement use among this population is not well understood. Although multivitamins, protein powders, and essential fatty acids are commonly used, the prevalence, patterns, and potential benefits of supplementation remain under-investigated in

athletes with disabilities.^{8,13} This study aims to assess the nutritional status, dietary intake patterns, and supplement use among Paralympic athletes in Yogyakarta, Indonesia. By identifying nutritional imbalances, this study seeks to inform targeted interventions to improve health, performance, and recovery in this underrepresented population.

METHODS

Study Design and Setting

This study employed a descriptive analytical design with a cross-sectional approach. It was conducted in Special Region of Yogyakarta, Indonesia, involving athletes under supervision of Yogyakarta branch of National Paralympic Committee (NPC). Research was carried out as part of regional training programme (Pelatda) for year 2024.

Participants and Sampling

Study population comprised all paralympic athletes registered with NPC Yogyakarta. Participants were selected using purposive sampling based on the following inclusion criteria: (1) athletes officially enrolled in 2024 Pelatda programme, (2) aged ≥ 15 years, and (3) willing to provide informed consent. Exclusion criteria included acute illness or unwillingness to participate. Total of 99 athletes met eligibility criteria and were enrolled in the study. Sample size was determined based on total population availability of paralympic athletes in the region.

Data Collection

Data were collected through a combination of direct physical measurements and structured questionnaires administered by trained researchers. Data collection procedure included:

1. Anthropometric assessments, including body weight (kg), height (cm), sitting height, mid-upper arm circumference (MUAC), and waist circumference, following WHO standard procedures.¹⁴
2. Vital sign evaluation, including systolic and diastolic blood pressure, using digital sphygmomanometers with participants at rest.
3. Dietary assessment using three-day food recall method, which involved documenting all foods and beverages consumed during two weekdays and one weekend day. Trained enumerators guided participants in estimating portion sizes using standard food models and measurement aids.
4. Supplement use and health history questionnaire, adapted from previously validated surveys,^{15,16} recorded information on supplement intake (type, frequency), injury history, and chronic medical conditions.

Key variables measured in this study included:

1. Nutritional status, assessed using Body Mass Index (BMI) and categorized according to WHO criteria (underweight <18.5, normal 18.5–24.9, overweight ≥25).
2. Macronutrient and micronutrient intake, derived from dietary recall and analyzed using Indonesian Food Composition Tables (DKBM) and Nutrisurvey software.
3. Supplement use, reported as categorical data (yes/no) for each supplement type.
4. Health and injury history, self-reported.

All data were processed and analyzed using SPSS software version 16.0 (IBM Corp, Armonk, NY). Descriptive statistics were employed to summarize demographic variables, nutritional intake (mean, standard deviation, minimum, and maximum), and supplement use frequency. No inferential tests were conducted as the study aimed to describe population-level characteristics rather than establish causal associations. However, cross-tabulations were performed to explore trends between categorical variables, such as BMI categories and supplement use, across different sports disciplines. This study adhered to ethical principles outlined in the Declaration of Helsinki and received ethical clearance from institutional ethics committee of Universitas Negeri Yogyakarta. Report adheres to STROBE checklist.

RESULTS

Participant Characteristics

Total of 99 Paralympic athletes participated in the study. Majority were male (64.6%), and predominant types of disabilities included lower limb physical impairment (63.6%), followed by visual impairment (21.2%). Athletes represented 10 different sports disciplines, with archery (18.2%) and table tennis (15.2%) having the largest proportions. Mean duration of athletic experience was 7.1 years (SD ±5.1), with a wide age range reflecting both junior and senior athletes.

Anthropometric and Clinical Findings

Anthropometric assessments showed mean height of 158.6 cm (SD ±11.1) and mean body weight of 59.8 kg (SD ±14.4). Mean Body Mass Index (BMI) was 23.6 kg/m² (SD ±4.7), ranging from 14.7 to 40.4. Based on WHO classification, 18 athletes (18.9%) were underweight, 47 (49.5%) had normal BMI, 22 (23.2%) were overweight, and 8 (8.4%) were classified as obese.

Vital signs assessment indicated that most athletes had normal systolic and diastolic blood pressure; however, a few individuals exhibited elevated readings, particularly among weightlifters and table tennis players, possibly associated with high sodium intake and BMI levels.

Dietary Intake and Nutritional Status

Analysis of dietary recall data over three days (table 1) revealed a wide variability in energy and nutrient intake. Mean daily energy intake was 1,950.6 kcal (SD ±866.3), with extremes ranging from 431 kcal to 5,104 kcal. Carbohydrate intake contributed majority of daily calories (mean 242.4 g/day), followed by fat (mean 73.1 g/day) and protein (mean 84.0 g/day). Some athletes demonstrated extremely low energy intakes (below 1,000 kcal/day), particularly in archery and boccia, raising concerns about undernutrition and inadequate recovery. Conversely, athletes in weightlifting and judo disciplines often reported excessive energy intake (>3,000 kcal/day), accompanied by high fat and cholesterol consumption. Micronutrient intake showed inconsistent patterns. Mean vitamin A intake was 1,510 µg (SD ±2,989), but some athletes had zero intake. Similar deficiencies were noted for vitamin C (mean 52.7 mg/day, SD ±137.8) and vitamin E (mean 6.9 mg/day, SD ±6.6). High standard deviations indicated substantial inter-individual variation. Sodium intake averaged 611.5 mg/day (SD ±908.7), with some athletes consuming over 5,800 mg/day, more than double WHO recommended upper limit.

Supplement Use

Notable portion of athletes reported irregular or no use of dietary supplements. Among those who did, most commonly consumed supplements were multivitamins, vitamin C, vitamin B1, folic acid, and protein powders. However, adherence and frequency of use varied by discipline and individual preference. Athletes from weightlifting and judo were more likely to use supplements compared to those from boccia or chess.

Sport-Specific Observations

1. Weightlifting athletes had the highest average BMI (29.1 kg/m²) and reported the highest daily energy intake. Several athletes exceeded daily recommendations for sodium, cholesterol, and calories, with limited intake of antioxidant vitamins.
2. Archery athletes, the largest group, exhibited wide variation in energy intake (600–3,400 kcal) and nutritional status, with some showing signs of undernutrition.
3. Table tennis athletes had normal average BMI but presented with abdominal obesity in some cases, supported by high cholesterol and saturated fat intake.
4. Boccia and chess athletes demonstrate lowest average energy intake and multiple micronutrient deficiencies.
5. Judo athletes recorded highest potassium and protein intakes, with elevated sodium and caloric intake contributing to above-normal BMI levels in several cases.

Table 1. Descriptive statistics of key dietary intake variables among 99 Paralympic athletes in Yogyakarta, based on three-day dietary recall data.

	Minimum	Maximum	Mean	Std. Deviation
Energy	431.0	5104.0	1950.648	866.3388
Protein	11.4	217.0	84.013	41.7096
Fat	3.4	222.4	73.096	50.5791
Carbohydrate	27.6	703.8	242.352	120.8865
Dietary fiber	0.2	45.6	13.296	8.6874
Alcohol	0	0	.00	.000
PUFA	0.6	85.8	18.335	16.6133
Cholesterol	0.0	3926.4	508.177	562.2678
Vit. A	0.0	22650.0	1510.098	2989.1439
Carotene	0.0	1.0	0.015	0.1095
Vit. E (eq.)	0.0	35.8	6.912	6.6211
Vit. B1	0.2	2.2	0.696	0.3716
Vit. B2	0.2	5.4	1.342	1.1373
Vit. B6	0.4	5.2	1.312	0.7764
Tot. fol.acid	18.4	1181.8	243.956	188.3133
Vit. C	0.0	1023.8	52.683	137.7715
Sodium	8.0	5855.6	611.504	908.7352
Potassium	248.0	19862.0	2354.573	3441.3977
Calcium	25.2	3725.8	441.758	532.1209
Magnesium	53.8	2335.0	348.283	408.4552
Phosphorus	189.0	4165.2	1068.383	616.3957
Iron	2.4	65.4	12.419	12.1768
Zinc	2.0	25.0	8.521	4.3660

4.DISCUSSION

Findings revealed considerable variability in energy and micronutrient intake across different sport disciplines, suggesting that current dietary practices may be suboptimal for supporting peak athletic performance and recovery. This aligns with prior research noting that athletes with disabilities often face unique nutritional challenges that are not adequately addressed in standard sports nutrition guidelines.^{4,6} Mean daily energy intake of 1,950 kcal in this study appears insufficient for high-performance athletes, particularly given their elevated energy expenditure during intensive training. Notably, some athletes consumed less than 1,000 kcal/day, which is concerning when viewed in the context of minimum energy availability required to maintain physiological and cognitive function in athletes.⁹ Chronic energy deficits have been linked to reduced muscle mass, impaired immune function, hormonal imbalances, and increased risk of injury.^{13,17} In contrast, other athletes, particularly in weightlifting and judo, consumed more than 3,000 kcal/day, suggesting a mismatch between energy intake and expenditure, potentially increasing risk of adiposity and metabolic strain.⁵ Dominance of carbohydrates as a primary energy source is consistent with national dietary patterns in Indonesia.¹⁸ However, wide standard deviations in macronutrient intake indicate inconsistent meal planning and possible lack of nutritional supervision.

Protein intake varied widely (11–217 g/day), which may reflect differences in sport demands or access to protein-rich foods and supplements. Although average intake may appear adequate, quality and timing of protein consumption are crucial for muscle repair and training adaptation.¹⁹

Micronutrient intake presented further concerns. Deficiencies in vitamin C, E, and A were observed in several athletes, despite these nutrients playing vital roles in immune function, antioxidant defence, and tissue repair.²⁰ These findings echo earlier studies of Paralympic athletes, such as Madden et al., which reported frequent shortfalls in micronutrients among both male and female athletes.⁵ Notably, 2021 Korean Paralympic nutrition study reported similar deficiencies in vitamin E and potassium intake among athletes with disabilities, supporting generalisability of present findings to other Asian contexts.¹⁰ Excessive sodium intake was a notable finding, particularly among weightlifters and judo athletes, where daily intake surpassed 5,000 mg in some cases. World Health Organization recommends an upper limit of 2,300 mg/day for adults, with excess intake linked to elevated blood pressure and increased cardiovascular risk.²¹ This may explain elevated systolic and diastolic blood pressure observed in several athletes.

Salt-rich processed foods and seasoning-heavy diets common in Indonesian culture may contribute to this pattern, warranting nutritional education and dietary counselling. Use of dietary supplements was inconsistent. While some athletes used multivitamins and protein powders, overall supplementation adherence was low, and few athletes reported regular intake of micronutrient-based supplements. This may reflect limited access, financial constraints, or a lack of nutrition education. Previous studies indicate that appropriate use of supplements can support performance, particularly in athletes with restricted dietary diversity or increased physiological demands.²² However, unregulated supplement use without professional guidance carries potential risks, including toxicity and contamination.²³ Sport-specific observations provided useful insights. For instance, archery athletes exhibited low BMI and energy intake despite the need for mental endurance and postural stability, which require consistent energy availability.²⁴ In contrast, weightlifters exhibited high BMI and caloric intake but low antioxidant consumption, highlighting risk of overnutrition coexisting with micronutrient deficiencies. Table tennis athletes displayed indications of abdominal obesity despite normal average BMI, emphasizing the importance of waist circumference as a complementary indicator of cardiometabolic risk.²⁵

Strengths and Limitations

Key strength of this study lies in its use of primary data collection across a large and diverse sample of athletes with disabilities, including a broad representation of sport disciplines. Additionally, combination of anthropometric data, dietary recall, and supplement use provides a multidimensional view of nutritional status. However, several limitations should be noted. First, three-day dietary recall method, while practical, is prone to recall bias and may not accurately reflect habitual intake.²⁶ Second, the cross-sectional nature of the study prevents causal inference regarding the relationship between dietary intake and performance or health outcomes. Third, unequal distribution across sports disciplines may limit the generalisability of sport-specific findings.

Implications

These findings underscore urgent need for targeted nutritional interventions and monitoring in Paralympic training programmes. Institutional support for individualized meal planning, regular assessment of micronutrient status, and professional dietary counselling is recommended. Given physiological variability associated with different disabilities, future research should adopt longitudinal designs and incorporate biochemical assessments to evaluate impact of tailored nutrition on athletic performance and recovery.

This study highlights substantial variability in nutritional status, dietary intake, and supplement use among Paralympic athletes in Yogyakarta. While some athletes demonstrated adequate energy and macronutrient intake, others exhibited patterns of undernutrition or overnutrition, often accompanied by micronutrient imbalances. Inconsistent use of dietary supplements and presence of sport-specific nutritional risks underscore the need for individualized nutritional assessment and guidance. Tailored dietary interventions, combined with structured nutrition education, may enhance athletic performance, reduce injury risk, and support long-term health in this underrepresented athletic population. Future research should adopt longitudinal and biomarker-based approaches to further investigate the impact of dietary strategies on functional and competitive outcomes in athletes with disabilities.

DECLARATIONS

Ethical statement

This study was performed in line with the principles of the Declaration of Helsinki.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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