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ORIGINAL SCIENTIFIC PAPER

College Athletes' Evaluation of Yips in Baseball

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Abstract

The absence of standardized methods to evaluate the occurrence and progression of yips in athletes has been noted. This study explored the criteria used by college baseball players to evaluate their own and others' yips. The data were collected using an open-ended survey, administered to 218 baseball players at three Japanese universities. The data were analyzed using qualitative content analysis, which identified higher- and lower-order themes in the self and external evaluations. The self-evaluations revealed 10 lower-order and 3 high-order themes, whereas the external evaluation produced 15 lower-order and 4 high-order themes. The self-evaluations prioritized internal sensations and emotions, whereas the external evaluations focused on observable behaviors like wild throws. The findings suggest that comprehensive assessment of the yips requires the integration of both subjective internal experiences and objective observable behaviors. Practical applications include the development of multidimensional evaluation frameworks that combine self-report measures with video analysis and kinematic assessments for coaches and practitioners working with athletes affected by the yips.

Keywords: *task-specific dystonia, psychological and physical interplay, athletic performance assessment, qualitative evaluation framework, baseball throwing mechanics*

Introduction

The yips are a temporary impairment of motor control, in which control is suddenly lost over motor skills developed for a sport, significantly reducing performance and potentially damaging an athlete's career. The yips have been reported in baseball, golf, billiards, darts, etc. (Gutierrez & Vanguri, 2023; Klämpfl, Lobinger, & Lehmann, 2020; Nijenhuis et al., 2024), with prevalence ranging from 10.2% to 47.1% in baseball (Aoyama et al., 2021; Maruo, Shimizu, & Miyamoto, 2024) and 25%–48% in golf (McDaniel, Cummings, & Shain, 1989; Smith et al., 2000). In baseball, the yips manifest as difficulty making accurate throws, particularly during routine plays. In golf, they may appear as involuntary twitches or hesitation during putting strokes. These examples illustrate their effects on well-practiced, previously automatic movements across sports. Studies have investigated the underlying mechanisms for prevention strategies and interventions.

Relevant studies have identified neurophysiological factors (e.g., focal dystonia; McDaniel et al., 1989), and psychological contributors (e.g., choking under pressure; Bawden & Maynard, 2001). These factors are thought to interact in complex ways in the development of the yips (Smith et al., 2000; Stinear, Coxon, & Fleming, 1980). Previous scholars reported its psychological mechanisms such as vivid negative motor imagery related to throwing failure (Aoyama et al., 2023). In parallel, neurophysiological investigations have elucidated motor coordination breakdown in symptomatic players, with abnormal muscle synergy patterns observed during dystonia-like throwing movements (Aoyama et al., 2024). The yips are significantly more common than other dystonias—for instance, musician's dystonia has a prevalence of approximately 1% (Altenmüller, 2003)—and differ in symptom expression (Ioannou, Klämpfl, & Lobinger, 2018). While choking typically occurs in high-pressure contexts, the yips can also emerge under low-pressure conditions such as practice (Papineau, 2015). These findings suggest that psychological and task-specific motor control impairments may contribute to the development of the yips, supporting the view that they constitute a multifactorial condition requiring further investigation.

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The lack of consensus regarding the development of the yips is partly due to the absence of standardized evaluation criteria, which has led to assessments based primarily on subjective self-evaluation and external observation (Adler, Temkit, & Crews, 2018). The absence of standardized evaluation criteria has also hindered both research progress and clinical management of the yips (Clarke, Sheffield, & Akehurst, 2015; Philippen, Legler, Land, Schuetz, & Schack, 2014). Klämpfl, Philippen, and Lobinger (2015) identified reliance on subjective evaluation as a significant limitation, suggesting that uncertainty in the evaluative criteria could contribute to variability in the reported prevalence of the yips.

To the best of our knowledge, no previous study has systematically examined the criteria underlying the subjective ratings provided by athletes for the yips. Given the career-threatening nature of the condition and the need for evidence-based assessment tools, understanding athletes' evaluation of the yips is essential. Self-evaluation criteria offer insights into the subjective experience of symptom onset and progression, while external evaluation criteria capture observable signs recognized by peers and coaches. Integrating both perspectives may contribute to the development of comprehensive assessment frameworks that bridge the gap between subjective experience and objective measurement. Therefore, elucidating evaluative criteria for validating existing assessments, identifying alternative approaches, and establishing standardized frameworks are crucial. This study focuses on the yips in baseball pitching among Japanese university players and identifies criteria used for self and external assessment. These findings enhance the reliability and validity of yips assessment methods while laying the groundwork for developing objective measurement techniques and targeted intervention strategies. This study addresses these critical gaps and contributes to a broader understanding of this persistent impairment.

Methods

A cross-sectional, survey-based study design targeting college baseball players was adopted. Data were collected online at three universities in Japan from May to June 2024. The Ethics Committee of Kumamoto Gakuen University and the ethics board of the first author's affiliation approved the study. The participants received detailed information and provided informed consent. Data privacy was ensured via anonymized Google Forms.

Participants

The participants included 224 college baseball players aged 18–22 years (mean age = 19.04 years, SD = 1.26 years). Six participants (2.7%) who responded, "I have heard the term 'yips' with reference to baseball but do not understand its meaning" or "I have never heard the term 'yips' with reference to baseball and do not know its meaning," were excluded, leaving 218 participants (mean age = 19.05 years, SD = 1.27 years).

This exclusion was essential for maintaining the validity of qualitative content analysis. This study specifically investigated the conceptualization and evaluation of the yips among athletes with knowledge of this phenomenon. The survey focused on articulating the criteria for evaluating the "yips" in themselves and others. Examples include "During which situations did you feel you developed the yips, and what were your reasons (criteria) for this judgment?" and "What reasons (criteria) led you to conclude that another athlete has developed the yips?" Meaningful responses presupposed a conceptual understanding of the elements constituting the yips. Without being able to conceptualize the phenomenon, participants would not have been able to articulate their evaluation criteria.

Previous studies highlighting the challenges of subjective yips assessment support the methodological necessity of this exclusion. For example, Klämpfl et al. (2015) identified variability in the prevalence of self-reported yips as a significant limitation, noting discrepancies between subjective identification and objective measurement. Clarke et al. (2015) emphasized that the absence of standardized evaluation criteria hinders research progress. Including participants unfamiliar with the term would introduce irrelevant variances because their responses would reflect general challenges in throwing rather than specific evaluation criteria, thereby threatening internal validity.

We acknowledge that certain athletes may experience symptoms similar to the yips without knowledge of the specific term. The relatively small proportion of excluded participants (2.7%) indicates that knowledge of the yips is widespread among Japanese college baseball players with extensive playing experience (mean = 11.44 years). However, investigating unconscious or unnamed experiences requires different methodological approaches, such as observational studies or biomechanical analyses, which are outside the scope of this study.

Mean baseball experience reached 11.44 years (SD = 2.22 years). Eighty-seven participants experienced the yips and knew others who had; 11, 92, and 28 personally experienced it, were aware of others' experience, and had neither personal nor observed experience.

Data collection instrument and procedure

This study employed a custom-designed, non-standardized questionnaire to collect large-scale data on the participants' evaluation criteria for the yips. A new survey tool was necessary given the absence of existing validated instruments. The questionnaire was formulated after conducting an extensive literature review (e.g., Bawden & Maynard, 2001; Clarke et al., 2015; Smith et al., 2000) and consulting with sport psychology experts with experience in yips research, qualitative studies, and the development of psychological scales. The questionnaire utilized open-ended questions designed to capture baseball players' subjective experiences and evaluation criteria. Prior to data collection, content validity was verified through a review conducted by two independent experts. The results confirmed the appropriateness of content and wording, and items were refined as necessary. The first author and team coaches conducted an online survey via anonymized Google Forms. The survey featured four major components: (1) demographic information, including gender, age, and years of baseball experience; (2) understanding and experience of the yips using a four-point scale; (3) self-evaluation criteria through open-ended questions (e.g., "During which situations did you feel that you developed the yips, and what were your reasons [criteria] for this judgment?"); and (4) other-evaluation criteria using open-ended questions (e.g., "What reasons [criteria] led you to conclude that another athlete has developed the yips?"). The participants provided informed consent and were assured of their privacy and confidentiality through anonymization protocols. Table 1 presents the survey components.

Data analysis

The authors independently reviewed and coded responses related to criteria for self and external evaluation using a content analysis approach (Bawden & Maynard, 2001; Smith et al., 2000). Lower-order themes were identified and grouped to form higher-order themes. For example, "loss of control" and "erratic throwing" were grouped into "performance instability." The researchers discussed any differences in coding until consensus was reached.

Table 1. List of Survey Items

Component	Details
Demographic information	Questions concerning gender, age, and years of baseball experience.
Understanding and experience of the yips	Participants were asked to choose one of the following options: (1) "I think I know well what the 'yips' are" (2) "I have a vague understanding of the 'yips,' but I am not sure of the details" (3) "I have heard the term 'yips,' but I do not know what it means" (4) "I have never heard of the 'yips' and do not know what it is" Participants who selected options (3) or (4) were excluded from the subsequent study as their limited understanding of the yips was considered insufficient for the analysis.
Self-evaluation criteria	Participants provided free-text responses to the following question: "In baseball, under what circumstances did you feel that you had the yips, and what are the reasons (criteria) for this judgment?"
External evaluation criteria	Participants provided free-text responses to the following question: "In baseball, what reasons (criteria) lead you to judge that someone else has developed the yips?"

Results

The comprehensive analysis enabled us to identify the criteria that baseball players use to evaluate the yips, with 3 higher-order and 10 lower-order themes derived from 151 responses. The evaluation criteria for the manifestation of the yips in others included 4 higher-order and 15 lower-order themes from 219 responses (Tables 2 and 3). Some participants provided a single criterion, whereas others listed several, leading to a discrepancy between the number of responses and participants. Representative descriptions are given in tables to increase clarity, with grammatical corrections made for readability.

Table 2. Free-Text Responses and Categories Regarding Criteria for Self-Evaluation of the Yips

Raw data	Lower-order themes (number of instances)	Higher-order themes (number of instances)
When I feel a fear of throwing from the mental aspect	Negative emotions and thinking related to throwing (23)	Negative emotions and cognitions related to throwing (23)
I lose sensation along my arm to my fingertips when throwing	Diminished proprioception in throwing (27)	Physical dysfunction and sensory disruptions (59)
My arm muscles stiffen at the moment of throwing	Muscle rigidity (15)	
My arm doesn't move as freely as I expect when throwing	Impaired arm swing (10)	
My body doesn't move the way I want it to	Impaired stable motor control (7)	
I can no longer throw the ball to the same distance I used to	Inability to throw as intended (28)	Performance deterioration (69)
When pitching at about 50% effort in batting practice, I find it difficult to throw to right-handed batters	Situation-specific symptom manifestations (22)	
The ball slips out of my hand or gets stuck	Ball slipping from or sticking on the fingers (15)	
When I start making more wild throws	Wild throws (3)	
My throwing form fell apart after I gave up a run on a bases-loaded walk and lost the game	Breakdown in throwing form (1)	

Note. Numbers in parentheses indicate the frequency of similar responses, listed in descending order of frequency in each category.

Criteria for self-evaluation: Negative emotions and thoughts related to throwing

This theme includes fear and anxiety associated with throwing, with 23 responses grouped under this theme. These are critical indicators of yips development. For instance, one participant stated that the yips may arise, "when I feel a fear of throwing from the mental aspect."

Criteria for self-evaluation: Physical dysfunction and sensory disruptions

This theme incorporates subthemes such as diminished proprioception in throwing (27 responses), muscle rigidity (15 responses), impaired arm swing (10 responses), and impaired motor control stability (7 responses). One participant mentioned that the yips arose when "I couldn't feel my fingers gripping the ball, which affected my performance."

Criteria for self-evaluation: Performance deterioration

This theme includes subthemes like the inability to throw as intended (28 responses) and situation-specific symptom manifestations (22 responses), ball slipping from or sticking to the fingers (15 responses), wild throws (3 responses), and breakdown in throwing form (1 response). For instance, one participant noted, "I can no longer throw the ball to the intended distance like I used to."

Table 3. Free-Text Responses and Categories Regarding Criteria for External Evaluation of the Yips in Other Athletes

Raw data	Lower-order themes (number of instances)	Higher-order themes (number of instances)
Afraid of throwing the ball	Negative emotions and thinking related to throwing (8)	Psychological instability and emotional responses (16)
Mental weakness	Mental instability (7)	
When their expression isn't positive	Unusual facial expression (1)	
The throwing motion isn't smooth, and it pauses midway	Muscle rigidity and movement freezing (28)	Physical dysfunction and sensory disruptions (40)
A player whose arm swing isn't smooth in arm throwing	Impaired arm swing (8)	
When they can no longer control what they used to be able to	Impaired motor control stability (4)	
It's clear to others that they can't throw the way they want to	Inability to throw as intended (58)	Performance deterioration (160)
They could throw normally when playing catch, but as soon as it was fielding practice, their throwing changed	Situation-specific symptoms (31)	
I realized it while watching their performance because their movements looked stiff and jerky	Abnormalities in form or throwing mechanics (28)	
Their throws don't reach the chest at all	Wild throws (25)	
Someone whose throws either get stuck or slip out	Sensation of the ball slipping or sticking on the fingers (12)	
Someone who keeps making the same mistakes	Repeated mistakes (4)	
They can't throw like they used to—whether it's control or ball speed	Changes in ball rotation and velocity (2)	
They said so themselves	Self-report (2)	Self-reported and subjective experiences (3)
A player showing the same symptoms as me	Symptoms common to self and others (1)* * Evaluation by individuals with experience of the yips	

Note. Numbers in parentheses indicate the frequency of similar responses, listed in descending order of frequency within each category.

Criteria for external evaluation: Psychological instability and emotional responses

This theme includes the subthemes of negative emotions and thoughts related to throwing (8 responses), mental instability (7 responses), and unusual facial expressions (1 response). For instance, one participant noted that, with the yips, others were "afraid of throwing the ball."

Criteria for external evaluation: Physical dysfunction and sensory disruptions

This theme includes the subthemes of muscle rigidity and freezing (28 responses), impaired arm swing (8 responses), and impaired motor control stability (4 responses). One participant observed that, in others, "the throwing motion isn't smooth and pauses midway."

Criteria for external evaluation: Performance deterioration

This theme includes the subthemes of inability to throw as intended (58 responses), situation-specific symptoms (31 responses), abnormalities in form or mechanics (28 responses), wild throws (25 responses), sensation of the ball slipping from or sticking to the fingers (12 responses), repeated mistakes (4 responses), and changes in ball rotation and velocity (2 responses). For instance, one participant noted, "I realized it while watching their performance because their movements looked stiff and jerky."

Criteria for external evaluation: Self-reported and subjective experiences

This theme includes self-reports (2 responses) and symptoms common to oneself and others (1 response). For instance, one participant noted, "They said it themselves" that they had the yips.

Discussion

This study provides the first systematic examination of the evaluation criteria used by baseball players to assess the yips in themselves and others. Both self- and external evaluations involved a multifaceted array of criteria, revealing distinct patterns in criterion selection. Self-evaluations emphasized internal sensations and emotional experiences, whereas external evaluations focused not only on psychological or contextual factors but also on observable abnormalities in motor behavior. These differences reflect the inherent limitations of relying solely on subjective or observational assessments and underscore the need for comprehensive evaluation frameworks that integrate both perspectives.

The most frequently cited criterion in both evaluation types was performance deterioration. This finding aligns with Maruo et al. (2024), who identified throwing accuracy deficits as a primary manifestation of the yips in youth baseball players. Our results further extend this understanding by highlighting that specific performance indicators differ between self- and external assessments. In self-evaluation, the most frequently reported criteria in-

cluded "Inability to throw as intended," "Situation-specific symptom manifestation," "Sensation of the ball slipping or sticking on the fingers," "Wild throws," and "Breakdown in throwing form." External evaluations also emphasized observable indicators, such as abnormalities in form or mechanics, repeated mistakes, and changes in ball rotation and velocity.

The next most frequently cited criteria for the yips in self and external evaluations were physical dysfunction and sensory disruptions. Particularly, self-evaluations are commonly referred to as "Diminished proprioception in throwing," "Muscle rigidity," "Impaired arm swing," and "Impaired motor control stability," whereas external evaluations often highlighted "Muscle rigidity and movement freezing," "Impaired arm swing," and "Impaired motor control stability." The findings are supported by analogous symptoms reported by cricketers in another study (Bawden & Maynard, 2001). Such physical and sensory abnormalities—particularly diminished proprioception—may serve as early indicators of neuroplastic changes associated with task-specific dystonia.

Regarding the key differences between self and external evaluations, the former emphasized internal sensations, such as finger proprioception and muscle control in throwing, whereas the latter relied on observable factors, including visible abnormalities of movement and apparent loss of coordination. These observations reflect differences in perspective between the individual and external observers, highlighting the interplay between internal awareness and external observations in comprehending yips-related behaviors.

Psychological criteria were frequently employed in self and external evaluations, including "Psychological instability and emotional responses" and "Negative emotions and thoughts related to throwing." Self-evaluations often highlighted "psychological instability and emotional responses," which is consistent with the association between negative motor imagery and yips symptom severity reported by Aoyama et al. (2023). In contrast, external evaluation emphasized "Negative emotions and thoughts related to throwing," "Mental instability," and "Unusual facial expressions."

Clarke et al. (2015) proposed a classification of the yips into three distinct types: Type I (predominantly physical symptoms), Type II (primarily psychological symptoms), and Type III (combination of physical and psychological symptoms). For athletes with Type I or Type III yips, psychological criteria may not be sufficient for evaluation. Moreover, some studies have indicated that neurophysiological factors, such as dystonia, may be underlying factors, whereas psychological factors, such as anxiety, intensifying the condition (McDaniel et al., 1989). These findings imply that changes in emotion and thinking toward throwing may not always serve as reliable criteria for evaluating the development of the yips.

The final criterion, "Self-reported and subjective experiences," was exclusively observed in external evaluation and includes two subcategories: The first is "Self-report," in which an athlete is diagnosed with the yips based on their account. The second is "Symptoms common to self and others," in which evaluators with personal experience of the yips identified others as having the condition based on symptoms similar to their own experiences.

This study identified common themes in performance deterioration and psychological instability in self and external evaluation. However, notable differences emerged. In the self-evaluation, internal sensations, such as diminished proprioception and muscle rigidity, were emphasized along with subjective emotional experiences, including fear and anxiety. By contrast, external evaluation focused on observable behaviors, including wild throws, repeated mistakes, and abnormalities in mechanics. While some criteria had the same category names, the specific content often differed, and individual responses varied considerably.

These findings indicate the multifaceted nature of yips evaluation and underscore the necessity for tools combining subjective experiences with objective measures. The discrepancies between self and external evaluations also indicate the need for further research.

Practical applications

The results of this study highlight the need for coaches and practitioners to revisit evaluation criteria for the yips. The diverse and divergent criteria identified in self and external evaluations suggest that relying solely on either perspective is insufficient. Establishing a standardized, multifaceted framework is therefore essential for accurate diagnosis and effective intervention. Given this variability, it is also crucial to develop integrated strategies that address both the psychological and physical dimensions of the yips. A comprehensive approach that incorporates both aspects is more likely to lead to successful outcomes. To bridge the gap between our findings and potential practical applications, coaches should adopt assessment protocols combining subjective and objective criteria, such as video analysis to investigate throwing mechanics, tailored questionnaires to examine internal sensations, and kinematic measurements to assess motor control, all of which can help identify and address the yips at early stages (Philippen et al., 2014). This multidimensional approach can improve diagnostic accuracy and guide targeted interventions, ultimately enhancing athlete performance and confidence.

Limitations and future directions

This study has its limitations. First, excluding participants unfamiliar with the term "the yips" (n = 6, 2.7%) may have overlooked athletes who experienced similar symptoms but lacked knowledge of the term. While necessary for the qualitative approach used to examine conscious evaluation criteria, this aspect represents a trade-off between conceptual clarity and comprehensive coverage. Second, the cross-sectional design and sample of Japanese college baseball players may limit generalizability to other contexts and populations.

Future research could address these limitations by (1) providing standardized yips education prior to data collection to ensure a shared conceptual understanding (Philippen et al., 2014), (2) combining qualitative assessments with objective measurements to capture conscious and unconscious manifestations; and (3) developing screening tools that identify experiences similar to the yips without requiring prior knowledge of the terminology. Despite these limitations, this study provides the first systematic examination of conscious evaluation criteria for the yips, offering valuable insights for the development of standardized assessment frameworks.

Conclusion

This study systematically examined the evaluation criteria for self and external assessments of the yips among 218 Japanese college baseball players. The self-evaluations emphasized internal sensations and emotions (3 higher- and 10 lower-order themes), whereas external evaluations focused on observable behaviors (4 higher- and 15 lower-order themes). The athletes most frequently cited performance deterioration as a criterion in both evaluations. The findings revealed fundamental differences between subjective and observational assessments, highlighting the need for comprehensive evaluation frameworks that integrate both perspectives. Thus, future research should validate these criteria across populations and develop tools for standardized assessments that combine subjective and objective measures.

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ORIGINAL SCIENTIFIC PAPER

Evaluating Sitting Body Proportions: A Gender-Based Anthropometric Study Among Nigerian Igbos

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Abstract

Anthropometry, in the field of ergonomics, is relevant in the assessment of sitting postures between genders during sedimentary work lifestyles. The present study was done to evaluate sitting body proportions using selected anthropometric variables of Nigerian Igbo adults and to analyse where sexual differences exist between them. This cross-sectional descriptive study measured sitting anthropometrics of 500 Nigerian Igbo individuals aged 18-35 years, equally balanced by gender. Participants met the selection criteria such as no musculoskeletal issues, no limb surgeries, and engaged in routine activities, and were recruited via multi-stage random sampling. Standardized anthropometric protocols were used for obtaining measurements including standing height (H), body weight (W), body-mass index (BMI), sitting height (SH), sitting eye height (SEH), shoulder height (SSH), knee height (SKH), and popliteal height (SPH). Data were analysed using SPSS version 25.0, presenting descriptive statistics and comparing sexes via Student's t-test, with significance set at $p<0.05$. Anthropometric outcomes in the current study revealed that the mean height and weight of the males were significantly higher compared to females, while the mean values for sitting height (SH) and knee height (SKH) differed significantly between genders. The other sitting anthropometric variables such as the eye height (SEH), shoulder height (SSH), and the popliteal height (SPH) did not differ significantly between genders ($p < 0.05$). The study concluded that there were selected gender differences observed in the sitting anthropometric parameters and this could be relevant towards the ergonomic design of seats for Nigerian Igbos.

Keywords: *sitting height, eye height, shoulder height, knee height, popliteal height*

Introduction

Anthropometry is the scientific study of measuring the physical dimensions of the human body (Green et al., 2019). It encompasses a variety of measurements, including linear body dimensions such as body height, circumferences of the head, neck, and chest, as well as body angular measurements (Utkualp & Ercan, 2015; Heymsfield et al., 2018). Generally, anthropometry is a way of measuring and collecting data about physical traits of people. This knowledge is not only important for understanding how body shapes and sizes of people differ between ethnic groups, but it is also useful in the fields of ergonomics and human engineering for designing products, workplaces, and systems that fit users well to improve comfort, safety, and performance (Garneau & Parkinson, 2016; Ma & Niu, 2021).

Ergonomics and anthropometry experts usually look at and analyse the body dimensions of people sitting in different posi-

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tions to find the best way to design chairs, workstations, vehicle interiors, and other seating areas that are comfortable, safe, and healthy (Utkualp & Ercan, 2015; Dianat et al., 2018; Almaz & Fawzy, 2022). These sitting postures inform our understanding on how the spine, pelvis, hips, knees, and ankles align when seated (Hey et al., 2017; Léger et al., 2023). When you sit down, you measure certain body parts that are important for sitting, such the height, depth, and breadth of the seat, the height of the backrest, and the lumbar support. These measurements are different than when you stand up since your body changes shape (Baharampour et al., 2013; Igbokwe et al., 2019). Furthermore, these ergonomic proportions make sitting for long periods of time more comfortable, safer, and able to fit a wide range of body types in cars and other public transportation vehicles thereby reducing musculoskeletal disorders among regular users of these means of transportation.

In line with a previous study done among Indonesians, Malaysians and Filipinos, findings revealed significant differences in sitting anthropometric parameters as Indonesian individuals generally exhibited the highest measurements across parameters such as sitting height, sitting eye height, and sitting shoulder height, thus indicating that they had taller and larger body physiques in these dimensions (Abd Rahman et al., 2018). It is evident from several literature that sitting anthropometrics of most ethnic populations are usually gender-specific, as males usually exhibit higher anthropometrics in comparison to females (Darius et al., 2011; Taifa & Desai, 2017; Kibria & Rafiquzzaman, 2019). However, there are dearth in literature on how sitting anthropometrics are sexually dimorphic among Nigerian adult populations. Therefore, the aim of this study was to evaluate sitting body proportions using selected anthropometric variables of Nigerian Igbo adults and to analyse where sexual differences exist between them.

Materials and methods

Ethical Considerations

Before the commencement of the study, an ethical clearance was obtained from the Research Ethics Committee of the University of Port Harcourt (with registration number UPH/CEREMAD/REC/MM/91/005).

Study Population and Selection of Participants

A cross-sectional, descriptive study design was used to obtain the sitting anthropometrics of five hundred (500) indigenous people (within the age interval of 18-35 years) of the Igbo ethnic group of Nigeria between September 2024 to December 2024. All subjects gave their informed consent, and their personal information was kept confidential. The study population includes 250 males and 250 females of Indigenous Igbo with no/any history of surgical operations in both upper and lower limb regions, no history of musculoskeletal disorders, and were either actively employed or regularly carried out routine daily activities to reflect typical postures. The study subjects were recruited using the multi-stage random proportionate sampling technique and the minimum sample size was calculated using the Taro Yamane formula for quantitative studies as shown in previous studies (Asiwe et al. 2024; Fawehinmi et al. 2024).

Procedures for Measurements

In accordance with the study done by Daruis et al. (2011) and Taifa & Desai (2017), the procedures for measuring and recording the sitting anthropometrics were as follows.

i. Standing Height (H) or Stature: Participants were instructed to stand erect with their heels together, touching the back of the measuring device, their feet flat on the ground, legs straight, arms relaxed at their sides, and their heads positioned in the Frankfort horizontal plane. Then the height was measured and recorded in centimetres.

ii. Body Weight (W): With the aid of a calibrated digital weighing scale, participants were asked to stand upright, and barefooted on the scale with feet evenly spaced and arms relaxed at sides while dressed in minimal clothing. Then, the weight was measured and recorded in kilograms. To ensure consistency in the results, each participant was measured two times and the average between both readings were obtained.

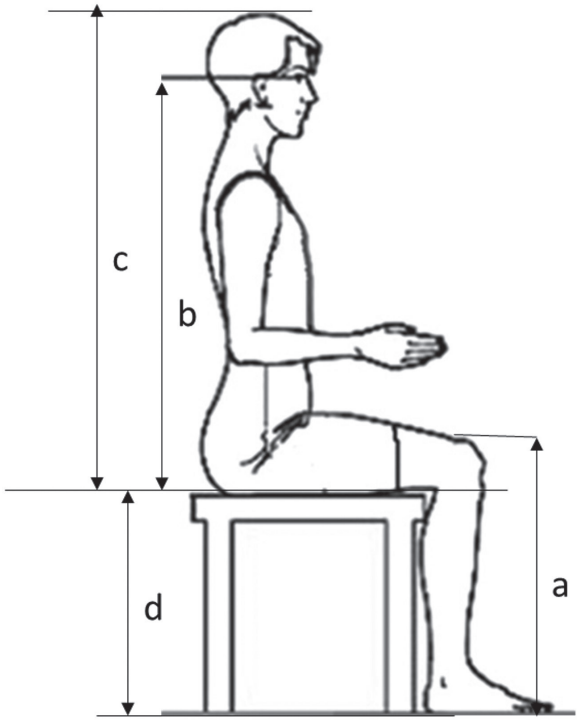

FIGURE 1. Showing the sitting measurements, where a = sitting knee height, b = sitting eye height, c = sitting height, d = sitting popliteal height

iii. Body Mass Index (BMI): Based on the measurements as obtained above (i and ii), the BMI was calculated by dividing the body weight (kilograms) by the square of the standing height (metres).

iv. Sitting Height (SH): Participants were told to sit up straight on an adjustable anthropometric chair, with their feet flat on the floor, thighs parallel to the floor, and heads in a neutral position. The anthropometer was set up so that it was perpendicular to the sitting surface and at the top of the head for each participant. SH was then measured as the vertical distance from the sitting surface to the top of the skull.

v. Sitting Eye Height (SEH): Participants were told to sit up straight with their heads and faces maintaining a natural, forward-looking position. With the anthropometer rod clearly placed and aligning with the eye level, SEH was measured as the vertical distance from the sitting surface to the inferior margin of the eye (usually the line of sight when looking horizontally) and the measurements were recorded.

vi. Sitting Shoulder Height (SSH): Just as in sitting height, the participants were instructed to sit up straight on an adjustable anthropometric chair and SSH was measured as the vertical distance from the sitting surface to the acromion process (the prominent point on the shoulder). To ensure consistency in the measurements, each participant was measured two times and the average between both readings were calculated.

vii. Sitting Knee Height (SKH): Just as in sitting height, the participants were instructed to sit up straight with their knees flexed at approximately 90° on an adjustable anthropometric chair and SKH was measured using the anthropometer as the vertical distance from the sitting surface to the inferior border of the popliteal fossa (the crease behind the knee), and later recorded in centimetres.

viii. Sitting Popliteal Height (SPH): In line with the procedure for measuring sitting knee height, participants were asked to seat upright with thighs horizontal, and their feet flat on the ground. However, SPH was measured as the distance from the surface of the seat to the lowest point of the popliteal fossa (back of the knee) using the anthropometer. Later, the readings were recorded in centimetres.

Reliability of Data

The reliability of the instrument and result was examined using two statistical methods. Firstly, a paired T-test was used to compare the data collected and secondly, we employed the use of the Cronbach alpha to evaluate the consistency of our results, and the outcome presented that the reliability scale was 0.78 which indicates that our results were consistent.

Methods of Data Analyses

The data obtained in this study were subjected to statistical analysis using the International Business Machine of Statistical Package for Social Sciences (IBM SPSS version 25) and results were present descriptively in the form of means, standard errors of means, standard deviation, minimum and maximum values, and the 5th, 50th, and 95th percentiles to understand the variability within the population. A student's t-tests was used to analyse the differences in anthropometrics between sexes and a probability of less than 0.05 was considered statistically significant.

Results

The results from Table 1 show that the mean standing height (H) of Igbo males is 176.12 cm, with a standard deviation (SD) of 6.96 and a range from 160.00 cm to 202.00 cm. The 5th, 50th, and 95th percentiles are 163.77 cm, 176.00 cm, and 186.73 cm, respectively. The mean body weight (W) is 69.02 kg, with an SD of 10.33, ranging from 49.00 kg to 108.00 kg. The BMI has a mean value of 22.24 kg/m², SD of 2.98, and ranges from 16.66 to 34.74, with the 5th percentile at 18.39, 50th percentile at 21.83, and 95th percentile at 28.52. The sitting eye height (SEH) has a mean of 72.63 cm, SD of 3.80 cm, with values ranging from 52.00 cm to 79.60 cm, and corresponding percentiles at 65.77 (5th), 73.00 (50th), and 79.00 (95th). The sitting shoulder height (SSH) has a mean of 57.01 cm, SD of 3.34 cm, with a range from 43.00 cm to 65.00 cm and percentiles at 50.86 (5th), 57.00 (50th), and 62.50 (95th). The sitting knee height (SKH) has a mean of 54.22 cm, SD of 3.61 cm, ranging from 34.00 cm to 63.00 cm, with the 5th percentile at 49.17 cm, the median at 54.05 cm, and the 95th percentile at 60.09 cm. Lastly, the popliteal height (SPH) has a mean of 42.92 cm, SD of 3.62 cm, with values ranging from 28.00 cm to 53.00 cm. The 5th percentile is 36.00 cm, the 50th percentile is 43.00 cm, and the 95th percentile is 49.00 cm.

The results from Table 2 show that the mean standing height (H) of Igbo females is 166.30 cm, with a standard deviation (SD) of 6.02 cm, ranging from 150.50 cm to 189.00 cm. The 5th percentile is 156.78 cm, the median is 166.00 cm, and the 95th percentile is 176.00 cm. The mean body weight (W) is 62.59 kg, with an SD of 10.62 kg and a range from 43.00 kg to 100.00 kg. The body mass index (BMI) has a mean of 22.64 kg/m², an SD of 3.70, and ranges from 15.87 to 36.13. The percentiles for BMI are 17.75 (5th), 21.95 (50th), and 29.33 (95th). In the sitting anthropometric measures, the sitting height (SH) has a mean of 84.35 cm, SD of 3.55 cm, with a minimum of 69.00 cm and a maximum of 89.90 cm. The 5th percentile is 78.00 cm, the median is 84.70 cm, and the 95th percentile is 89.60 cm. For sitting-related measurements, the sitting height (SH) has a mean of 83.32 cm, SD of 4.31, and ranges between 64.00 cm and 89.90 cm. The sitting eye height (SEH) has a mean of 72.30 cm, SD of 3.87, with a minimum of 52.40 cm and maximum of 79.50 cm. The sitting shoulder height (SSH) has a mean of 56.53 cm, SD of 3.55 cm, and ranges from 47.00 cm to 68.00 cm. The sitting knee height (SKH) has a mean of 53.31 cm, SD of 3.20, with values between 43.00 cm and 63.30 cm. The popliteal height (SPH) shows a mean of 42.64 cm, SD of 3.38, and ranges from 33.00 cm to 52.00 cm. Across these sitting anthropometric measures, the 5th, 50th, and 95th, percentiles indicate a relatively tight distribution, with, for example, SH having 5th percentile at 76.00 cm, 50th percentile at 84.00 cm, and 95th percentile at 89.40 cm.

The results presented in Table 3 show sex differences in sitting anthropometric parameters among Igbo subjects, with several statistically significant variations between males and females. Standing height (H) was significantly higher in males than females with a mean difference of -9.82 cm and a highly significant t-value of -16.870 ($p = 0.001$). Body weight (W) also showed a significant sex difference, with males weighing more than females yielding a mean difference of -6.43 kg ($t = -6.867$, $p = 0.001$). However, BMI did not differ significantly between sexes with a t-value of 1.334 ($p = 0.183$). Among the sitting anthropometric variables, sitting height (SH) was slightly higher in females than males, and the difference was statistically significant (mean difference = 1.03 cm; $t = 2.925$; $p = 0.004$). Sitting knee height (SKH) also showed a significant difference, with females having higher values compared to males ($t = 2.974$, $p = 0.003$). In contrast, sitting eye height (SEH), sitting shoulder height (SSH), and sitting popliteal height (SPH) did not show statistically significant differences between the sexes, with p-values of 0.346, 0.125, and 0.380 respectively. Significant sexual dimorphism was observed in standing height, body weight, sitting height, and sitting knee height, while BMI and other sitting measures (SEH, SSH, SPH) did not show significant sex-related variation among the Igbo subjects studied.

Table 1. Descriptive Statistics of Anthropometrics for Igbo males

Variables	Mean	SEM	SD	Min	Max	Male Percentile		
						5th	50th	95th
H (cm)	176.12	0.44	6.96	160.00	202.00	163.77	176.00	186.73
W (kg)	69.02	0.65	10.33	49.00	108.00	54.28	68.00	90.23
BMI (kg/m^2)	22.24	0.19	2.98	16.66	34.74	18.39	21.83	28.52
SH (cm)	84.35	0.23	3.55	69.00	89.90	78.00	84.70	89.60
SEH (cm)	72.63	0.24	3.80	52.00	79.60	65.77	73.00	79.00
SSH (cm)	57.01	0.21	3.34	43.00	65.00	50.86	57.00	62.50
SKH (cm)	54.22	0.23	3.61	34.00	63.00	49.17	54.05	60.09
SPH (cm)	42.92	0.23	3.62	28.00	53.00	36.00	43.00	49.00

H=standing height, W=body weight, BMI=body mass index, SH=sitting height, SEH=sitting eye height, SSH=sitting shoulder height, SKH=sitting knee height, SPH=sitting popliteal height

Table 2. Descriptive Statistics of Anthropometrics for Igbo females

Variables	Mean	SEM	SD	Min	Max	Female Percentile		
						5th	50th	95th
H (cm)	166.30	0.38	6.02	150.50	189.00	156.78	166.00	176.00
W (kg)	62.59	0.67	10.62	43.00	100.00	50.00	61.00	82.675
BMI (kg/m^2)	22.64	0.23	3.70	15.87	36.13	17.75	21.95	29.33
SH (cm)	83.32	0.27	4.31	64.00	89.90	76.00	84.00	89.40
SEH (cm)	72.30	0.25	3.87	52.40	79.50	66.59	72.35	78.14
SSH (cm)	56.53	0.22	3.55	47.00	68.00	51.00	56.50	62.78
SKH (cm)	53.31	0.20	3.20	43.00	63.30	48.60	53.00	58.74
SPH (cm)	42.64	0.21	3.38	33.00	52.00	37.25	42.35	48.73

H=standing height, W=body weight, BMI=body mass index, SH=sitting height, SEH=sitting eye height, SSH=sitting shoulder height, SKH=sitting knee height, SPH=sitting popliteal height

Table 3. Gender Differences between Anthropometrics

Variables	Male	Female	Mean Difference	T-test	Significance	Inference
H (cm)	176.11±6.96	166.30±6.01	-9.82	-16.87	0.001	Significant
W (kg)	69.01±10.32	62.58±10.62	-6.43	-6.87	0.001	Significant
BMI (kg/m^2)	22.23±2.98	22.64±3.70	0.40	1.33	0.183	Non-Significant
SH (cm)	84.35±3.55	83.32±0.27	1.03	2.93	0.004	Significant
SEH (cm)	72.62±3.79	72.30±3.89	0.32	0.94	0.346	Non-Significant
SSH (cm)	57.00±3.33	56.53±3.54	0.47	1.54	0.125	Non-Significant
SKH (cm)	54.22±3.60	53.31±6.96	0.91	2.97	0.003	Significant
SPH (cm)	42.91±3.62	69.01±10.32	0.28	0.88	0.380	Non-Significant

H=standing height, W=body weight, BMI=body mass index, SH=sitting height, SEH=sitting eye height, SSH=sitting shoulder height, SKH=sitting knee height, SPH=sitting popliteal height

Discussions

The measurement of the dimensions of the human body is crucial in building work environments that are suited to individual needs irrespective of the gender differences (Garneau & Parkinson, 2016; Wiggermann et al., 2019). When employees sit for lengthy periods of time, discrepancies between their body proportions and the furniture or workstation design might cause pain and health problems. For instance, if a chair does not support the natural curvature of the spine, this imbalance might cause the body to be in awkward postures eventually creating discomfort and in extreme cases, pose a threat on their musculoskeletal health (Reid et al., 2010; Kwon et al., 2018). The present study was done to evaluate the anthropometry of different sitting body proportions of adult Nigerian Igbos and to check where the sexual dimorphism exists between both genders.

Anthropometric outcomes obtained from participants in the current study revealed that the mean height and weight of the males were significantly higher compared to females, only the mean values for sitting height (SH) and sitting knee height (SKH) differed significantly between genders. The other sitting anthropometric variables such as the sitting eye height (SEH), sitting shoulder height (SSH), and the sitting popliteal height (SPH) did not differ significantly between genders ($p < 0.05$). In comparison with a related study done among a Malaysian population by Abd Rahman et al. (2018), gender dimorphism was significant for variables such as SH, SSH, SKH, and SPH, although it was not significant for SEH.

As shown in table 4, the results showed that except for the 5th percentile values for SEH, SSH, and SPH, as well as 95th percentile values for SSH in the current study, percentile values for all sitting anthropometric variables were slightly higher in males than females. With respect to SH, the differences in sitting postures between males and females is usually in relation to the variations in the musculoskeletal architecture of the thoracic and upper spinal regions, as well as the positioning of the head relative to the torso during prolonged sitting. For the 5th percentile of females that showed higher SEH, SSH, and SPH values compared to men, it could be explained that the seat of these females was adjustable to the morphological differences in their cervical spine, shoulder and thigh regions.

Table 4. Comparison of sitting anthropometric variables of the present study with related literature

Study	Study Population	Variables	Gender	Mean	5th Percentile	50th Percentile	95th Percentile
Darius et al. (2011)	Malaysian	SH (cm)	Male	86.89	78.69	N. A	95.08
			Female	82.00	74.21	N. A	89.80
		SEH (cm)	Male	74.94	66.31	N. A	83.58
			Female	69.88	62.48	N. A	77.29
		SSH (cm)	Male	56.66	47.26	N. A	66.07
			Female	53.27	46.01	N. A	60.53
		SKH (cm)	Male	51.94	42.04	N. A	61.85
			Female	48.95	40.51	N. A	57.38
		SPH (cm)	Male	45.40	39.02	N. A	51.77
			Female	43.40	35.87	N. A	50.93
Taifa & Desai (2017)	Indian	SH (cm)	Male	80.50	73.00	80.50	88.00
			Female	77.90	73.00	78.00	82.00
		SEH (cm)	Male	70.80	63.00	71.00	78.00
			Female	67.90	63.00	68.00	72.00
		SSH (cm)	Male	56.90	52.00	57.00	62.00
			Female	54.80	50.00	55.00	58.00
		SKH (cm)	Male	53.20	49.00	53.00	57.00
			Female	47.40	42.00	47.00	53.00
		SPH (cm)	Male	45.00	41.00	45.00	48.70
			Female	42.20	37.50	42.00	47.00
Kibria & Rafiquzzaman (2019)	Bangladeshi	SH (cm)	Male	85.21	79.00	85.05	92.05
			Female	80.35	76.26	79.76	85.40
		SEH (cm)	Male	72.15	58.00	74.00	81.16
			Female	68.70	64.06	68.20	73.32
		SSH (cm)	Male	56.57	44.00	58.00	65.05
			Female	54.22	47.10	54.20	59.08
		SKH (cm)	Male	54.90	47.00	54.00	63.69
			Female	49.47	44.92	49.20	54.24
		SPH (cm)	Male	47.43	43.00	47.00	52.00
			Female	39.71	32.68	39.90	46.18
Current Study	Nigerian Igbos	SH (cm)	Male	84.35	78.00	84.70	89.60
			Female	83.32	76.00	84.00	89.40
		SEH (cm)	Male	72.63	65.77	73.00	79.00
			Female	72.30	66.59	72.35	78.14
		SSH (cm)	Male	57.01	50.86	57.00	62.50
			Female	56.53	51.00	56.50	62.78
		SKH (cm)	Male	54.22	49.17	54.05	60.09
			Female	53.31	48.60	53.00	58.74
		SPH (cm)	Male	42.92	36.00	43.00	49.00
			Female	42.64	37.25	42.35	48.73

SH=sitting height, SEH=sitting eye height, SSH=sitting shoulder height, SKH=sitting knee height, SPH=sitting popliteal height, N. A = Not Available

From an ergonomic perspective, the current study findings seek to suggest the relevance of gender dimorphism in the design of seating arrangements, workplace furniture, and working environments since females and males often differ in body composition variables such as pelvic width, abdomen size, thigh length, and spinal curvature. Such differences could impact preferred sitting postures and the likelihood of developing musculoskeletal disorders. For instance, women generally have a wider pelvis and different lumbar lordosis angles, which can affect lumbar support requirements and seat pan dimensions (Been & Kalichman, 2014).

The intricate interplay between human physiology and environmental design lies at the heart of ergonomics, a discipline fundamentally dedicated to optimizing human well-being and overall body system performance (Punchihewa & Gyi, 2016; Adiga, 2023; Kamijantono et al., 2024). Within this critical domain, the precise application of anthropometric data serves as a foundational blueprint, essential for crafting adaptive and inclusive environments. It is within this vital context that the current investigation into the anthropometry of sitting body proportions among adult Nigerian Igbos assumes significant importance. Through a meticulous examination of sexual dimorphism between genders, this study offers a nuanced and detailed information vital for tailoring work environments to meet specific individual needs, thereby contributing to a more inclusive and efficient ergonomic landscape. Indeed, anthropometric data are indispensable for engineering workplaces that not only mitigate the risk of musculoskeletal disorders (MSDs) and associated health ailments but also foster optimal comfort and productivity (Garneau & Parkinson, 2016; Widana et al., 2021). In addition, the utility of this data extends to resolving a spectrum of bio-ergonomic challenges, which are inherently modulated by factors such as race, occupation, and gender – variables known to profoundly influence individual body composition, proportions, and ergonomic preferences. Anthropometric data can differ significantly among various races due to genetic and environmental factors. For example, the study conducted by Abd Rahman et al. (2018) among a Malaysian population found significant gender dimorphism in sitting anthropometric variables, while the current study among Nigerian Igbos showed differences only in sitting height, sitting knee height, and a few percentile values. These variations in anthropometric data further highlight the importance of collecting race-specific data to design work environments that cater to the specific needs of different populations.

Different occupations may require distinct anthropometric data due to the nature of the tasks performed and the equipment used. For instance, workers in the manufacturing industry may require adjustable chairs and workstations to accommodate their height and reach, while office workers may need ergonomic chairs that support their spinal curvature and promote good posture (Van Niekerk et al., 2012; Kahya, 2021). Moreover, jobs that involve repetitive movements or heavy lifting may necessitate the design of workstations that minimize the risk of MSDs and other injuries. The study findings emphasize the significance of gender dimorphism in the design of seating arrangements, workplace furniture, and working environments. Women and men often differ in body composition variables such as pelvic width, abdomen size, thigh length, and spinal curvature, which can impact preferred sitting postures and the likelihood of developing MSDs. For example, women generally have a wider pelvis and different lumbar lordosis angles, which can affect lumbar support requirements and seat pan dimensions. Therefore, ergonomic designs should consider these gender-specific differences to ensure comfort and minimize health risks.

Based on the results obtained in this present study, the usage of anthropometric data in ergonomics can be seen in various industries and workplaces. Firstly, ergonomic chairs and workstations are designed based on anthropometric data to provide optimal support and comfort for workers. These designs consider factors such as sitting height, sitting shoulder height, and sitting popliteal height to ensure that the chair supports the natural curvature of the spine and promotes good posture. Additionally, adjustable chairs and workstations can cater to individual preferences and body proportions, reducing the risk of MSDs and other health issues. In industries where workers perform repetitive tasks or handle heavy equipment, ergonomic designs can minimize the risk of injuries and MSDs. For example, adjustable workstations can be designed to accommodate different heights and reach distances, reducing the need for workers to bend or stretch excessively. Moreover, ergonomic tools and equipment can be designed to minimize the force and repetitive movements required to perform tasks, reducing the risk of strain and injury (Dianat et al., 2018).

Conclusion

Based on the study results, the anthropometric data for Igbo men and women demonstrated evident and noteworthy patterns of sexual dimorphism, as well as some traits that are shared across the two groups. Igbo males were significantly taller and heavier than Igbo females. Interestingly, while males were taller overall, Igbo females exhibit a significantly greater sitting height (SH) than males suggesting that Igbo males had proportionally longer lower limbs relative to their trunk length compared to Igbo females. Also, sitting knee height (SKH) showed a significant difference, with females having higher values compared to males. In contrast to overall height, weight, and specific lower sitting dimensions (SH, SKH), other key sitting anthropometric measures such as, sitting eye height (SEH), sitting shoulder height (SSH), and sitting popliteal height (SPH) did not demonstrate statistically significant differences between the sexes. This implied that the vertical dimensions of the upper body, when seated, and the popliteal height are remarkably similar between Igbo males and females, despite their overall size differences.

Recommendations

The current study provided basic anthropometric data for the Igbo people. Because the current data does not specify age ranges, future research should investigate how these anthropometric parameters vary by age group (e.g., children, adolescents, young adults, middle-aged, elderly) to better understand growth patterns, peak physical dimensions, and age-related changes. Furthermore, a future study ought to include dynamic anthropometric measures related to specific activities, professional duties, or athletic performance. Finally, longitudinal studies that follow changes in anthropometric characteristics over time within the research sample population are critical for providing information on growth trajectories, aging processes, and the long-term influence of environmental variables.

Because the present study focused solely on men and women of the Nigerian Igbo ethnic extractions, its findings may not be generalizable to other ethnic groups within Nigeria or to other populations globally. Therefore, future research should conduct similar studies on other Nigerian ethnic groups and compare the findings to establish ethnic-specific sexual dimorphisms and traits shared among them. Also, the study does not account for potential confounding factors like nutritional status, health conditions, or lifestyle habits which could possibly impact body composition and measurements. That being noted, prospective research ought to examine holistically how these factors could significantly influence the body measurements.

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ORIGINAL SCIENTIFIC PAPER

The Relationship between Dynamic Balance and Soccer Passing Ability among University Level Soccer Players

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Abstract

Dynamic balance is essential in soccer, aiding stability during movements like dribbling and passing. Since passing is critical for maintaining possession and facilitating team play, it may be influenced by a player's balance control. The objective of this study was to examine the relationship between dynamic balance and soccer passing ability among soccer players and to assess performance across different playing positions. Thirty-four university-level soccer players (N=34, Age: 19.9 ± 1.2 years; Weight: 67.6 ± 6.7 kg; Height: 1.73 ± 5.1 m) volunteered to participate. Players were categorized into forward (N=11), defender (N=11), and midfielder (N=12). Dynamic balance was evaluated using the Johnson Modification Dynamic Balance Test (JMBT), while soccer passing ability was assessed using the Loughborough Soccer Passing Test (LSPT). Pearson correlation analysis revealed a significant positive correlation between dynamic balance and soccer passing ability ($r = 0.77$, $P < 0.05$) suggesting players with good balance demonstrated better passing accuracy. However, no significant differences in dynamic balance and passing performances were found across playing positions ($P > 0.05$). These findings highlight the potential benefits of incorporating balance training into soccer conditioning programs to enhance technical skills such as passing. Further research is recommended to explore the effects of long-term balance training interventions on various soccer skills across different levels of play. At this point, it can be concluded that there is a significant relationship between dynamic balance and soccer passing ability in soccer players.

Keywords: *Football, youth, dynamic balance, balance test, performance, soccer skills*

Introduction

Soccer, also referred to internationally as football, is a dynamic and high-intensity sport that requires players to execute a range of technical skills under varying degrees of physical and psychological stress (Atan, Azli, Jakiwa, & Rustam, 2023; Carling, Williams, & Reilly, 2005). Among these skills, passing is a fundamental component essential for maintaining possession, creating scoring opportunities, and implementing team strategies (Galang, Qowiyyuridho, Tomoliyus, & Fauzi, 2021). The execution of effective passes not only necessitates technical proficiency but is also influenced by physical attributes such as balance. Balance is a fundamental component of motor skill-related fitness and is significantly associated with athletic performance across multiple sports disciplines. Existing literature in sports science has provided evidence of the correlation between balance and performance, including its role in injury prevention (Al Attar et al., 2022). However, despite the recognized importance of balance in athletic performance, the specific relationship between dynamic balance and passing ability in soccer remains an area of limited empirical investigation.

Balance is generally classified into two primary categories: static and dynamic. Static balance refers to the ability to maintain an upright or stable position while stationary, such as stand-

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ing still or holding a specific posture (Haddad, 2024). In soccer, static balance is crucial for maintaining stability during one-legged stances, which frequently occur when players prepare for kicks or change direction (Przysucha et al., 2024; Sinulingga et al., 2024). Additionally, it plays a vital role in preventing falls and ensuring stability during stationary activities, including defensive maneuvers and ball control (Chiarovano et al., 2015). Previous research has demonstrated a significant association between static balance and neuromuscular parameters such as trunk endurance and strength (Babagoltabar & Norasteh, 2024). Moreover, studies suggest that goalkeepers exhibit superior static balance compared to players in other positions, indicating that position-specific demands influence balance performance (Mahmoudi et al., 2023). While static balance is essential for soccer performance, particularly for goalkeepers, dynamic balance also plays a fundamental role in overall athletic capability. Given the fast-paced and continuously evolving nature of soccer, dynamic balance is often considered more critical than static balance. However, the interaction between the two suggests that both are essential for optimizing performance and minimizing injury risk.

Dynamic balance is the ability to maintain stability while in motion, particularly during quick directional changes and sudden turns when executing soccer skills (Bloomfield et al., 2007). Effective balance enables athletes to perform technical skills proficiently while adapting to the dynamic and unpredictable nature of gameplay (Kostopoulos et al., 2012). For example, successful dribbling necessitates the ability to maneuver swiftly and change direction while maintaining balance, which is essential for ball control and minimizing the risk of dispossession by opponents. Additionally, dynamic balance plays a crucial role in shooting and passing, as players must efficiently shift their weight and adjust body positioning to generate accurate and powerful shots and passes (Wrisberg, 2007). Beyond offensive actions, dynamic balance is equally important in defensive performance, where defenders must constantly modify their stance to intercept passes, mark opponents, and regain possession of the ball (Da Costa et al., 2009). Furthermore, dynamic balance also influences key physical attributes such as acceleration, maximum speed, agility, and technical execution, all of which are essential for optimal soccer performance (Kim & Kang, 2022). Collectively, these factors contribute significantly to overall success in soccer.

Balance, either static or dynamic, has been extensively documented to improve through balance training across diverse populations, including athletes, older adults, or individuals undergoing rehabilitation (Behm et al., 2015). For instance, research has demonstrated that exercises such as single-leg standing, wobble board drills, and proprioceptive neuromuscular facilitation contribute to enhanced static balance, significantly improving postural control and reducing postural sway (Zech et al., 2010). Furthermore, Granacher et al. (2010) reported that athletes who incorporated these exercises exhibited superior postural stability during movement tasks compared to those who did not. Additionally, exercises such as agility drills, single-leg hops, and unstable surface training have been shown to enhance dynamic postural control (Lesinski et al., 2015). Paillard (2017) suggested that dynamic balance exercises offer greater functional benefits for athletes, as they closely replicate sports-related movements. Moreover, dynamic balance training has been found to enhance neuromuscular coordination, thereby contributing to improved athletic performance (Zahra et al., 2021). Consequently, the development of static and dynamic balance should be tailored to align with the specific demands of the athlete and their respective sport.

Despite the growing body of literature addressing various performance in soccer and balance, there remains a significant gap in research addressing the critical role of dynamic balance in soccer performance. Understanding the connection between dynamic balance and passing performance may provide valuable insights for coaches, trainers, and sports scientists in designing targeted training programs. If dynamic balance is found to significantly influence passing ability, balance training could be incorporated into soccer drills to enhance technical execution and overall gameplay. Therefore, the aim of this study is to investigate the relationship between dynamic balance and soccer passing ability in soccer players, exploring whether players with superior dynamic balance exhibit greater passing accuracy and efficiency. The second objective was to investigate playing abilities in different playing position. It was hypothesis that there is a significant relationship between dynamic balance and soccer skills performance and midfields will have better balance and soccer performances compared to other positions.

Methodology

Participants

Thirty-four soccer players (N= 34) volunteered to participate in this study (age 19.9 ± 1.23 years; Height: 1.73 ± 5.1 m, body mass: 67.6 ± 67 kg). All participants given their consent after being thoroughly informed the benefits and potential risks of the study. The participants were also asked to fill the Health Screening Questionnaire to ensure that they are healthy and free from any injury. The study protocol was approved by the University Research Ethics Committee (JKEP 13).

Experimental Design

Data were collected during the competitive season of Institut

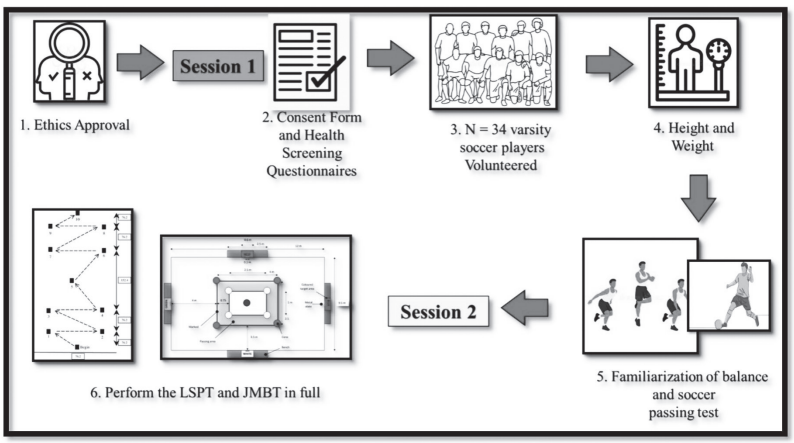

FIGURE 1. Data Collection Procedure

Pengajian Tinggi (IPT) Football League and took place in participants training ground. The participants were categorised into three playing position: Defender (N=11), Midfields (N=11) and Forward (N=12). The participants attended two sessions, one to familiarise them with the protocols and record the height and weight of the participants. Then they performed Johnson Modification of the Bass Test of Dynamic Balance (JMBT) and Loughborough Soccer Passing Test (LSPT). A JMBT was selected tool to assess dynamic balance and LSPT were used to assess the soccer skill performances. Following familiarisation, the JMBT and LSPT was performed in full in the second session. Participants completed three repetitions for each test (Trial 1, Trial 2 and Trial 3). Before each testing, participants performed a standardised 10 min warm up.

Johnson Modification of the Bass Test of Dynamic Balance (JMBT)

The JMBT test is a test that measures the ability to maintain balance during movement upon landing from a jump (Miller, 2005). The test required participants to maintain their base of support with one leg, reaching ten directions alternately with the other leg without compromising their base of support of the stance leg and hold for 5 seconds on each station. The test consists of 100 points with a maximum of 10 points that were given for each mark. The reliability level of JMBT was reported r =0.75 and face validity of 0.46.

The test scoring was given based on these criteria:

- 5 points will be given for landing successfully on the tape mark.
- 1 point is given for each second the steady position is held on tape marks; A maximum 10 points per tape mark and 100 points for the test may be earned; Any landing errors were penalized by 5 points.
- The landing error could be defined as failing to stop upon landing, touching the floor with any parts of the body other than the ball of the landing foot and failing to completely cover the tape mark with the ball of the foot.
- If the test performer makes a landing error, it could still have assumed correct balance if the performer could hold for maximum five seconds.
- If the performers landed accordingly but committed any errors before completing five seconds, 1 point will be deducted.
- The errors included touching the floor with any part of the body rather than the ball of the landing foot and failing to hold it for five seconds.
- If the performer lost balance, the test performer would return to the proper mark and jump to the next mark.

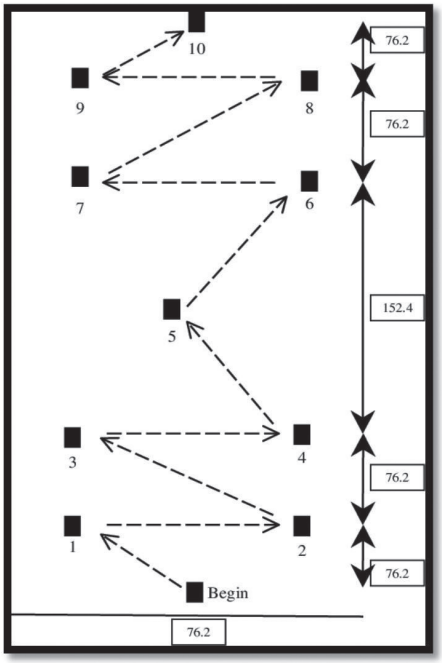

FIGURE 2. Schematic representation of the JMBT

Loughborough Soccer Passing Test (LSPT)

The LSPT was developed to assess the multi-faceted aspects of soccer skills including passing, dribbling, control and decision-making (Ali, Williams, Hulse, et al., 2007) and has been found to be a valid and reliable soccer skill performance for adolescents (Le Moal et al., 2013). The LSPT required players to complete 16 passes as quickly as possible. Le Moal et al. (2013) reported that LSPT test is a valid and reliable test to assess soccer skill performances. The reliability of the test was 0.83, and the validity was 0.64. Participants were informed that passes were only allowed to be executed from within the passing area, between the set of marked lines (see Figure 2). Participants were also told that upon retrieval from the previous pass, the ball had to cross two of the inner marked lines before the next pass could be attempted. Players must perform 16 passes against coloured target areas as quickly as possible (8 long (green and blue) and 8 short (white and red) (see Figure 2).

Penalty given if the participants performed the 16 passes more than 45 second. Penalty time was awarded for the following errors:

- 5 s for missing the bench completely or passing to the wrong bench.
- 3 s for missing the target area (0.6 x 0.3 m)
- 3 s for handling the ball
- 2 s for passing the ball from outside of the designated area.
- 2 s if the ball touched any cone
- 1 s for every second taken over the allocated 43 s to complete the test.
- 1 s was deducted from the total time if the ball hit the 10-cm strip in the middle of the target.

The penalty time was added to the time taken to complete the test and summed up as the total performance time.

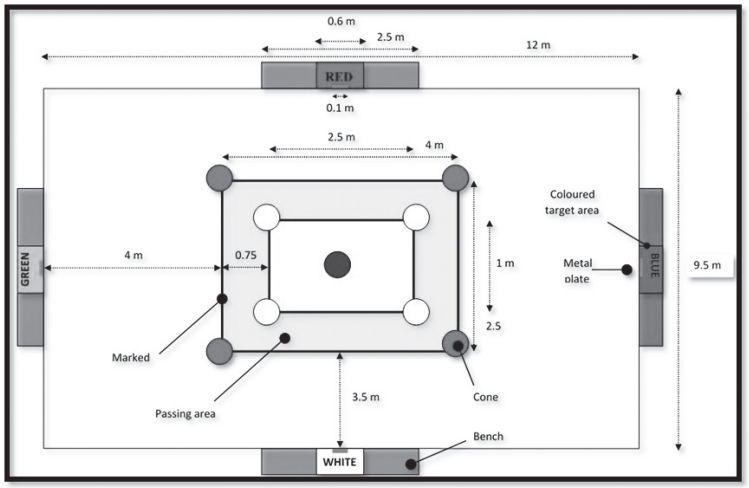

FIGURE 3. Schematic representation of the LSPT

Statistical Analysis

All results are reported as means ± standard deviations. Relationship between dynamic balance and soccer skills was assessed using the Pearson's product movement correlation (r) and Intra-class correlation coefficients (ICC). A one-way analysis of variance (ANOVA) was used to investigate differences between playing position and Repeated Measures ANOVA was conducted to compare performance across the three trials. All statistical analyses were performed with SPSS software (version 21.0, SPSS Inc, Chicago, IL) with the level of significance set at P≤ 0.05.

Results

Johnson Modification of the Bass Test of Dynamic Balance (JMBT)

Table 1 represents the mean ± SD of the JMBT scores. This data represents the performance of 34 participants across three trials, categorized by playing positions: Defenders, Midfielders, and Forwards. Overall Performance showed there is slight variation across trials, with Trial 3 showing the highest average score (92.4 ± 8.0) and lowest in standard deviation suggesting more consistent performance in that trial compared to Trials 1 and 2.

Table 1. Mean ± SD for Johnson Modification of the Bass Test of Dynamic Balance (JMBT)

Participants (n=34)	Trial 1	Trial 2	Trial 3	Mean ± SD
JMBT	87.2 ± 12.1	86.5 ±11.8	92.4 ±8.0	88.7 ± 9.2
Defender	86.8 ± 11.0	86.8 ±11.0	92.6 ±8.6	88..8 ± 8.4
Midfielder	88.9 ± 13.4	86.3 ±13.8	93.8 ±7.0	89.7 ± 10.3
Forward	85.8 ± 15.3	85.8 ±13.2	89.5 ±8.1	87.1± 11.2

Performance by position showed Defender performance is stable in Trials 1 and 2 (86.8) but improves in Trial 3. Midfielder showed a slight dip in Trial 2 but perform best in Trial 3 and Forward have the lowest mean performance and the least improvement in Trial 3 indicating less consistency compared to other positions. The improvement in Trial 3 across all groups suggests that familiarity with the task or test may have played a role in better performance. A repeated measures ANOVA was conducted to compare performance across the three trials. The results indicated a significant effect of trial on performance (P< 0.05). This suggests that participants' performance significantly changed over time, indicating players improved or changed their performance over time. One-way ANOVA was conducted to compare the performance differences among positions (Defenders, Midfielders, and Forwards). The results indicated that there was no statistically significant effect of positional role on performance (P>0.05). These findings suggest that playing position did not strongly influence performance in this test. Players significantly improved over the three trials (likely due to learning effects or warm-up). No significant difference between positions, suggesting that all positions performed similarly.

Loughborough Soccer Passing Test (LSPT)

Table 2 represents the mean ± SD of performance time (including penalty time) for the LSPT across three trials among 34 participants, categorized by playing position (Defender, Midfielder, and Forward). The mean performance time decreased from Trial 1 to Trial 3, indicating an improvement in passing efficiency. The overall group mean time was 104.6s in Trial 1, 95.7s in Trial 2, and 88.8s in Trial 3, with a final average of 96.4s ± 5.9. This suggests that participants improved their passing ability over successive trials, potentially due to better decision-making, ball control, or adaptation to test conditions.

Table 2. Mean ± SD for Loughborough Soccer Passing Test (LSPT)

Participants (n=34)	Trial 1	Trial 2	Trial 3	Mean ± SD
	Performance Time including penalty time			
LSPT	104.6 ± 12.8	95.7 ±10.4	88.8 ±11.6	96.4 ± 5.9
Defender	107.4 ± 11.2	96.2 ±9.8	92.6 ±7.2	98.7 ± 5.8
Midfielder	103.2 ± 8.2	93.8 ±6.4	85.7 ±18.4	94.2 ± 6.0
Forward	97.8 ± 20.9	96.8 ±17.1	81.3 ±5.0	92.0± 6.2

Defender had the highest overall mean time (98.7s ± 5.8), indicating they were the slowest among the three positions. Their improvement from 107.4s (Trial 1) to 92.6s (Trial 3) was notable but still slower than other positions. Midfielder performed slightly better than defenders, with an overall mean of 94.2s ± 6.0, and showed consistent improvement across trials, dropping from 103.2s (Trial 1) to 85.7s (Trial 3). In contrast, Forward recorded the fastest times overall (92.0s ± 6.2), with a significant improvement from 97.8s (Trial 1) to 81.3s (Trial 3). Their lower times align with the expectation that forwards need quick, precise passing under pressure. The One-Way ANOVA results show a significant difference between positions on LSPT performance (P< 0.05). Forward having the best performance compared to Defender and Midfielder. No differences were observed between Defender and Midfielder. This suggests that Forwards may have superior passing efficiency compared to Defenders, possibly due to their offensive role requiring quick ball movement. Midfielders, who balance both attacking and defensive duties, showed intermediate performance.

Relationship between Dynamic Balance and Soccer Skill Performances

The Pearson correlation coefficient (r=0.77) indicates a strong positive relationship between dynamic balance and soccer skill performance, as shown in Figure 1. The trend in the graph suggests that players with higher dynamic balance scores are more likely to demonstrate better soccer skill performance.

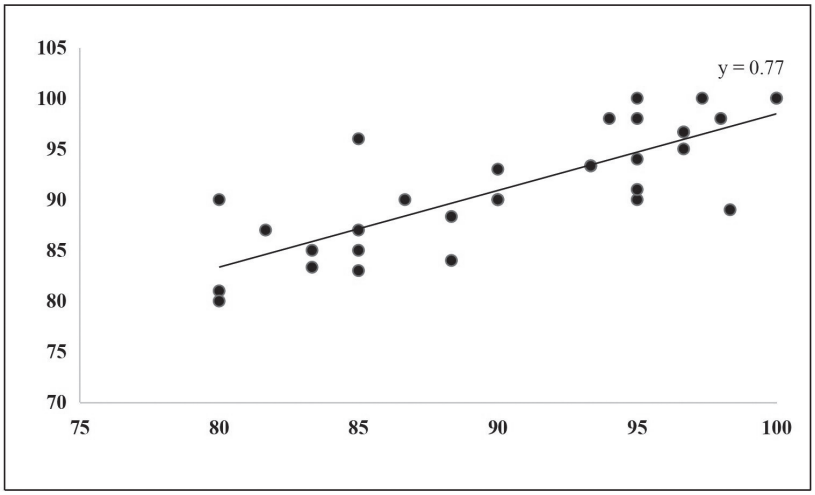

FIGURE 4. The relationship between JMBT and LSPT

Discussion

The aims of this study were to investigate the relationship between dynamic balance and soccer passing ability in soccer players and the objective was to investigate playing abilities in different playing positions. The results indicate a significant positive correlation between dynamic balance and passing performance, suggesting that players with better dynamic balance tend to execute more accurate and effective passes. This supports the notion that balance is a fundamental component of technical skill execution in soccer. This aligns with previous study by Atan (2009), that have highlighted improvement on dynamic balance significantly improved passing ability in soccer players. One possible explanation for this relationship is that maintaining stability during dynamic movements allows players to exert better control over their lower limbs, leading to more precise passing. Since passing often occurs under pressure and in motion, a player's ability to maintain balance can directly impact their success in executing accurate passes.

Nevertheless, it is important to highlight that the soccer passing skill observed in this player cohort was poor when compared to previous studies. Impellizzeri et al. (2008) reported faster time in comparison to junior soccer players (mean age: 17.8 ± 0.6 years; Height: 1.78 ± 0.5 m; Weight: 74.5 ± 6.9 kg), with an average completion time of 60.7 ± 4.1 seconds, including penalty time. Similarly,

Rampinini et al. (2008) recorded a completion time of 65.5 ± 8.9 s for the LSPT. Meanwhile, Ali et al. (2007) demonstrated improved soccer skill performance influenced by carbohydrate intake, with a total completion time of 50.5 ± 5.5 seconds in semi-professional and university team players (mean age: 21.3 ± 3.0 years; Height: 1.80 ± 0.07 m; Weight: 74.6 ± 6.8 kg; VO2max: 56.0 ± 1.6 mL.kg.min1). In contrast, in the current study, participants required 96.4 ± 5.9 seconds to complete the 16-passes of the LSPT. Passing is a fundamental skill that requires a combination of proper technique, body positioning, weight transfer, and accuracy to maintain ball possession, creating goal-scoring opportunities, and determining the pace of the game (Torrey et al., 2005). Furthermore, the LSPT involves quick decision-making. The test requires players to make rapid decisions under time constraints, as they must pass the ball accurately to designated targets while adjusting their actions based on the test's structured sequence. If individuals are unable to perform the LSPT quickly, it may indicate deficiencies in cognitive processing speed, reaction time, or technical ability, all of which are crucial for high-level soccer performance (Romeas, Guldner & Faubert, 2016). Slow execution in this current study result in increased completion times and errors, highlighting areas for improvement in player training programs. This can be improved by practice regularly in passing technique, both individually and in game-like scenarios which focus on accuracy, weight of the pass, and decision-making. Furthermore, soccer players can seek feedback from coaches, teammates, or experienced players. They can provide insights into areas for improvement and offer guidance on refining players passing technique (Carling et., 2005).

Additionally, this study also investigated playing abilities in different playing positions. No differences were found between positions in dynamic balance, however significant differences were found in passing ability. Forwards indicated the best performance compared to defenders and midfielders which can be attributed from the positional roles, consequently, result in higher passing accuracy and efficiency due to their frequent involvement in attacking during match plays (Lago Peñas et al., 2012).

Despite these results, some limitations should be addressed in this current study. The study was conducted on university-level players, and the findings may not be generalizable to younger or elite professional players. Additionally, external factors such as fatigue, environmental conditions, and psychological pressure were not controlled, which could influence passing performance. Future research should explore the impact of specific balance training programs on passing accuracy and overall soccer performance. Longitudinal studies could provide more conclusive evidence on how balance improvements translate into game performance. Furthermore, investigating the role of other physical attributes, such as agility and reaction time, in relation to passing ability would offer a more comprehensive understanding of soccer performance determinants.

Additionally, the sample size in this present study was limited to university-level soccer players only, which may limit the generalizability of the findings to players from other competitive levels or age groups. Moreover, the assessment of dynamic balance and passing ability was conducted under controlled conditions, which may not fully reflect the complex and unpredictable nature of actual match situations. Additionally, variations in participants' training background, fatigue levels, and motivation during testing could have influenced the results. Lastly, only selected aspects of balance and passing were examined; other factors such as decision-making, vision, and technical execution under pressure were not considered but may also contribute to passing performance.

Conclusion

In conclusion, the study highlights the importance of dynamic balance in soccer passing ability and underscores the need for incorporating balance-related exercises into training programs. By improving balance, players may enhance their technical execution, ultimately contributing to better overall performance on the field. The findings of this study may have practical implications for soccer training and performance, as improving dynamic balance may contribute to better soccer passing ability.

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ORIGINAL SCIENTIFIC PAPER

Olympic Values Study

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Abstract

The Olympic Day Celebration (ODC) represents a unique and underexplored area of exciting research. This study examined how Olympic values are reflected in the ODC. A qualitative case study design was adopted as the main methodological approach. Results revealed four core values specific to the ODC, referred to as the P4s: preparation value, participation value, program value, practices value. The findings highlight that ODC plays a crucial role in promoting Olympic values through collective participation, inclusivity and effective organization. The absence of prior research on this topic underscores the originality and significance of the present study, which provides a meaningful foundation for future scholarly inquiry in this emerging field.

Keywords: *Olympic day celebration, Olympic values, National Olympic Committee of Sri Lanka*

Introduction

The concept of values has long been examined from multiple philosophical, sociological, and cultural perspectives. Broadly, values refer to the significance or acceptance of principles, ideals, or standards that guide human behavior within nature or society. In recent years, values have received increasing global attention across diverse fields of research, including sport. Numerous scholars have explored the role of values within sport settings (Kelmendi et al., 2024; Georgiadis et al., 2024; Ghorbani et al., 2024). Notably, a substantial body of literature highlights how sport functions as a medium through which moral, social, and cultural values are cultivated and expressed (Simon, 2000; McFee, 2004; Sari et al., 2024; Morgan, 2024; Tuakli-Wosornu et al., 2024; Alfurqan et al., 2024; Jahrir et al., 2024; Risyanto et al., 2024). Thus, sport is increasingly recognized not merely as a pursuit of athletic victory but also as a mechanism that promotes social values (Zawadzki, 2024; Ribeiro et al., 2024; Lefort, 2024), economic values (Lefort, 2024), and individual development values (Jiang et al., 2024; Ribeiro et al., 2024; Kristiansen et al., 2024; Melchiorri et al., 2025).

The Olympic Charter (2015) articulates the core Olympic values of respect, friendship, and excellence (IOC, 2021). Friendship, often highlighted in sport, fosters social connection among participants of all ages and promotes cooperation, teamwork, and social cohesion (Parry, 2013; Ryall, 2016). Respect underscores learning to value oneself, opponents, rules, the environment, and society at large. Excellence emphasizes continual self-improvement, encouraging athletes and, by extension, all individuals to pursue personal growth and strive to become better (IOC, 2023).

The Olympic Movement has initiated numerous programmes designed to promote these values. These initiatives emphasize respect for oneself and one's body, consideration for others, adherence to rules, appreciation of sport, and care for the environment (IOC, Fundamentals of Olympic Values Education, 2016). Consequently, Olympic-related activities such as educational programs, the International Olympic Academy, athletes' commissions, ceremonial events, and the Olympic Games themselves serve as powerful expressions of these core values. The foundation of Olympic educational programmes rests on principles of preparation, participation, teamwork, celebration, appreciation, education, and achievement, all of which reinforce the spirit and philosophy of Olympism (Park & Lim, 2022). For example, the opening ceremony symbolically communicates respect, belief, commitment, and the joy of effort, while motivating individuals to cultivate courage, self-discipline, pride, and mutual respect. As scholars note, "Olympism is expressed through actions which link sport to culture and education" (Garcia, 2022; Gargalianos et al., 2015).

Empirical and theoretical studies further demonstrate how Olympic values are promoted across global contexts. Blanco (2024) found that the Philippine Olympic movement emphasizes excellence, respect, and friendship, particularly in its commitment to athlete welfare and rights. McNamee et al. (2012) highlighted the youth Olympic Games as a response to declining youth engagement in sport, designed to re-motivate young people through Olympic values. Theodorakis et al. (2024) noted the movement's

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focus on excellence, friendship, respect, safety, sustainability, and gender equality, while Kamberidou (2011) identified the promotion of peace, respect for diversity, and non-violent conflict resolution as central outcomes of value-based Olympic education.

Olympic education programmes further align with five major Olympic educational values: joy of effort, fair play, practising respect, pursuit of excellence, and balance between body, will, and mind (IOC, 2021). Georgiadis (2010) emphasized that such programmes cultivate values through diverse educational and cultural opportunities surrounding the Games. Later, Georgiadis (2020) noted that these programmes inspire students while promoting cooperation, empowerment, critical thinking, and non-discriminatory responsibility.

Fundamental Principle 1 of the Olympic Charter describes Olympism as "a philosophy of life, exalting and combining in a balanced whole the qualities of body, will and mind" (IOC, 2021). Olympism blends sport with culture and education, encouraging joy in effort, the educational value of good example, and respect for universal ethical principles. Host countries often integrate Olympic values into their Games. For instance, the Tokyo 2020 Olympics emphasized gender equality, achieving 48% female participation in the Olympics and 42% in the Paralympics for the first time. The Paris 2024 Olympic Games centred on societal cohesion, health promotion, social inclusion, environmental responsibility, and expanding sport participation. At Rio 2016, ten refugee athletes competed under the Olympic flag, symbolizing hope for displaced communities worldwide (IOC, 2016). Nissiotis (1985) argued that Olympic values represent universal human aspirations that unite individuals, races, and nations, while McNamee (2006) highlighted the role of sport in shaping ethical development among young people.

Existing scholarship has examined Olympism's potential to disseminate its philosophy globally. Most studies focus on Olympic values education programmes (Chatziefstathiou, 2005; Grasso et al., 2015; Molina & Gorrono, 2015; Hwang, 2018; Scarton et al., 2019; Ruiz-Rabadan & Moya-Mata, 2020; Geurin & Naraine, 2020; Park & Lim, 2022). Other strands of research explore Olympic Games hosting (Delaplace & Schut, 2019), economic impacts (Short, 2018; Chang et al., 2025), women's participation (Ruiz-Rabadan & Moya-Mata, 2020), athlete performance (Geurin & Naraine, 2020), and broader Olympic sport research (Millet et al., 2021).

However, the context of Olympic values within the Olympic Day Celebration (ODC) has received minimal scholarly attention. As of 2025, seventy-seven years have passed since the first ODC in 1948 (IOC, 2023, p.1). The ODC presents a unique yet underexplored opportunity to promote Olympic values through community-based activities and mass participation. A review of current literature reveals an absence of focused research on how Olympic values are expressed, reinforced, or interpreted within ODC events, indicating two notable gaps: (1). limited scholarly attention to ODC as a platform for Olympic value promotion; and (2). insufficient understanding of how Olympic values are reflected or not reflected in ODC activities.

Against this backdrop, the present study examines how Olympic values manifest within the ODC. The study seeks to advance understanding of Olympic-themed educational initiatives and contribute new insights into the ways Olympic values are expressed through Olympic programmes. Accordingly, the primary objective of this research is to explore how Olympic values are reflected in the Olympic Day Celebration, thereby enriching the broader literature on Olympic education and value-based sport promotion.

The Olympic Day Celebration (ODC)

In January 1948, at the 42nd IOC Session in St Moritz, the members adopted the project of a World Olympic Day. Presented at the previous Session in 1947 by IOC member Dr. Josef Gruss from Czechoslovakia, the proposal was for National Olympic Committees (NOC) to organize this event between 17 and 24 June to commemorate the founding of the modern Olympic Movement and promote the Olympic ideals in their countries (IOC,2023, p.1). Accordingly, the first ODC was celebrated on 23 June 1948, under the leadership of IOC President Sigfrid Edstrom. Historical records indicate that the National Olympic Committees of Portugal, Greece, Austria, Canada, Switzerland, Great Britain, Uruguay, Venezuela, and Belgium participated in this inaugural event. Later, the ODC was incorporated into the main Olympic recommendations. The 1978 edition of the Olympic Charter formally recommended that all National Olympic Committees organize an Olympic Day to promote the Olympic Movement, stating that "an Olympic Day be organized regularly (if possible, every year) for the purpose of promoting the Olympic Movement" (International Olympic Charter, 1978). The core activity associated with Olympic Day is the Olympic Day Run, a concept introduced in 1987 by the "Sport for All" Commission of the IOC. This initiative aimed to promote mass participation in sport and encourage physical activity for all. During its first year, 45 National Olympic Committees took part in the celebration, emphasizing inclusivity and the universal spirit of sport.

ODC are based on the three pillars: "Move, learn, discover. Move: This pillar encourages people to get active on Olympic Day. "Move" can refer to all sorts of physical activities for people of all ages and abilities from Olympic Day Runs to individual and team sports. Learn: Olympic Day is a great opportunity to learn about the Olympic Values, which are excellence, friendship and respect, and look at the contribution of sport to global social issues that can affect your community, such as education, health promotion, HIV prevention, women's and girls' empowerment, environmental protection, peace building and local community development. Being a responsible citizen is also part of the philosophy of Olympism Discover: This pillar is about people trying new sports and activities that they have never done before. This is done in a number of ways, for instance, by inviting Olympians to do a demonstration of their sport or a workshop in which participants can try the sport under an athlete's guidance (Factsheet, 2023)

The Case of Sri Lanka

The National Olympic Committee of Sri Lanka (NOCSL) was established in 1937 and was recognized by the IOC in the same year. The NOCSL serves as the national governing body for Olympic sports in Sri Lanka, responsible for representing the country within the Olympic Movement. Over the decades, the NOCSL has introduced numerous Olympic programs and possesses a long and distinguished history of promoting Olympic ideals. Among its many initiatives, the annual ODC holds a central place in its calendar of activities.

In 2025, the NOCSL organized the ODC on 23 June in the city of Galle, located in the Southern Province of Sri Lanka. Galle is a well-known coastal city and a popular tourist destination recognized for its rich cultural heritage. The celebrations took place at the football field adjacent to the Galle International Cricket Stadium in Sri Lanka.

The 2025 ODC comprised several key components, including the opening ceremony, the Olympic Day Run, the Olympic poster competition, the Olympic video competition, the cultural showcase, the closing ceremony, and a final group photo session. The event attracted a diverse range of participants and stakeholders, including officials of the NOCSL, Olympian, sports administrators, representatives from the Ministry of Sports, police officers, media representatives, university students and faculty members, sponsors, and residents of Galle city.

In addition, students and fine Arts teachers from several schools, both girls' and boys' schools actively contributed to the

cultural showcase segment, which reflected the local cultural traditions and artistic talent of the region. The entire event was conducted from 8:30 a.m. to 1:30 p.m., successfully combining sport, culture, and education in line with the spirit of Olympism.

Methods

This study was conducted to investigate how Olympic values are reflected in ODC in Sri Lanka. The selected case study is presented under the section The Case of Sri Lanka. A qualitative case study design was adopted to explore the meanings and practices embedded within the event. This approach was chosen because it enables an in-depth understanding of complex social, cultural, and organizational processes within real-life contexts (Hussein, 2023; Kwon, 2020; Osorio-García-de-Oteyza et al., 2020; Hervira, 2022). The qualitative case study method facilitates exploration not only of what occurs in the ODC but also of how and why it occurs, emphasizing participants lived experiences, interactions, and perceptions rather than numerical measurement.

Data Collection Methods

Data was collected through field observations, semi-structured interviews, and secondary data sources. Using multiple methods allowed for triangulation, which enhances the reliability and validity of qualitative research findings (Shankaran et al., 2020; Ati Sulastri et al., 2020). Triangulation provided opportunities to cross-verify data gathered from different sources, ensuring a more comprehensive understanding of the ODC and the values it represents.

Field Observations

Field observations were conducted before and during the ODC to understand NOCSL's organizational culture and event execution. The researcher observed the preparation process, including planning meetings, staff coordination, and task allocation. Observations during the celebration focused on the functioning of teams, decision-making practices, communication flow, and leadership behaviors. These experiences provided direct insights into how the organization promoted Olympic values such as teamwork, respect, and excellence. Key incidents, statements, and behavioral patterns were recorded in detailed field notes, which later informed the thematic analysis.

Semi-Structured Interviews

Semi-structured interviews were conducted with 16 participants eight men and eight women representing staff members, sports officials, athletes, and other contributors to the event. Participants were selected using random sampling to reduce bias and ensure diverse perspectives. Each interview lasted approximately 30 to 45 minutes and followed a flexible interview guide that allowed participants to express their experiences freely. Open-ended questions were used to encourage discussion on personal experiences, organizational practices, communication patterns, and leadership behaviors related to the ODC.

Interviews were conducted through multiple channels, including face-to-face sessions during event breaks and virtual platforms such as WhatsApp and teleconferencing, to accommodate participants' availability. Following Oplatka (2018), particular care was taken in planning and conducting interviews to maintain sensitivity when addressing participants' experiences and emotions. This research adhered to the ethical standards of the Declaration of Helsinki, ensuring voluntary participation, informed consent, and the protection of participants' rights and confidentiality (World Medical Association, 2013). Accordingly, participants' informed consent was obtained prior to each interview, and they were assured of confidentiality and the voluntary nature of their participation.

Secondary Data Sources

Secondary data were collected from official and publicly available sources to complement primary data and enhance contextual understanding. These included the official NOCSL website, media publications (in Sinhala and English) related to ODC, event programs and agendas, YouTube recordings, and relevant research literature on Olympic values. Reviewing these materials provided historical and organizational insights into the development and objectives of the ODC. The use of secondary sources also allowed for cross-validation of information obtained through interviews and observations, thereby strengthening the credibility and consistency of the findings.

Data Analysis

Data analysis was conducted using thematic analysis, a widely applied method in qualitative research (Braun & Clarke, 2006, 2021; Finlay, 2021). The process involved reading and analyzing the interview transcripts, observation notes, and documents to identify recurring ideas and patterns. Initial coding was used to mark significant segments of text relevant to the research question. The themes were refined and reviewed to ensure they accurately captured participants' experiences and perspectives. The final thematic structure was interpreted considering existing literature and research complied with the ethical standards of the Declaration of Helsinki (World Medical Association, 2013), ensuring voluntary participation, informed consent, and the protection of participants' rights and confidentiality. (Table 1).

Ethical Considerations

Ethical integrity was upheld throughout all stages of the research process. Participants were fully informed about the purpose of the study, their right to withdraw at any time, and the confidentiality measures applied to their information. Informed consent was obtained prior to conducting interviews and observations. All collected data including field notes, audio recordings, and transcripts were securely stored and used exclusively for research purposes. During data reporting, excerpts were carefully paraphrased or anonymized to protect participant identities and maintain organizational confidentiality. All secondary data were appropriately cited, and interpretations remained faithful to the original meanings of the consulted sources.

According to the World Medical Association (2013), this research adhered to the ethical standards of the Declaration of Helsinki, ensuring voluntary participation, informed consent, and the protection of participants' rights and confidentiality. Interviewees were clearly informed, both in writing and verbally, about the objectives of the study. They were explicitly reassured that their names would not be disclosed, that they were free to withdraw at any stage, and that their privacy, confidentiality, dignity, and respect would be safeguarded. Participants were also informed that their data would be utilized only with their explicit consent after they had read and understood the interview transcripts. These procedures ensured that no individual's privacy was compromised and that only those genuinely interested in the sport and the research participated willingly. Consequently, no participant expressed reluctance, and all data were obtained in an ethically sound manner. Furthermore, no deception, coercion, or exploitation occurred at any point during the study.

Results

A comprehensive account of the values identified through field observations and semi-structured interviews conducted during the ODC is presented in Table 1. The analysis identified

four overarching themes preparation value, participation value, programme value, and practices value under which 22 sub-themes were classified. Specifically, five sub-themes were identified under preparation value, four under participation value, six under programme value, and six under practices value. Collectively, these sub-themes revealed a total of 41 values associated with the ODC.

The findings indicate that the values reflected by participants are expressed across multiple dimensions, primarily through collectivism, education, and participation, rather than through individualistic orientations. Notably, team spirit and fairness emerged as recurring values evident in nearly all aspects of the event. The ODC, characterized by minimal competition, functioned as a platform for community-based engagement, where collective values were more prominent than individual achievements. This observation suggests that the celebration embodies a cycle of shared values that foster unity and mutual respect among participants.

Table 1. Description of Values identified through Olympic Day Celebration

Phases	Descriptions	Value Characteristics
Preparation	– Moving towards a value addition approach. – Focus on risk management. – Focus on upholding international standards. – Focus on organizing plans to achieve program objectives. – Acting in accordance with the knowledge and instructions of responsible officials.	Passion Discipline Commitment Teamwork Responsibility Focus Respect Fairness Perseverance Creativity Enjoyment Integrity Perseverance Confidence
Reflected Value	Preparation Value	
Participant	– Participation of culturally diverse youth. – Representation of both men and women. – Participation of university and school children and lectures and teachers. – Participation of Olympians, sports officials and coaches.	Community Engagement Teamwork Respect Fairness Perseverance Creativity Social Bound Respect Rules
Reflected Value	Participant Value	
Program	– Adherence to the Olympic Day Celebration theme – Highlighting local and international identities Recognition of participants and competition winners – Competition design content designed to educate about the – Olympics and to create and encourage interest in it – Including team activities – Official Olympic flags, T-shirts, nameplates, designed with a common theme – Including the participation of government institutions	Rituals Education Celebration Tradition Motivation Experiences Teamwork Respect, Fairness Perseverance Creativity Collective Commitment Achievement Unity Symbolic Elements Cultural Exchange
Reflected Value	Program Value	
Practices	– The art of teamwork – Having a key officer in charge of the program – Working with attention to previous experiences – Organizers having an understanding of every task – Working in a friendly manner – Using formal communication methods	Collective Commitment Due Respect Social Bound Inclusivity Managing Emotions Cooperation toward shared goals Localizing a global event Teamwork
Reflected Value	Practices Value	

The results further demonstrate that specific activities within the program such as the Olympic day run, Olympic poster competition, Olympic video competition, cultural showcase, token of appreciation, and the opening and closing ceremonies served as primary avenues for the expression of Olympic values. During the preparation phase, values related to program management, collaboration, and organizational discipline were particularly evident. The participation phase highlighted values linked to inclusion, mutual support, and social connection, emphasizing the importance of shared experiences among diverse groups. Throughout the programme phase, cultural and symbolic values were prominently displayed, reflecting the integration of local identity with the universal ideals of Olympism. Learning and curiosity emerged as foundational elements in the creation and reinforcement of these values. In the practices phase, non-exclusion and multi-stakeholder participation were central, illustrating how both individual and collective values coexisted and complemented one another. Table 1 presents a detailed description of the values identified through the ODC, organized according to the four main themes and corresponding sub-themes.

Moreover, these findings suggest that the ODC not only facilitates value transmission but also fosters an inclusive environment that reinforces social cohesion and intercultural understanding. Finally, Figure 1 provides a conceptual mapping of the values that emerged from the ODC, illustrating the interrelationships among them. Collectively, these findings reveal that the ODC embodies a multidimensional value framework conceptualized as P^4 representing preparation value, participation value, programme value, and practices value which encapsulates the holistic reflection of Olympic values within the Sri Lankan context (Figure 1).

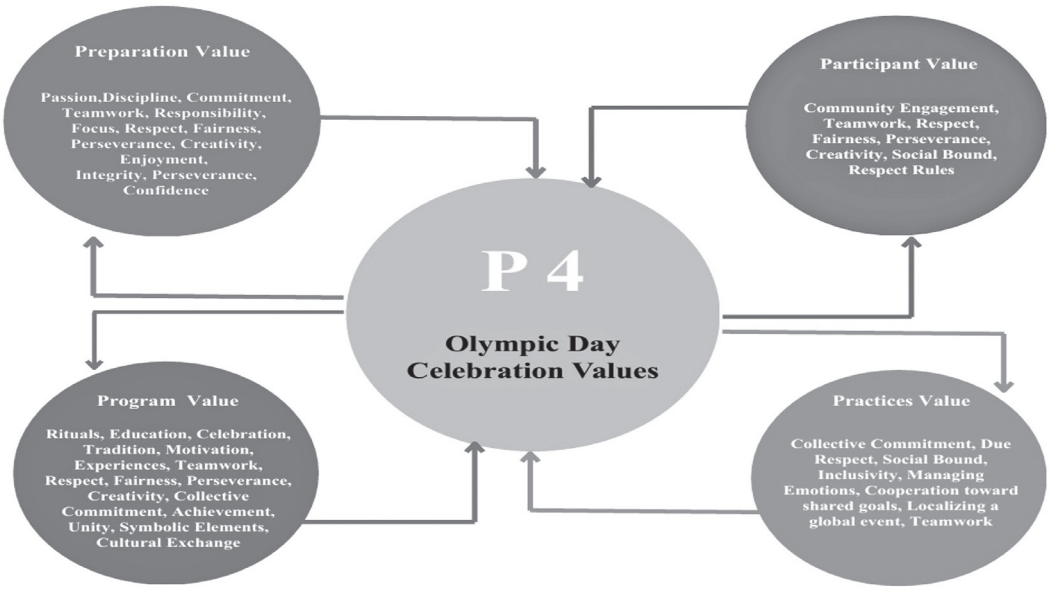

FIGURE 1. Conceptual mapping of the P4 values that emerged from the ODC in Sri Lankan context

Discussion

The objective of this study was to examine how Olympic values are reflected in the ODC. The findings highlight four key values embedded within the event: preparation value, participation value, programme value, and practices value. The study further reveals how Olympic values are fostered through programs grounded in Olympic educational themes. This aligns with Park and Lim (2022), who argue that Olympic educational programs are built upon the principles of preparation, participation, teamwork, celebration, appreciation, education, and achievement elements that collectively reinforce the spirit and philosophy of Olympism. Furthermore, recent studies (Jiang et al., 2024; Ribeiro et al., 2024; Kristiansen et al., 2024; Melchiorri et al., 2025) have demonstrated that individual values can be cultivated through Olympic-related activities, a finding that is corroborated by the current results.

The Olympic Charter (2015) articulates the core Olympic values of respect, friendship, and excellence (IOC, 2021), and this study shows that the ODC program has effectively embodied and promoted these values. The preparation value, participation value, and programme value identified in this research further reinforce the capacity of Olympic Day initiatives to deliver on these ideals. McNamee et al. (2012) have emphasized the role of the Youth Olympic Games in re-engaging young people with Olympic values, and similarly, this study finds that Olympic Day celebrations stimulate interest in the Olympic Movement among young participants, encouraging their involvement in Olympic activities.

These findings underscore the broader potential for promoting Olympic values through ODC as well as through other initiatives (Olympic Charter, 2015; IOC, Fundamentals of Olympic Values Education, 2016; Park & Lim, 2022; Blanco, 2024). Given the paucity of research in this area, the present study contributes a comprehensive analysis of values expressed through sport in general and those advanced through the Olympic Games and associated programs.

However, this study is not without limitations. It was conducted over a single year, which restricts the temporal depth of the findings. The qualitative case study design, combined with reliance on voluntary participation within a limited timeframe, further constrains the generalizability of the results. Additionally, the limited availability of prior research directly addressing Olympic Day posed challenges in situating and contextualizing the study within the broader literature.

Despite these constraints, the novelty and contribution of the study constitute its major strengths. To the best of current knowledge, this is the first scholarly work to examine Olympic values specifically through the lens of the ODC. The generation of new insights in an area unexplored for 77 years since the establishment of Olympic Day underscores the significance of this research. While substantial scholarship exists on Olympic values through educational programs (Chatziefstathiou, 2005; Grasso et al., 2015; Molina & Gorrono, 2015; Hwang, 2018; Scarton et al., 2019; Ruiz-Rabadan & Moya-Mata, 2020; Geurin & Naraine, 2020; Park & Lim, 2022), this study is the first to focus on how values are ex-

pressed through International Olympic Day celebrations an event observed globally in 206 countries. Conducting such pioneering work in Sri Lanka, a nation with only two Olympic medals, offers both symbolic and scholarly value to the global body of Olympic research.

Previous studies on Olympic values have predominantly focused on educational programs and youth initiatives that promote Olympic ideals (Kamberidou, 2011; IOC, 2021; Georgiadis, 2010). In contrast, this study emphasizes the importance of examining practical and contemporary applications of these values. Such an approach provides insights into how Olympic values are enacted in real-world contexts and adapted to modern societal needs. These findings may support policymakers in designing broader, more responsive programs aligned with contemporary social priorities. Moreover, emerging discussions and discoveries in this field can enhance the international visibility of the Olympic Movement and stimulate further scholarly engagement (Theodorakis et al., 2024).

Finally, several directions for future research emerge (Chatziefstathiou & Henry, 2020). Future scholars could conduct more extensive investigations into Olympic values using both quantitative and qualitative approaches (Binder, 2021), employ longitudinal data collection over several years (Naul et al., 2017), and undertake cross-country comparative analyses (Teetzel & Mazzucco, 2020). Research may also explore participant perceptions (Brown & Gasser, 2021), compare ODC with other international sports days (Maguire, 2020), and engage in evidence-based investigations to deepen the scholarly understanding of Olympic values (Kohe & Purdy, 2018).

Conclusion

The findings of this study indicate that ODC plays a crucial role in promoting Olympic values through collective participation, inclusivity and effective organization. Furthermore, the study identifies four P4 core values specific to ODC such as preparation value, participation value, programme value and practices value. These findings insights for policymakers and practitioners seeking to design initiatives that strengthen the promotion of Olympic values through community-based and educational programmes. By recognizing and applying these values, the Olympic vision can be more effectively localized and sustained.

Ultimately, this research highlights that the realization of Olympic values extends beyond individual athlete excellence, encompassing collective participation and shared experiences. Olympic Day serves as an inclusive platform where both athletes and non-athletes can embody and practice the universal ideals of Olympism. The absence of prior research on this topic underscores the originality and importance of this study, which offers a meaningful foundation for future scholarly inquiry in this emerging field.

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ORIGINAL SCIENTIFIC PAPER

Anthropometric Correlates of Menstrual Disorders in Women Attending a Fertility Clinic in Southeast Nigeria

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Abstract

We aimed to investigate the association between anthropometric parameters—body mass index (BMI), waist-to-hip ratio (WHR), and waist-to-height ratio (WHtR)—and menstrual disorders (oligomenorrhea, menorrhagia, and amenorrhea) among women attending the Fertility Clinic at Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi, Nigeria. We employed random sampling to select 200 women aged 17 to 43 years who had no underlying medical conditions known to affect menstrual cycles. Data collection involved a structured questionnaire that gathered demographic information, menstrual history, and anthropometric measurements, including height, weight, waist circumference, and hip circumference. Results of the analysis showed a strong positive correlation between oligomenorrhea and BMI ($r = 0.445$, $p = 0.001$), WHR ($r = 0.207$, $p = 0.003$), and WHtR ($r = 0.440$, $p = 0.001$). However, no significant correlations were found between menorrhagia and BMI ($r = -0.035$, $p = 0.618$), WHR ($r = -0.010$, $p = 0.890$), or WHtR ($r = -0.008$, $p = 0.912$). Age was weakly correlated with oligomenorrhea ($p = 0.084$) and menorrhagia ($p = 0.104$), but these associations were not statistically significant. Notably, there were no reported cases of amenorrhea among participants. The findings indicated that higher BMI is likely a risk factor for oligomenorrhea, whereas age does not significantly impact the likelihood of experiencing either oligomenorrhea or menorrhagia. Additionally, amenorrhea was not observed in this population.

Keywords: *BMI, Menstrual disorders, Menstrual irregularities, Obesity, Young women*

Introduction

Menstrual disorders encompass a variety of changes or irregularities in a woman's menstrual cycle, including variations in cycle frequency, duration, and the amount of menstrual bleeding. It is estimated that about 20–40% of women in their reproductive year experience menstrual irregularities (Ansong et al., 2019; Igbokwe & John-Akinola, 2021; Ju et al., 2014). These disorders include conditions such as amenorrhea (absence of menstruation), oligomenorrhea (infrequent menstruation), menorrhagia (excessive bleeding), and metrorrhagia (irregular bleeding), along with associated symptoms like menstrual pain. A typical menstrual cycle ranges between 21 and 35 days (NHS, 2023), though individual variability means some cycles may fall outside this range (Grieger & Norman,

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2020). The menstrual cycle is a highly regulated biological process essential for reproduction, controlled by hormones from the hypothalamus and pituitary gland. Any hormonal imbalance can disrupt this cycle, leading to significant disturbances (Amboss, 2023; Popat et al., 2008). Such disruptions may indicate underlying issues in the endocrine or reproductive systems, organic disorders, or conditions like polycystic ovarian syndrome (Rasquin Leon et al., 2023). Furthermore, research has linked other menstrual disorders to anthropometric measures (Abdolahian et al., 2020; Dhar et al., 2023; Thathapudi et al., 2014).

Anthropometric parameters include physical characteristics such as height, weight, body mass index (BMI), and waist circumference, which are useful indicators of overall health and disease risk (Casadei & Kiel, 2022). Waist circumference and waist-to-hip ratios, for instance, serve as measures of abdominal obesity and visceral fat distribution (Gadekar et al., 2020). BMI, a widely used metric for body fat, is calculated by dividing an individual's weight in kilograms by the square of their height in meters (kg/m²) (Casadei & Kiel, 2022). BMI classifications range from underweight (<18.5), normal weight (18.5–24.9), overweight (25.0–29.9), to various levels of obesity: class 1 (30.0–34.9), class 2 (35.0–39.9), and class 3 (≥40.0), as defined by the World Health Organization (WHO, 2010) and the Centers for Disease Control and Prevention (CDCP, 2022). In Nigeria, the prevalence of overweight individuals falls between 20.3% and 35.1%, while obesity rates range from 8.1% to 22.2% (Chukwuonye et al., 2013).

Recent studies have explored how body measurements correlate with menstrual irregularities. Anthropometric indices, particularly BMI, are strongly associated with energy balance, and deviations in this balance – whether due to undernutrition or overnutrition – can affect menstrual function (Bradley et al., 2023; Entringer et al., 2012; Fluitman et al., 2017; Romieu et al., 2017). High waist circumference, particularly when accompanied by elevated BMI, has been linked to an increased likelihood of disorders like oligomenorrhea and anovulation (Itriyeva, 2022; Lentscher & Decherney, 2021). Excess abdominal fat may disrupt the hormonal equilibrium critical for menstrual cycle regulation. The interplay between menstrual disorders and anthropometric factors is multifaceted, influenced by physiological and psychological mechanisms (Castillo-Martínez et al., 2003; Attia et al., 2023).

Despite the global attention to obesity and menstrual health, research from underrepresented regions such as southeastern Nigeria remains limited. Therefore, this study was designed to examine the relationship between key anthropometric parameters—body mass index (BMI), waist-hip ratio (WHR), and waist-height ratio (WHtR)—and menstrual disorders, including oligomenorrhea, menorrhagia, and amenorrhea, among women attending a fertility clinic in Southeast Nigeria.

Methods

Ethics approval

The study strictly adhered to the institutional ethics guidelines. The study ethics approval was obtained from the Faculty of Basic Medical Sciences Ethics Committee of College of Health Sciences, Nnamdi Azikiwe University, Nnewi campus, Nigeria. The approval reference number is NAU/CHS/NC/FMBS/496 dated 11th April 2023.

Study design

This study adopted a cross-sectional analytical design to examine the association between anthropometric parameters and menstrual disorders among women attending the Fertility Clinic of the Obstetrics and Gynecology Unit, Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi, Nigeria. Anthropometric indices such as body mass index (BMI), waist-hip ratio (WHR) and waist-height ratio (WHtR), and menstrual characteristics were assessed concurrently to determine potential correlations within the study population. We employed this design with the aim to enhance the generalizability of our findings to the typical patient population seeking fertility care.

Inclusion and exclusion criteria

Participants in this study were selected based on specific criteria. Inclusion criteria required participants to be women aged 15 to 49 years, within their reproductive years, attending the Fertility Clinic at NAUTH, and free from known medical conditions that could affect menstrual function. This age range was selected to encompass the entire spectrum of reproductive-aged women likely to present at a fertility clinic, from post-adolescence to the perimenopausal transition.

Exclusion criteria ruled out women who were pregnant, breastfeeding, or perimenopausal; those with a history of hormonal contraception, hormonal therapy, gynecological surgery, or reproductive disorders; individuals with chronic health conditions that could influence menstruation; and women unable to provide informed consent.

Participant screening

Participants were provided with detailed informed consent forms, which were thoroughly explained to them. Data collection commenced only after obtaining voluntary consent. Eligibility was determined based on defined inclusion and exclusion criteria.

Sampling

Eligible participants were selected randomly, and the sample size was determined using a standardized formula:

$$n = \frac{\hat{p}(1-\hat{p})z^2}{ME^2}$$

Using a margin of errors of 5% (ME=0.05), Confidence interval of 90% (z=1.645) and a 0.5 level of significance (=0.5), the sample size is evaluated thus:

$$n = \frac{(1.645)^2 \times 0.5(1-0.5)}{(0.05)^2} = \frac{2700 \times 0.25}{0.0025}$$

$$n = 270$$

The study included a total of 200 patients selected from over 2,000 individuals who visited the Fertility Clinic at Nnamdi Azikiwe University Teaching Hospital, Nnewi, Nigeria, during the study period. Participants ranged in age from 17 to 43 years.

Data collection tools and timeline

Demographic information and menstrual history were gathered using a structured questionnaire, which helped identify menstrual irregularities such as infrequent cycles, excessive or prolonged bleeding, and amenorrhea. Anthropometric data were collected using standardized instruments, including a weight scale, steel tape, and flexible measuring tape, over the course of three months (April 20, 2023, to July 19, 2023).

Measurement protocols for anthropometric parameters

Height (cm): Height was measured using a steel tape securely fixed to a wall. Subjects stood barefoot in an upright position, with their back of the head, shoulder blades, buttocks, and heels in contact with the wall. Measurements were taken from the highest point of the scalp and recorded to the nearest 0.1 cm (ISAK, 2011).

Weight (kg): Weight was determined using a digital scale, ensuring subjects stood barefoot with minimal clothing and balanced weight distribution. The scale was placed on a flat, hard surface to prevent errors. Any heavy clothing, such as jackets, was removed before measurement. Values were recorded to the nearest 0.1 kg (ISAK, 2011).

Waist circumference (cm): A flexible tape was used to measure waist circumference. Measurements were taken while participants stood upright, at the narrowest section between the last palpable rib and the iliac crest, typically at the navel. The tape was snug but not tight, and readings were taken at the end of a normal exhalation (ISAK, 2011; WHO, 2011).

Hip circumference (cm): Hip circumference was measured at the widest part of the hips using a flexible, stretch-resistant tape. Care was taken to ensure the tape lay flat and did not compress the skin. Measurements were accurate to the nearest 0.1 cm (ISAK, 2011; WHO, 2011).

Body mass index (BMI) (kg/m²): BMI was calculated using the formula below, based on the participant's height and weight:

$$\text{BMI (kg/m}^2) = \frac{\text{Weight (kg)}}{\text{Height}^2\ (\text{m}^2)}$$

The resulting BMI values were interpreted according to the World Health Organization's standard classification (WHO, 2010).

Methodology for collecting menstrual history of participants

Menstrual cycle length: Participants were asked to provide the duration in days between the onset of one menstrual cycle and the next.

Menstrual flow: Participants were interviewed about the typical duration and intensity of their menstrual flow, including whether they experienced heavy or prolonged bleeding. While participants could not specify the exact volume of blood loss, they provided details about the average duration of their flow and estimated intensity by reporting the number of sanitary pads used daily.

Menstrual regularity: Participants were asked about irregularities in their menstrual cycles, such as skipped periods or noticeable fluctuations in cycle length.

Menstrual symptoms: Information was gathered on additional symptoms associated with menstruation, such as dysmenorrhea (cervical pain).

Statistical analysis

The data collected were analyzed using IBM SPSS Statistics version 25. Statistical significance was set at $p \leq 0.05$. Pearson's correlation coefficient (r) was used to determine the relationships between anthropometric measurements and menstrual abnormalities. The strength of Pearson correlation coefficients (r) was interpreted using conventional qualitative descriptors based on established thresholds (Evans, 1996). Coefficients were categorized as follows: $r \geq 0.80$ (very strong positive), 0.60 – 0.79 (strong positive), 0.40 – 0.59 (moderate positive), 0.20 – 0.39 (weak positive), and 0.00 – 0.19 (very weak positive).

Results

Out of 200 participants, 40 reported experiencing menorrhagia, 36 reported oligomenorrhea, and none reported amenorrhea (Table 1). Consequently, statistical analysis for correlations between amenorrhea and anthropometric parameters (body mass index, waist-to-hip ratio, and waist-to-height ratio) was not feasible (Table 2). The mean age of participants ranged from 23 to 24 years (Table 1). The anthropometric characteristics of the participants are summarized in Table 2. The mean weight and height were 77.02 kg and 168.23 cm, respectively, resulting in a mean Body Mass Index (BMI) of 27.28 kg/m², which falls within the overweight range. The mean waist and hip circumferences were 86.13 cm and 106.76 cm, respectively, yielding a mean waist-hip ratio (WHR) of 0.81, which is within generally accepted health limits. In contrast, the mean waist-height ratio (WHtR) was 0.51, slightly exceeding the recommended cutoff of 0.5.

Table 1. Descriptive Statistics of Menstrual Variables among subjects

	Mean	SD	N
Menorrhagia	40.0	0.41	200
Oligomenorrhea	36.0	0.39	200

SD: Standard Deviation; N: Sample size

Table 2. Descriptive Statistics of Anthropometric Variables among subjects

	N	Minimum	Maximum	Mean	SEM	SD
Age (years)	200	17	43	23.89	0.36	5.09
Weight (kg)	200	46.30	137.00	77.02	1.39	19.60
Height (cm)	200	150	190	168.23	0.47	6.69
Waist circumference (cm)	200	60	135	86.13	1.03	14.51
Hip circumference (cm)	200	78	145	106.76	0.94	13.34
Body Mass Index (BMI)	200	15.85	50.94	27.28	0.50	7.05
Waist-Hip Ratio (WHR)	200	0.68	1.01	0.81	0.01	0.07
Waist-Height Ratio (WHtR)	200	0.36	0.82	0.51	0.01	0.09

N: Sample size; SEM: Standard Error of Mean; SD: Standard Deviation

Relationship between oligomenorrhea and anthropometric parameters

Pearson's correlation analysis revealed the following: a moderate positive correlation between oligomenorrhea and BMI (r=0.445, n=200, p=0.001); a weak positive correlation between oligomenorrhea and waist-to-hip ratio (r=0.207, n=200, p=0.003); a moderate positive correlation between oligomenorrhea and waist-to-height ratio (r=0.440, n=200, p=0.001); a very weak positive correlation between oligomenorrhea and age, which was not statistically significant (r=0.112, n=200, p=0.084) (Table 3).

Relationship between menorrhagia and anthropometric parameters

Analysis showed the following correlations: a very weak negative correlation between menorrhagia and BMI, which was not statistically significant (r= −0.035, n=200, p=0.618); a very weak negative correlation between menorrhagia and waist-to-hip ratio, also not statistically significant (r= −0.010, n=200, p=0.890); a very weak negative correlation between menorrhagia and waist-to-height ratio, which was similarly non-significant (r= −0.008, n=200, p=0.912); a very weak positive correlation between menorrhagia and age, which was not statistically significant (r=0.115, n=200, p=0.104) (Table 3).

Table 3. Relationship between Amenorrhea, Oligomenorrhea and Menorrhagia, and Body Mass Index (BMI), Waist-hip ratio (WHR), and Waist-Height ratio (WHtR)

		AGE	BMI	WHR	WHtR
Oligomenorrhea	Pearson Correlation	0.122	0.445**	0.207**	0.440**
	Sig. (2-tailed)	0.084	<0.001	0.003	<0.001
	N	200	200	200	200
Menorrhagia	Pearson Correlation	0.115	-0.035	0.010	-0.008
	Sig. (2-tailed)	0.104	0.618	0.890	0.912
	N	200	200	200	200

*. Correlation is significant at the 0.05 level (2-tailed); **. Correlation is significant at the 0.01 level (2-tailed); Correlation strength is indicated using qualitative descriptors (e.g., Strong, Moderate); see the Methods section for the corresponding numerical thresholds and citation.

Discussions

The data revealed significant insights into the relationship between menstrual irregularities and anthropometric parameters among participants. However, the absence of amenorrhea in the cohort limited the scope of correlation analysis to menorrhagia and oligomenorrhea.

Correlations between menorrhagia and anthropometric indices were very weak and statistically non-significant. These findings suggested that menorrhagia was not influenced by BMI, WHR and WhtR in this population. A useful conceptual framework posited that menstrual disorders are often dichotomized into those driven by chronic anovulation and endocrinopathy (such as oligomenorrhea) and those driven by structural pathology (such as menorrhagia) (Harlow et al., 2000). The failure of BMI, WHR, and WHtR to correlate with menorrhagia indicated that the disorder in this population was likely not primarily hypothalamic-pituitary-ovarian (HPO) axis dysfunction exacerbated by obesity, but rather localized uterine pathology. In support of this, several Nigerian studies had consistently confirmed that the presence and size of fibroids were the strongest predictors of heavy menstrual bleeding (Uimari et al., 2022; Vannuccini et al., 2023). This result aligned with Amgain et al. (2022), who observed that increased waist-to-height ratio did not predispose study subjects to menorrhagia.

In contrast, oligomenorrhea demonstrated moderate positive correlations with BMI and waist-to-height ratio, as well as a weaker yet significant correlation with waist-to-hip ratio. These findings supported prior research linking higher BMI and central adiposity to irregular menstrual cycles, likely due to their influence on insulin resistance, androgen levels, and hypothalamic-pituitary-ovarian axis function (Pasquali et al., 2007). This was further corroborated by studies on Nigerian women with polycystic ovary syndrome—a condition strongly associated with chronic anovulation and often characterized by oligomenorrhea—which had revealed significant relationships with increased BMI and WHR (Emokpae et al., 2024; Ukibe et al., 2021).

Notably, the non-significant correlation between oligomenorrhea and age suggested that in this relatively young population, age was not a major determinant of this menstrual irregularity. This observation was consistent with reports that irregular cycles in younger age groups often reflect ongoing reproductive system maturation rather than aging-related factors (Hickey & Balen, 2003). However, the broad age range of our cohort, while increasing the generalizability of our findings, may also have introduced physiological heterogeneity. For instance, the etiologies of oligomenorrhea could differ between a 17-year-old with HPO axis immaturity and a 40-year-old with declining ovarian reserve. The non-significant correlation between age and oligomenorrhea in our study may have reflected this confluence of underlying causes. Future studies with larger sample sizes could be stratified by age groups to elucidate more specific risk factors within different reproductive stages.

This study was conducted in a region where research infrastructure and technological resources remain limited, largely due to constraints in research funding and access to advanced laboratory diagnostics. However, these limitations did not hinder scientific inquiry; rather, they encouraged context-specific methodologies that maximized available resources to generate relevant data. Our findings, derived from direct anthropometric measurements and careful clinical history, demonstrated the capacity of such locally driven investigations to provide valuable insight into population-specific health patterns. Studies emerging from such underrepresented environments were crucial for challenging broad generalizations and contributing to a more balanced and equitable global understanding of reproductive health.

Overall, these findings support the growing body of evidence that adiposity and altered body composition are key modulators of menstrual health, reinforcing the need for early lifestyle interventions and targeted reproductive counseling among women of reproductive age.

Conclusion

This study demonstrated a significant association between oligomenorrhea and higher body mass index, waist-to-hip ratio, and waist-to-height ratio among women attending a fertility clinic in Southeast Nigeria. In contrast, no meaningful relationship was found between these anthropometric indices and menorrhagia. These findings highlight obesity and central adiposity as modifiable risk factors for oligomenorrhea, reinforcing the importance of weight management in clinical strategies for menstrual health and fertility. Furthermore, this research underscores the value of locally driven investigations in underrepresented regions to enrich global understanding and promote equitable reproductive healthcare.

Recommendations and future lines of research

Based on the findings of this study, the following recommendations are proposed:

For clinical practice, routine anthropometric screening, including BMI, waist-to-hip ratio, and waist-to-height ratio should be integrated into gynecological and fertility consultations. Identifying women with elevated adiposity metrics provides a critical opportunity for early intervention. Healthcare providers should offer targeted counseling on weight management as a fundamental component of treating oligomenorrhea and improving reproductive outcomes.

At the public health level, there is a need for community-based education campaigns that emphasize the link between healthy body weight and menstrual health. These initiatives should promote balanced nutrition and regular physical activity, specifically tailored to the cultural and socioeconomic context of Southeast Nigeria, to mitigate the risk of obesity-related menstrual dysfunction.

Future research should prioritize longitudinal studies to establish causal relationships between adiposity and menstrual disorders in this population. To provide a more comprehensive understanding, such studies would benefit from employing gold-standard body composition assessment tools like Bioelectrical Impedance Analysis (BIA) or Dual-Energy X-ray Absorptiometry (DXA). Furthermore, other promising lines of research could explore the utility of these markers in routine clinical screening.

Investigations into menorrhagia should focus on elucidating the role of structural pathologies, such as uterine fibroids, given the lack of correlation with anthropometric factors. Furthermore, building local capacity and securing funding for advanced diagnostic tools are essential to advance reproductive health research in underrepresented regions.

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Author roles

DNO: Conceptualization, Supervision, Writing – original draft, Methodology, Formal analysis, Writing – review and editing. IFO: Investigation, Formal analysis, Writing – review and editing. AKC: Resources, Investigation, Project administration, Writing – review and editing. ATN: Resources, Formal analysis, Writing – review and editing. CBA: Data curation, Resources, Writing – review and editing. AEA: Methodology, Data curation, Writing – review and editing. CGO: Investigation, Project administration, Writing – review and editing. DEE: Formal analysis, Methodology, Writing – review and editing. OMA: Writing – review and editing.

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Svetlana Nepocatych[1], Gytis Balilionis[1], Eric K. O'Neal[2]

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Word count: 2,946

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Works by six or more authors: cite only the name of the first author followed by et al. and the year
- ✓ Krustrup et al. (2003) studied
- ✓ In one study (Krustrup et al., 2003), soccer players

Two or more works in the same parenthetical citation: Citation of two or more works in the same parentheses should be listed in the order they appear in the reference list (i.e., alphabetically, then chronologically)
- ✓ Several studies (Bangsbo et al., 2008; Duffield & Marino, 2007; Reilly, 1997) suggest that

2.4.3. Examples for Reference list

Journal article (print):

Nepocatych, S., Balilionis, G., & O'Neal, E. K. (2017). Analysis of dietary intake and body composition of female athletes over a competitive season. *Montenegrin Journal of Sports Science and Medicine, 6*(2), 57-65. doi: 10.26773/mjssm.2017.09.008

Duffield, R., & Marino, F. E. (2007). Effects of pre-cooling procedures on intermittent-sprint exercise performance in warm conditions. *European Journal of Applied Physiology, 100*(6), 727-735. doi: 10.1007/s00421-007-0468-x

Krustrup, P., Mohr, M., Amstrup, T., Rysgaard, T., Johansen, J., Steensberg, A., Bangsbo, J. (2003). The yo-yo intermittent recovery test: physiological response, reliability, and validity. *Medicine and Science in Sports and Exercise, 35*(4), 697-705. doi: 10.1249/01.MSS.0000058441.94520.32

Journal article (online; electronic version of print source):

Williams, R. (2016). Krishna's Neglected Responsibilities: Religious devotion and social critique in eighteenth-century North India [Electronic version]. *Modern Asian Studies, 50*(5), 1403-1440. doi:10.1017/S0026749X14000444

Journal article (online; electronic only):

Chantavanich, S. (2003, October). Recent research on human trafficking. *Kyoto Review of Southeast Asia, 4*. Retrieved November 15, 2005, from http://kyotoreview.cseas.kyoto-u.ac.jp/issue/issue3/index.html

Conference paper:

Pasadilla, G. O., & Milo, M. (2005, June 27). *Effect of liberalization on banking competition*. Paper presented at the conference on Policies to Strengthen Productivity in the Philippines, Manila, Philippines. Retrieved August 23, 2006, from http://siteresources.worldbank.org/INTPHILIPPINES/Resources/Pasadilla.pdf

Encyclopedia entry (print, with author):

Pittau, J. (1983). Meiji constitution. In *Kodansha encyclopedia of Japan* (Vol. 2, pp. 1-3). Tokyo: Kodansha.

Encyclopedia entry (online, no author):

Ethnology. (2005, July). In *The Columbia encyclopedia* (6th ed.). New York: Columbia University Press. Retrieved November 21, 2005, from http://www.bartleby.com/65/et/ethnolog.html

Thesis and dissertation:

Pyun, D. Y. (2006). *The proposed model of attitude toward advertising through sport.* Unpublished Doctoral Dissertation. Tallahassee, FL: The Florida State University.

Book:
Borg, G. (1998). *Borg's perceived exertion and pain scales*: Human kinetics.

Chapter of a book:
Kellmann, M. (2012). Chapter 31-Overtraining and recovery: Chapter taken from Routledge Handbook of Applied Sport Psychology ISBN: 978-0-203-85104-3 *Routledge Online Studies on the Olympic and Paralympic Games* (Vol. 1, pp. 292-302).

Reference to an internet source:
Agency. (2007). Water for Health: Hydration Best Practice Toolkit for Hospitals and Healthcare. Retrieved 10/29, 2013, from www.rcn.org.uk/newsevents/hydration

2.5. Tables

All tables should be included in the main manuscript file, each on a separate page right after the Reference section.

Tables should be presented as standard MS Word tables.

Number (Arabic) tables consecutively in the order of their first citation in the text.

Tables and table headings should be completely intelligible without reference to the text. Give each column a short or abbreviated heading. Authors should place explanatory matter in footnotes, not in the heading. All abbreviations appearing in a table and not considered standard must be explained in a footnote of that table. Avoid any shading or coloring in your tables and be sure that each table is cited in the text.

If you use data from another published or unpublished source, it is the authors' responsibility to obtain permission and acknowledge them fully.

2.5.1. Table heading

Table heading should be written above the table, in Title Case, and without a full stop at the end of the heading. Do not use suffix letters (e.g., Table 1a, 1b, 1c); instead, combine the related tables. *See* example:

- ✓ **Table 1.** Repeated Sprint Time Following Ingestion of Carbohydrate-Electrolyte Beverage

2.5.2. Table sub-heading

All text appearing in tables should be written beginning only with first letter of the first word in all capitals, i.e., all words for variable names, column headings etc. in tables should start with the first letter in all capitals. Avoid any formatting (e.g., bold, italic, underline) in tables.

2.5.3. Table footnotes

Table footnotes should be written below the table.

General notes explain, qualify or provide information about the table as a whole. Put explanations of abbreviations, symbols, etc. here. General notes are designated by the word *Note* (italicized) followed by a period.

- ✓ *Note.* CI: confidence interval; Con: control group; CE: carbohydrate-electrolyte group.

Specific notes explain, qualify or provide information about a particular column, row, or individual entry. To indicate specific notes, use superscript lowercase letters (e.g. $^{a, b, c}$), and order the superscripts from left to right, top to bottom. Each table's first footnote must be the superscript ^{a}.

- ✓ ^{a}One participant was diagnosed with heat illness and n = 19.^{b}n =20.

Probability notes provide the reader with the results of the texts for statistical significance. Probability notes must be indicated with consecutive use of the following symbols: * † ‡ § ¶ || etc.

- ✓ *P<0.05,†p<0.01.

2.5.4. Table citation

In the text, tables should be cited as full words. *See* example:

- ✓ Table 1 (first letter in all capitals and no full stop)
- ✓ ...as shown in Tables 1 and 3. (citing more tables at once)
- ✓ ...result has shown (Tables 1-3) that... (citing more tables at once)
- ✓ ....in our results (Tables 1, 2 and 5)... (citing more tables at once)

2.6. Figures

On the last separate page of the main manuscript file, authors should place the legends of all the figures submitted separately.

All graphic materials should be of sufficient quality for print with a minimum resolution of 600 dpi. JASPE prefers TIFF, EPS and PNG formats.

If a figure has been published previously, acknowledge the original source and submit a written permission from the copyright holder to reproduce the material. Permission is required irrespective of authorship or publisher except for documents in the public domain. If photographs of people are used, either the subjects must not be identifiable or their pictures must be accompanied by written permission to use the photograph whenever possible permission for publication should be obtained.

Figures and figure legends should be completely intelligible without reference to the text.

The price of printing in color is 50 EUR per page as printed in an issue of JASPE.

2.6.1. Figure legends

Figures should not contain footnotes. All information, including explanations of abbreviations must be present in figure legends. Figure legends should be written bellow the figure, in sentence case. *See* example:

- ✓ **Figure 1.** Changes in accuracy of instep football kick measured before and after fatigued. SR – resting state, SF – state of fatigue, *p>0.01, †p>0.05.

2.6.2. Figure citation

All graphic materials should be referred to as Figures in the text. Figures are cited in the text as full words. *See* example:

- ✓ Figure 1
  - × figure 1
  - × Figure 1.
  - ✓ ….exhibit greater variance than the year before (Figure 2). Therefore…
  - ✓ ….as shown in Figures 1 and 3. (citing more figures at once)
  - ✓ ….result has shown (Figures 1-3) that... (citing more figures at once)
  - ✓ ….in our results (Figures 1, 2 and 5)... (citing more figures at once)

2.6.3. Sub-figures

If there is a figure divided in several sub-figures, each sub-figure should be marked with a small letter, starting with a, b, c etc. The letter should be marked for each subfigure in a logical and consistent way. *See* example:

- ✓ Figure 1a
- ✓ …in Figures 1a and b we can…
- ✓ …data represent (Figures 1a-d)…

2.7. Scientific Terminology

All units of measures should conform to the International System of Units (SI).

Measurements of length, height, weight, and volume should be reported in metric units (meter, kilogram, or liter) or their decimal multiples.

Decimal places in English language are separated with a full stop and not with a comma. Thousands are separated with a comma.

Percentage	Degrees	All other units of measure	Ratios	Decimal numbers
✓ 10%	✓ 10º	✓ 10 kg	✓ 12:2	✓ 0.056
× 10 %	× 10 º	× 10kg	× 12 : 2	× .056

Signs should be placed immediately preceding the relevant number.		
✓ 45±3.4	✓ p<0.01	✓ males >30 years of age
× 45 ± 3.4	× p < 0.01	× males > 30 years of age

2.8. Latin Names

Latin names of species, families etc. should be written in italics (even in titles). If you mention Latin names in your abstract they should be written in non-italic since the rest of the text in abstract is in italic. The first time the name of a species appears in the text both genus and species must be present; later on in the text it is possible to use genus abbreviations. *See* example:

- ✓ First time appearing: *musculus biceps brachii*

Abbreviated: *m. biceps brachii*

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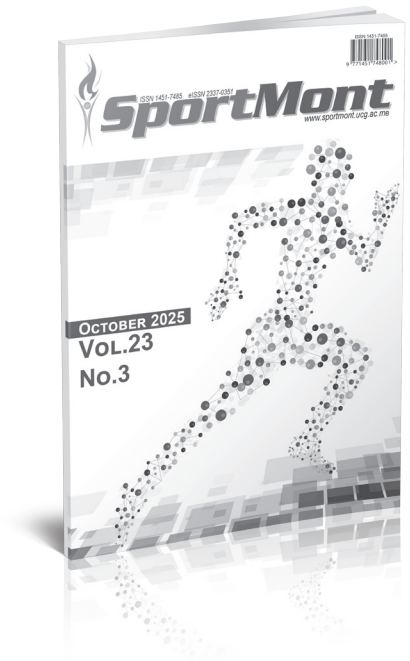

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Prospective authors should submit manuscripts for consideration in Microsoft Word-compatible format. For more complete descriptions and submission instructions, please access the Guidelines for Authors pages at the SMJ website: http://www.sportmont.ucg.ac.me/?sekcija=page&p=51. Contributors are urged to read SMJ's guidelines for the authors carefully before submitting manuscripts. Manuscripts submissions should be sent in electronic format to sportmont@ucg.ac.me or contact following Editors:

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MJSSM is published biannually, in September and March of each year. MJSSM publishes original scientific papers, review papers, editorials, short reports, peer review - fair review, as well as invited papers and award papers in the fields of Sports Science and Medicine, as well as it can function as an open discussion forum on significant issues of current interest.

MJSSM covers all aspects of sports science and medicine; all clinical aspects of exercise, health, and sport; exercise physiology and biophysical investigation of sports performance; sport biomechanics; sports nutrition; rehabilitation, physiotherapy; sports psychology; sport pedagogy, sport history, sport philosophy, sport sociology, sport management; and all aspects of scientific support of the sports coaches from the natural, social and humanistic side.

Prospective authors should submit manuscripts for consideration in Microsoft Word-compatible format. For more complete descriptions and submission instructions, please access the Guidelines for Authors pages at the MJSSM website: http://www.mjssm.me/?sekcija=page&p=51. Contributors are urged to read MJSSM's guidelines for the authors carefully before submitting manuscripts. Manuscripts submissions should be sent in electronic format to office@mjssm.me or contact following Editors:

Dusko BJELICA, Editor-in Chief – sportmont@t-com.me
Damir SEKULIC, Editor-in Chief – damirsekulic.mjssm@gmail.com

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MONTENEGRIN SPORTS ACADEMY

Founded in 2003 in Podgorica (Montenegro), the Montenegrin Sports Academy (MSA) is a sports scientific society dedicated to the collection, generation and dissemination of scientific knowledge at the Montenegrin level and beyond.

The Montenegrin Sports Academy (MSA) is the leading association of sports scientists at the Montenegrin level, which maintains extensive co-operation with the corresponding associations from abroad. The purpose of the MSA is the promotion of science and research, with special attention to sports science across Montenegro and beyond. Its topics include motivation, attitudes, values and responses, adaptation, performance and health aspects of people engaged in physical activity and the relation of physical activity and lifestyle to health, prevention and aging. These topics are investigated on an interdisciplinary basis and they bring together scientists from all areas of sports science, such as adapted physical activity, biochemistry, biomechanics, chronic disease and exercise, coaching and performance, doping, education, engineering and technology, environmental physiology, ethics, exercise and health, exercise, lifestyle and fitness, gender in sports, growth and development, human performance and aging, management and sports law, molecular biology and genetics, motor control and learning, muscle mechanics and neuromuscular control, muscle metabolism and hemodynamics, nutrition and exercise, overtraining, physiology, physiotherapy, rehabilitation, sports history, sports medicine, sports pedagogy, sports philosophy, sports psychology, sports sociology, training and testing.

The MSA is a non-profit organization. It supports Montenegrin institutions, such as the Ministry of Education and Sports, the Ministry of Science and the Montenegrin Olympic Committee, by offering scientific advice and assistance for carrying out coordinated national and European research projects defined by these bodies. In addition, the MSA serves as the most important Montenegrin and regional network of sports scientists from all relevant subdisciplines.

The main scientific event organized by the Montenegrin Sports Academy (MSA) is the annual conference held in the first week of April.

Annual conferences have been organized since the inauguration of the MSA in 2003. Today the MSA conference ranks among the leading sports scientific congresses in the Western Balkans. The conference comprises a range of invited lecturers, oral and poster presentations from multi- and mono-disciplinary areas, as well as various types of workshops. The MSA conference is attended by national, regional and international sports scientists with academic careers. The MSA conference now welcomes up to 200 participants from all over the world.

It is our great pleasure to announce the upcoming 24th Annual Scientific Conference of Montenegrin Sports Academy “Sport, Physical Activity and Health: Contemporary Perspectives” to be held in Budva, Montenegro, from 16 to 19 April, 2026. It is planned to be once again organized by the Montenegrin Sports Academy, in cooperation with the Faculty of Sport and Physical Education, University of Montenegro and other international partner institutions (specified in the partner section).

The conference is focused on very current topics from all areas of sports science and sports medicine including physiology and sports medicine, social sciences and humanities, biomechanics and neuromuscular (see Abstract Submission page for more information).

We do believe that the topics offered to our conference participants will serve as a useful forum for the presentation of the latest research, as well as both for the theoretical and applied insight into the field of sports science and sports medicine disciplines.

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As we continue to increase the quality of our publications across the field, we hope that you will continue to regard MSA journals as authoritative and stimulating sources for your research. We would be delighted to receive your comments and suggestions, mostly due to the reason your proposals are always welcome.

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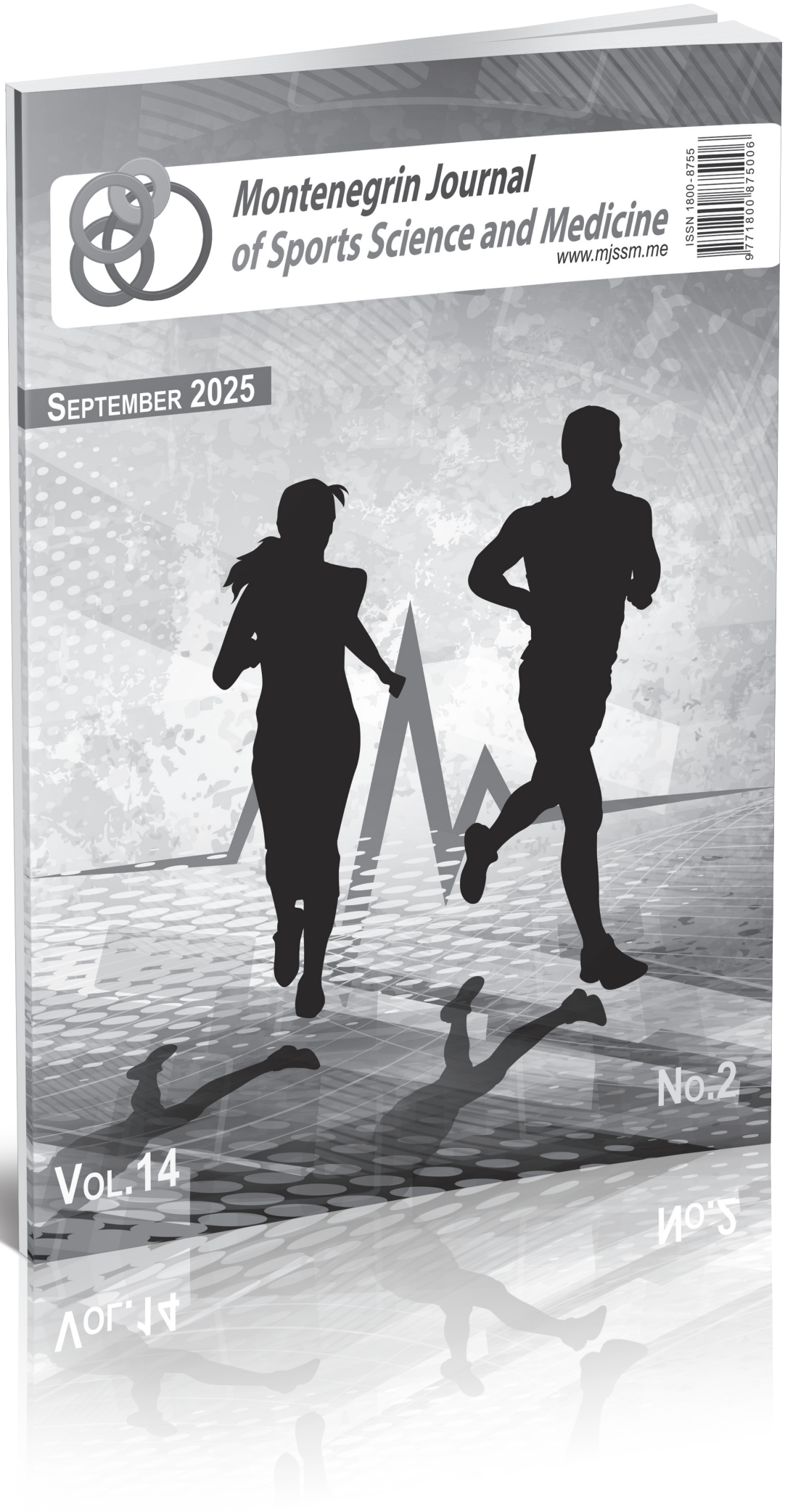
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