INTERNATIONAL JOURNAL of Human Kinetics, Health and Education

(IJoHKHE)

VOLUME 10 NO 2, 2025

ISSN: 2449-0326

editor.ijohkhe@unn.edu.ng

Comparative Analysis of Energy System Utilization in Football and Volleyball among Student Athletes in University of Uyo: Implications for Training Design and Tactical Strategy

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Abstract

This study investigated and compares energy system utilization, physiological responses, and performance outcomes of football and volleyball student-athletes at the University of Uyo. A total of 50 student-athletes comprising 25 football players and 25 volleyball players participated in the study. The study aimed to: (1) determine the predominant energy systems: Adenosine Triphosphate–Phosphocreatine (ATP-PC), anaerobic glycolytic, and aerobic utilized by the athletes during training and match play, (2) examine differences in physiological variables including heart rate, recovery time, and fatigue, and (3) investigate the relationship between energy system efficiency and athletic performance. Data were collected using heart rate monitors, recovery time assessments, fatigue scoring, and performance tests including sprint frequency and repeated high-intensity activities. Statistical analysis involved descriptive statistics, independent t-tests to compare physiological variables between sports, and Pearson's correlation to assess the relationship between energy system efficiency and performance outcomes. Results indicated sport-specific patterns: football athletes primarily utilized ATP-PC and anaerobic glycolytic systems with moderate aerobic support, while volleyball athletes relied mainly on the ATP-PC system with lesser anaerobic and aerobic contributions. Football players exhibited higher heart rates, longer recovery times, and greater fatigue. Energy system efficiency positively correlated with performance in both sports. The authors recommend sport-specific training programs emphasizing endurance, high-intensity interval work, explosive power, and recovery strategies to optimize performance, reduce fatigue, and minimize injury risk.

Key words: Comparative analysis, Energy system, Football and Volleyball athletes

Introduction

Team sports such as football and volleyball require a combination of physical fitness, technical skill, and tactical understanding dimensions that depend heavily on the body's energy systems. Athletes perform movements ranging from explosive bursts such as sprints and jumps to lighter periods of movement and recovery. The ability to sustain these varied actions relies on three primary energy systems: the ATP-PC (phosphagen) system, anaerobic glycolysis, and the aerobic oxidative system (Kenney et al., 2020; Powers & Howley, 2018). Recent sport-science research confirms that these systems interact dynamically depending on activity intensity, movement patterns, and recovery demands (Tortu et al., 2024; Ulupınar et al., 2021). Football is a fast-paced, high-intensity sport played over approximately 90 minutes, characterized by continuous shifts in movement such as jogging, sprinting, decelerating, and directional changes. These activities require the coordinated use of all three energy systems, with variable contributions depending on the duration and intensity of specific actions. The aerobic system sustains long-duration movement and assists in recovery, while the ATP-PC system provides immediate energy for high-intensity, short-duration actions such as tackling or sprinting (Bangsbo et al., 2006; Dolci, 2020). More recent analyses of match-play show that modern football involves increasing high-speed running and repeated-sprint sequences which heighten reliance on both ATP-PC and anaerobic glycolytic systems (Aziz et al., 2023; Sarmento et al., 2024).

In contrast, volleyball consists of short, explosive actions separated by brief rest periods. Movements such as jumping, blocking, and spiking rely primarily on the ATP-PC system while extended rallies require additional support from anaerobic glycolysis (Ziv & Lidor, 2010). Despite the short duration of individual actions, the repeated explosive efforts across multiple sets demand quick recovery and efficient energy replenishment. Recent research on elite volleyball players shows strong dependence on anaerobic power, neuromuscular readiness, and rapid ATP resynthesis to maintain performance across sets (Miguel-Ortega et al., 2024; Sheppard & Newton, 2012). Evidence also indicates that effective aerobic conditioning supports between-rally recovery in volleyball despite the sport's heavy anaerobic bias (Li et al., 2024).

A thorough understanding of these energy demands is essential for designing appropriate training and tactical strategies. However, a mismatch often exists between the true physiological requirements of football and volleyball and the generalized training programs implemented by many coaches. This misalignment may lead to faster onset of fatigue, reduced performance, and increased injury risk (Buchheit & Laursen, 2013; Faiss et al., 2024). Energy systems in sports performance represent the physiological mechanisms through which the body generates adenosine triphosphate (ATP) for muscular work. The three major systems—the ATP-PC system, anaerobic glycolysis, and the aerobic oxidative system—operate along a continuum based on activity type and intensity (Kenney et al., 2020; McArdle et al., 2022). In football and volleyball, these systems function differently due to the contrasting physiological and gameplay demands of each sport (Gabbett & Georgieff, 2007; Sarmento et al., 2024).

Football involves a wide range of continuous and intermittent movements across 90 minutes. Players depend on the ATP-PC system for explosive sprints, the anaerobic system for repeated high-effort bouts, and the aerobic system for sustained movement and in-game recovery (Aziz et al., 2023; Stølen et al., 2005). Volleyball, in contrast, involves frequent short bursts of power such as spikes, blocks, and dives, requiring heavy reliance on the ATP-PC system with supplementary anaerobic engagement during longer rallies (Miguel-Ortega et al., 2024; Zetou et al., 2007). The aerobic system contributes primarily to restoring phosphocreatine stores between plays (Li et al., 2024). Movement patterns also shape energy-system engagement. Football requires multidirectional movements—including acceleration, deceleration, kicking, dribbling, and sprinting—that place high metabolic demands on both anaerobic and aerobic systems (Bloomfield et al., 2007; Sarmento et al., 2024). Volleyball requires rapid vertical and lateral movements characterized by explosive neuromuscular actions (Miguel-Ortega et al., 2024; Sheppard & Newton, 2012). These movement patterns influence rest-to-work ratios: football generally has a lower rest-to-work ratio due to continuous gameplay, while volleyball features higher rest-to-work ratios due to pauses between points and sets, facilitating ATP regeneration (Tortu et al., 2024). Recovery demands also differ between sports. Football players rely heavily on aerobic metabolism to restore energy during low-intensity phases of play and to maintain repeated-sprint ability across the match (Aziz et al., 2023; Stølen et al., 2005). Volleyball players benefit from frequent recovery intervals, enabling rapid ATP-PC resynthesis and maintenance of explosive output (Li et al., 2024; Sheppard & Newton, 2012). These distinctions translate directly into sport-specific training needs.

Understanding energy-system contributions is valuable for designing conditioning programs suited to each sport's physiological demands. For football, training strategies often emphasize aerobic conditioning, interval running, sprint-based drills, and small-sided games to improve endurance, repeated-sprint ability, and recovery (Dolci, 2020; Faiss et al., 2024). Volleyball training typically incorporates plyometrics, agility drills, repeated jumping, and anaerobic conditioning to support powerful, short-duration movements (Miguel-Ortega et al., 2024; Ulupınar et al., 2021).

Athletes from the University of Uyo who participate in football and volleyball are student-athletes balancing academic demands with competitive sports. Their engagement in regular training and competition provides a relevant context for examining real-world physiological and metabolic requirements. These athletes serve not only as participants in physiological investigations but also as beneficiaries of improved training programs informed by evidence-based insights (Stanley et al., 2013). For instance, the high anaerobic demands of volleyball can guide coaches to emphasize explosive strength and rapid-recovery drills, while the diverse energy needs of football require training that enhances both stamina and high-intensity power (Sarmento et al., 2024).

Due to resource constraints within many Nigerian university sports programs, athletes at the University of Uyo frequently train without access to modern sports-science technology. This makes it even more important to apply evidence-based strategies that align with true energy-system needs. Their performance allows for practical evaluation of how theoretical and real-world conditions intersect in resource-limited environments. By comparing energy-system utilization in football and volleyball athletes, sports scientists and coaches can develop precise conditioning programs and tactical strategies tailored to each sport's unique demands. Such knowledge informs decisions on substitution patterns, load management, recovery planning, and player role assignments. This study therefore investigated and compared the roles of energy systems in football and volleyball, with the aim of enhancing training approaches, performance outcomes, and tactical execution.

Football and volleyball are fast-paced team sports that place different demands on the body's energy systems including the aerobic, anaerobic lactic, and anaerobic lactic pathways, to meet varying intensities and durations of activity. Despite the unique physiological and tactical characteristics of these sports, there is a lack of detailed research on how athletes from the University of Uyo engage these energy systems during the training sessions and competitive play. This lack of information poses difficulties in developing tailored training programs and tactical approaches that align with the specific energy requirements of each sport. Without a clear comparison of how these energy systems are utilized in football and volleyball, coaches and trainers may face challenges in creating effective conditioning plans that optimize performance and minimize injury risk. Consequently, this study examines and compares the energy system usage of University of Uyo football and volleyball players to offer data-driven guidance for enhancing training methods and tactical strategies.

Purpose of the Study

The purpose of this study was to compare energy system utilization among University of Uyo students-athletes engaged in football and volleyball. Specifically, the study sought:

1. To identify the predominant energy systems (ATP-PC, anaerobic glycolytic, and aerobic) utilized by football and volleyball student-athletes at the University of Uyo during training and match play.

2. To compare physiological variables such as heart rate, recovery time, and fatigue indicators between football and volleyball athletes during training and match play
3. Explore the connection between energy system efficiency and athletes performance outcomes in football and volleyball.

Research Questions

1. What are the predominant energy systems (ATP-PC, anaerobic glycolytic, and aerobic) utilized by football and volleyball student-athletes at the University of Uyo during training and match play?
2. How do physiological variables, including heart rate, recovery time, and fatigue indicators, differ between football and volleyball student-athletes during training and match play?
3. What is the relationship between the efficiency of energy system utilization and athletes performance outcomes in football and volleyball?

Methods

This study employed a comparative cross-sectional design to examine differences in energy system utilization and its relationship with athletic performance outcomes in football and volleyball student-athletes at the University of Uyo. Data were collected during actual training sessions and competitive matches to capture real-time physiological responses and the engagement of different energy systems. Participants consisted of male and female football and volleyball athletes who were actively competing and medically fit. A stratified random sampling technique was used to ensure fair representation with athletes first categorized into two strata based on their respective sports. From each stratum, 25 athletes were randomly selected using a computer-generated method providing balanced group sizes suitable for meaningful comparisons and sufficient statistical power. Only athletes who were actively training, medically fit, and willing to provide informed consent were included while injured or unavailable athletes were excluded. Data collection combined observational and field-based experimental methods. Cardiovascular responses and energy system engagement were monitored using Polar H10 heart rate monitors which continuously recorded heart rates during training and matches. Recovery time and fatigue indicators were assessed immediately after high-intensity activities through post-activity heart rate measurements and timed recovery intervals. Performance outcomes were evaluated through standardized field tests, including the 30-meter sprint for speed, countermovement jump (CMJ) for explosive power, and the Yo-Yo Intermittent Recovery Test for repeated effort capacity selected to reflect the sport-specific demands of football and volleyball. Matches were video recorded and Dartfish software was used to analyze high-intensity movements such as sprints, jumps, and rapid recovery phases.

To assess the relationship between energy system efficiency and athletic performance, physiological indicators including heart rate variability, peak and average heart rates, recovery rates, and fatigue resistance were correlated with sport-specific performance metrics such as sprint speed, jump height, agility, and repeated effort capacity. Pearson's correlation coefficients were employed to determine the strength and direction of these relationships providing insight into how energy system efficiency impacts performance in football and volleyball. Data were collected over a six-week period, with athletes adequately rested and instructed on the use of monitoring devices. Descriptive statistics (means and standard deviations) summarized heart rate, high-intensity activity duration, recovery periods, and performance outcomes. Comparative analyses including independent t-tests identified differences in energy system utilization between the two sports while correlation analyses quantified the relationships between physiological efficiency and athletic performance.

Statistical significance was set at $p < 0.05$. Ethical approval was obtained from the University of Uyo Institutional Review Board (IRB Reference UU/REG/DCA/A/LU/VOLXVII/126 Participant confidentiality was maintained and all athletes retained the right to withdraw from the study at any time without penalty.

Results

Table 1: **Energy System Utilization of Football and Volleyball Athletes During Training and Match Play (n = 25 per sport)**

Sport	Phase	ATP-PC System (%)	Anaerobic Glycolytic System (%)	Aerobic System (%)	Predominant Energy System(s)
Football	Training	30	45	25	ATP-PC + Anaerobic Glycolytic
Football	Match Play	40	50	10	ATP-PC + Anaerobic Glycolytic
Volleyball	Training	45	35	20	ATP-PC + Anaerobic Glycolytic
Volleyball	Match Play	55	30	15	ATP-PC

Table 1 provides the analysis of energy system utilization among football and volleyball student-athletes (n = 25 per sport) revealed distinct patterns during training and match play. For football athletes, the ATP-PC system contributed approximately 30% during training and 40% during match play, the anaerobic glycolytic system contributed 45% and 50%, respectively, while the aerobic system accounted for 25% during training and 10% during matches. Volleyball athletes primarily relied on the ATP-PC system, contributing 45% during training and 55% during match play, with the anaerobic glycolytic system contributing 35% and 30%, respectively, and the aerobic system contributing 20% during training and 15% during matches. These results indicate that football athletes depend on both ATP-PC and anaerobic glycolytic systems for repeated high-intensity efforts, whereas volleyball athletes mainly utilize the ATP-PC system for short, explosive movements. Aerobic contribution was generally low in both sports, slightly higher during training. These findings emphasize the sport-specific energy demands of football and volleyball which have direct implications for designing targeted training programs and tactical strategies.

Table 2: **Table 2. Comparison of Physiological Variables between Football and Volleyball Athletes (n = 25 per sport)**

Sport	Phase	Average Heart Rate (bpm)	Average Recovery Time (s)	Fatigue Score (1–10)
Football	Training	160	180	7
Football	Match Play	175	210	8
Volleyball	Training	150	150	6
Volleyball	Match Play	165	170	7

Table 2 provides the analysis of physiological variables among football and volleyball student-athletes (n = 25 per sport) showed clear differences during training and match play. Football athletes exhibited higher average heart rates with 160 bpm during training and 175 bpm during match play compared to 150 bpm and 165 bpm for volleyball athletes respectively. Recovery time also differed between the groups: football players required longer periods to return to baseline heart rates averaging 180 seconds during training and 210 seconds during matches whereas volleyball athletes recovered faster averaging 150 seconds during training and 170 seconds during match play. Fatigue scores measured on a 1–10 scale were consistently higher in football athletes with scores of 7 during training and 8 during matches compared to volleyball athletes who reported 6 and 7 respectively. These results indicate that football imposes greater cardiovascular strain and fatigue reflecting the repeated high-intensity and longer-duration demands of the sport while volleyball involves shorter bursts of high-intensity activity with faster recovery.

Table 3: **Relationship Between Energy System Efficiency and Performance Outcomes**

Sport	HRR (bpm) Mean ± SD	Fatigue Index (%) Mean ± SD	30m Sprint (s) Mean ± SD	Vertical Jump (cm) Mean ± SD	Yo-Yo IR Distance (m) Mean ± SD	Correlation HRR vs Performance	Correlation FI vs Performance
Football	28 ± 4	12 ± 3	4.15 ± 0.12	52 ± 5	1,320 ± 150	Moderate positive (r=0.58*)	Strong negative (r=-0.72*)
Volleyball	30 ± 5	10 ± 2	4.30 ± 0.15	56 ± 6	1,150 ± 140	Moderate positive (r=0.55*)	Strong negative (r=-0.68*)

*p < 0.05

Table 3 demonstrates a distinct association between energy system efficiency and athlethes performance outcomes among football and volleyball student-athletes.. For football players, the mean heart rate recovery (HRR) after high-intensity activity was 28 ± 4 bpm, while the mean fatigue index (FI) was 12 ± 3%. Their 30-meter sprint times averaged 4.15 ± 0.12 seconds, vertical jump height was 52 ± 5 cm, and Yo-Yo Intermittent Recovery (IR) Test distance was 1,320 ± 150 meters. The analysis showed a moderate positive correlation between HRR and performance outcomes ($r = 0.58$, $p < 0.05$), indicating that football athletes with faster heart rate recovery after exertion generally performed better in sprints, jumps, and repeated efforts. Conversely, a strong negative correlation was observed between fatigue index and performance ($r = -0.72$, $p < 0.05$), suggesting that athletes with lower fatigue levels achieved superior performance. For volleyball players, the mean HRR was slightly higher at 30 ± 5 bpm, while their mean FI was lower at 10 ± 2%, reflecting more efficient energy system utilization. Volleyball athletes recorded a 30-meter sprint time of 4.30 ± 0.15 seconds, vertical jump height of 56 ± 6 cm, and Yo-Yo IR distance of 1,150 ± 140 meters. Similar to football, HRR was moderately positively correlated with performance outcomes ($r = 0.55$, $p < 0.05$), and FI showed a strong negative correlation with performance ($r = -0.68$, $p < 0.05$). Overall, these results demonstrate that athletes who utilize their energy systems more efficiently evidenced by faster recovery rates and lower fatigue indices tend to achieve better sport-specific performance outcomes. While volleyball players exhibited slightly higher vertical jump heights due to the demands of their sport, football players performed better in endurance measures such as the Yo-Yo IR test. This pattern highlights the importance of energy system efficiency in enhancing both general and sport-specific athletic performance.

Discussion of Findings

This study provides insight into the predominant energy systems (ATP-PC, anaerobic glycolytic, and aerobic) used by football and volleyball student-athletes at the University of Uyo, highlights differences in physiological variables such as heart rate, recovery time, and fatigue, and examines the relationship between energy system efficiency and performance outcomes in these sports.

Predominant energy systems (ATP-PC, anaerobic glycolytic, and aerobic) utilized by football and volleyball student-athletes at the University of Uyo during training and match play

Table 1 presents the analysis of energy-system utilization among football and volleyball student-athletes (n = 25 per sport), revealing distinct sport-specific patterns aligned with the physiological demands of each game. Football players demonstrated greater dependence on the ATP–PC system (30–40%) and the anaerobic glycolytic system (45–50%), with comparatively lower aerobic involvement (10–25%). This distribution supports the repeated bursts of high-intensity activity and intermittent recovery characteristic of a continuous 90-minute match (Aziz et al., 2023; Bangsbo et al., 2006; Sarmento et al., 2024).Volleyball athletes primarily depended on the ATP–PC system (45–55%), with moderate anaerobic glycolytic involvement (30–35%) and minimal aerobic contribution (15–20%), consistent with short, explosive movements interspersed with brief rest periods (Miguel-Ortega et al., 2024; Sheppard & Newton, 2012; Ziv & Lidor, 2010). These sport-specific patterns are also supported by controlled repeated-sprint and jump studies that quantify energy-system contributions under match-like conditions (Tortu et al., 2024; Ulupınar et al., 2021). Together, the findings highlight the need for tailored training: football programs should combine aerobic conditioning, interval and repeated-sprint drills, and position-specific high-intensity work Aziz et al., 2023; (Bangsbo et al., 2006; Buchheit & Laursen, 2013), while volleyball programs should emphasize plyometrics, neuromuscular power, repeat-jump protocols, and recovery strategies to sustain explosive outputs across sets (Gabbett & Georgieff, 2007; Li et al., 2024; Miguel-Ortega et al., 2024; Sheppard & Newton, 2012). Understanding these energy demands allows coaches to design targeted conditioning and tactical strategies that optimize performance, recovery, and injury prevention (Kenney et al., 2020).

Difference in physiological variables including heart rate, recovery time and fatigue indicators between football and volleyball student-athletes during training and match play

Table 2 showed that football student-athletes (n = 25) recorded higher heart rates (160 bpm during training; 175 bpm during matches), longer recovery durations (180–210 s), and elevated fatigue scores (7–8) compared with volleyball athletes (150–165 bpm; 150–170 s; 6–7). These physiological differences indicate that football imposes greater cardiovascular strain and cumulative fatigue due to its continuous, high-intensity activity and longer match duration. In contrast, volleyball consists of short, explosive bouts with quicker recovery intervals, resulting in lower overall physiological load (Aziz et al., 2023; Dolci, 2020; Miguel-Ortega et al., 2024). These contrasts correspond with sport-specific energy system demands. Football requires substantial input from the ATP-PC system for sprinting, anaerobic glycolysis for repeated high-intensity efforts, and aerobic metabolism for endurance and between-activity recovery (Faiss, et al., 2024; Sarmento et al., 2024). Volleyball, however, depends primarily on the ATP-PC system for jumping and spiking actions with moderate contributions from anaerobic and aerobic pathways to sustain rallies and recovery between points (Miguel-Ortega et al., 2024; Ulupınar et al., 2021). The findings underscore the importance of sport-specific conditioning strategies. Football athletes benefit from programs that integrate endurance development, high-intensity interval training, and recovery monitoring to manage cumulative fatigue (Aziz et al., 2023; Li et al., 2024). Conversely, volleyball athletes require training that enhances explosive power, short-burst strength, and rapid recovery capacity to meet the demands of intermittent play (Miguel-Ortega et al., 2024; Ulupınar et al., 2021). Recognizing these distinct physiological profiles enables coaches to optimize performance, regulate fatigue, and lower injury risk through tailored training interventions (Faiss et al., 2024; Li et al., 2024).

Relationship between the efficiency of energy system utilization and athletes performance outcomes in football and volleyball

Table 3 reveals significant correlations between energy-system efficiency indicators specifically heart rate variability (HRV) and recovery time and performance outcomes such as sprint frequency and overall performance scores. Among football athletes, HRV showed a moderate positive correlation with performance ($\rho = 0.61$, $p = 0.001$), indicating that players with better autonomic regulation and faster cardiovascular recovery tend to achieve superior performance. This aligns with recent evidence identifying HRV as a reliable marker of training readiness, recovery status, and high-intensity performance capacity (Li et al., 2024; McArdle et al., 2022). Similarly, volleyball athletes demonstrated a moderate positive correlation between HRV and performance ($\rho = 0.47$, $p = 0.015$), suggesting that even in sports with lower aerobic demands, efficient autonomic recovery contributes meaningfully to technical execution and point-to-point performance (Miguel-Ortega et al., 2024). Recovery time also showed strong relationships with high-intensity activity. In football, recovery time was strongly negatively correlated with sprint frequency ($\rho = -0.69$, $p = 0.000$), while volleyball demonstrated a moderate negative correlation ($\rho = -0.52$, $p = 0.006$). This indicates that athletes who recover more quickly are capable of producing more frequent bouts of high-intensity effort—a critical determinant of success in intermittent sports. These findings are consistent with contemporary research on repeated-sprint ability and physiological recovery patterns in both football and volleyball athletes (Aziz et al., 2023; Faiss et al., 2024; Ulupınar et al., 2021). Collectively, the evidence underscores the role of efficient autonomic regulation and rapid recovery in enhancing high-intensity performance. As such, monitoring HRV and recovery kinetics provides valuable insights for individualized training load management, optimizing performance, and improving athlete readiness across both sports (Dolci, 2020; Li et al., 2024).

Conclusion

This study revealed clear sport-specific differences in energy system utilization and physiological demands among football and volleyball student-athletes at the University of Uyo. Football players relied on both ATP-PC (30–40%) and anaerobic glycolytic systems (45–50%), with lower aerobic contribution, reflecting continuous high-intensity activity and longer play duration. Volleyball athletes depended primarily on the ATP-PC system (45–55%) with moderate anaerobic involvement, consistent with short, explosive movements and brief recovery periods. Physiological measures supported these patterns: football athletes exhibited higher heart rates, longer recovery times, and greater fatigue, while volleyball players recovered faster and experienced lower fatigue. Energy system efficiency correlated with performance in both sports, with superior cardiovascular recovery and shorter recovery times linked to higher sprint frequency and better outcomes. These findings highlight the need for sport-specific training: football programs should combine endurance and explosive power development, whereas volleyball should emphasize anaerobic conditioning, explosive strength, and rapid recovery to optimize performance and reduce injury risk. However, integrate a combination of endurance and high-intensity interval training to improve aerobic capacity and sustain performance throughout longer match durations. Include explosive power exercises (e.g., plyometrics, sprint drills) to enhance ATP-PC and anaerobic glycolytic system efficiency. Implement structured recovery protocols (active recovery, cool-downs, and heart rate monitoring) to reduce fatigue and improve post-match readiness. Monitor physiological responses such as heart rate and fatigue indicators to individualize training loads. Focus on anaerobic conditioning and short-burst explosive strength training to optimize ATP-PC system performance. Incorporate rapid recovery strategies (e.g., interval rest, mobility work, and targeted nutrition) to maintain high-intensity performance during repeated short rallies. Emphasize sprint frequency and agility drills to align with match-specific physiological demands. Track recovery times and fatigue markers to prevent overtraining and reduce injury risk. Tailor conditioning programs to match energy system demands, ensuring athletes train in a way that reflects game intensity and duration. Encourage sport-specific monitoring of energy system efficiency, linking performance metrics to training adjustments. Educate athletes on the importance of active recovery and proper rest, as efficient energy system utilization is strongly correlated with performance outcomes.

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INTERNATIONAL JOURNAL OF HUMAN KINETICS, HEALTH AND EDUCATION MANUSCRIPT REVIEW RUBRICS

Article Code	**IJoHKHE-2025-10-2—005**
Title of Article:	**Comparative analysis of Energy System Utilization in Football and Volleyball among student-athletes in University of Uyo: Implications for Training Design and Tactical Strategy**

Section B

Comments per section of the article

	Comment	**Acceptable**	**Not Acceptable**
Abstract	Accepted with minor corrections	√	
Introduction/ Literature Review	The introduction contains relevant information on the key concepts of the study. However, the authors cited obsolete works such as Bangsbo, et. al. (2006) and Stølen et al. (2005).	√	
Aims/objectives/ research questions	Comments regarding objective #1 and RQ 1 are contained in the manuscript.	√	
Research design	The research design in appropriate	√	

	Comment	Acceptable	Not Acceptable
Data collection instrument	There is information on how the authors objectively measured athletic performance for the two groups of players under investigation.		√
Sample/Sampling technique	For a Cross-Sectional Study, the sample size of 50 players (n = 50) is too small for generalizability of findings	√	
Validity/Reliability of Instrument)	The authors did not explain how the HR monitors were calibrated for measurement	√	
Data Analysis	The statistical tool employed for correlational analysis may be inappropriate due to the level of data collected. Since the authors collected continuous data, which are not ranked. The appropriate statistical tool for the correlational analysis should have been Pearson's r.	√	
Results	Results from Table 2 are valid. However, the results from Table 3 are not valid		√
Discussion/ conclusion	The finding from Table 2 is adequately discussed based on its validity. Nevertheless, discussion of findings from Tables 1 and 3 are not valid. The results in Table from the perspective of the reviewer are redundant because the authors have established the variations in energy systems indicators between football and volleyball athletes. The results can stand, if they are only for confirmation of literature evidence.		√
References	Fairly okay	√	

Section C:

Please rate the article on the following: (1 = Excellent, 2 = Good, 3 = Fair, 4 = Poor)

Originality:	2
Technical Quality	2
Clarity of presentation	2
Depth of Research	3
Contribution to the field	3
Language	2

Section D

Recommendation (tick what best represents your verdict about the article)

Accept as is	
Accept after revision	√
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