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COMPARISON OF STATIC AND DYNAMIC BALANCE BETWEEN NETBALL AND VOLLEYBALL IN FEMALE ATHLETES OF UNIKL RCMP

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ABSTRACT

Background: Balance is crucial for how a person moves, involving the interaction of the body systems to keep us stable. It is not just the ability to stand upright then extends to holding stationary positions as well as dynamic activities like walking, running, and other forms of locomotion, balance is about capably controlling the body's center of mass about its base of support. The body continually alters muscles and joints in an upright position to maintain its balance and avoid falling due to gravity. To maintain our upright posture and prevent accidents the nervous system controls small changes in our muscles and joints. Balance becomes essential when moving around a lot, such as when playing sports or on uneven surfaces to keep the body stable and prevent any injuries. **Objective:** Thus, this study aims to compare the balance abilities of female athletes in two sports, netball and volleyball, at UniKL RCMP. **Methods:** This study was a cross-sectional type of study design involving 62 participants (31 netball, 31 volleyball) that was conducted over six weeks from August to mid-September 2024 using purposive sampling technique at Physiotherapy Gymnasium and Electro Laboratory of UniKL RCMP. Flamingo Balance Test (FBT) was used to evaluate static balance and Y-Balance Test (YBT) was used to evaluate dynamic balance. Mann-Whitney was used to determine the significant difference of static balance while Independent-t test was used to determine the significant difference of dynamic balance between female netball and volleyball team. The data was analyzed using SPSS version 26. **Results:** The results revealed that there is no significant difference of static and dynamic balance between female netball and volleyball team of UniKL RCMP ($p>0.05$). Static balance showed no significant differences between groups (Right FBT: netball = 28.16 vs volleyball = 34.84, $p = 0.141$; Left FBT: netball = 31.69 vs volleyball = 31.31, $p = 0.932$). Dynamic balance was also comparable (Right YBT: netball = 95.92 ± 18.86 vs volleyball = 95.31 ± 16.99, $p = 0.894$; Left YBT: netball = 96.56 ± 19.66 vs volleyball = 93.29 ± 19.14, $p = 0.509$). **Conclusion:** These findings suggest that despite the unique demands of each sport, the balance abilities of netball and volleyball players are comparable, likely due to shared movement requirements such as agility, rapid directional changes, and frequent jumping that are essential in both sports. The similarity in balance performance may also be attributed to the homogeneity of participant characteristics, including age, training backgrounds, and physical attributes. This uniformity in athletic conditioning could contribute to baseline similarities in balance, diminishing measurable differences

Keywords: *Static Balance, Dynamic Balance, Flamingo Balance Test, Y-Balance Test, Netball, Volleyball*

INTRODUCTION

Balance plays a crucial role in maintaining stability and effective movement, depend on on the coordinated interaction of the body systems to control the center of mass relative to the base of support. It is essential not only for stationary tasks like standing upright but also for dynamic activities such as walking, running, and sports. The nervous system adjusts muscles and joints continuously to counteract gravity and maintain balance. Proprioception, muscular strength, and sensory feedback from visual, vestibular, and somatosensory systems work together to help the body stay balanced during activities (Mukhtar et al., 2020). Balance contributes significantly to mobility, functionality, and overall well-being, acting as a foundation for movement and physical health (Kamarudin et al., 2021). Two types of balance exist: static and dynamic. Static balance refers to maintaining stability in a static position, such as holding a yoga pose or standing in line while dynamic balance involves controlling body stability during movement, such as walking, running, or navigating uneven surfaces (Paryushi et al., 2018; Roshan et al., 2020). Both rely on neuromuscular coordination, sensory integration, and proprioceptive feedback, allowing individuals to adapt to different tasks and environments.

In sports, balance is essential not only for performance but also for injury prevention. Athletes rely on both static and dynamic balance to perform precise movements, maintain posture, and react to challenges during play. For example, netball players need static balance to stay steady when receiving a pass and dynamic balance to maintain control while dodging opponents (Paillard et al., 2017; Marinkovic et al., 2021). Enhanced balance improves movement efficiency, reduces injury risks, and provides a competitive advantage (Paryushi et al., 2018). Lower limb injuries, such as ankle and knee sprains, are common in sports like netball and volleyball, emphasizing the importance of balance training as a preventive strategy. Studies highlight a higher incidence of injuries among female athletes, with ankle injuries being particularly prevalent in volleyball (Downs et al., 2021; Seman et al., 2019). Balance-enhancing exercises and proprioceptive training can minimize these risks, supporting both injury prevention and optimal athletic performance (Brachman et al., 2017). Evaluating balance involves standardized tests that measure different aspects of static and dynamic stability. For static balance, the Flamingo Balance Test, FBT is a widely recognized tool that assesses postural control by having participants balance on one leg. It is less cost, easy to conduct, and highly reliable, with validity and reliability scores between 0.90 and 0.95 (Aboelwafa et al., 2019). Dynamic balance is evaluated through tasks requiring coordinated movement and postural control, such as the Y Balance Test, YBT. This test is effective in identifying potential injury risks and balance asymmetries, with validity scores ranging from 0.89 to 0.97 (CL et al., 2019). Understanding the differences in static and dynamic balance among female athletes at UniKL RCMP can provide awareness into injury risks and inform strategies for performance optimization and injury prevention.

This study addresses the limited research on balance among female athletes by focusing on recreational netball and volleyball players at UniKL RCMP, addressing gaps from previous studies that mostly focused on male athletes and had small sample sizes. The objective is to compare the static and dynamic balance abilities of female athletes in these sports, aiming to identify which shows good balance. The study hypothesizes both the presence and absence of significant differences in balance between these two groups. By examining sport-specific balance demands with a larger sample size, the findings aim to enhance understanding of balance in female athletes, informing targeted training strategies to improve performance, agility, and stability while reducing injury risks. This research also aims to elevate the overall standard of sports at UniKL RCMP by encouraging a culture of athletic excellence and injury prevention. We hypothesize that there is no significant difference in static and dynamic balance performance between female netball and volleyball players.

METHODOLOGY

Study design and study population

This was a cross-sectional study, which means data collected from both netball and volleyball players at a single point in time. There was no follow-up or intervention involved. Data collection takes place over six weeks from August to mid-September 2024, with each participant undergoing assessment only once. The participants were female students from UniKL RCMP who play netball or volleyball. They were selected using purposive sampling techniques, which means they were chosen based on specific criteria related to their involvement in those sports. The total number of participants was 62, with 31 athletes in each group (netball and volleyball). The Physiotherapy Gym and Electro lab at UniKL RCMP used as the location for conducting tests and recruiting participants.

Instrument and measurement outcome

The test used for this study was Flamingo Balance Test, FBT for static balance and Y-Balance Test, YBT for dynamic balance. For FBT, Participants stood on a beam measuring 50 cm in length, 5 cm in height, and 3 cm in width. Positioned barefoot on one leg, they flexed the free leg at the knee, bringing the foot close to the buttocks, while placing their hands on the iliac crests, resembling the stance of a flamingo. Upon starting the stopwatch, participants were instructed to maintain this stance for one minute. The stopwatch was paused each time a participant lost balance, only resuming once they regained stability. If a participant fell more than 15 times within the initial 30 seconds, the trial was invalid. Each participant completed three attempts on each leg with their eyes open. The number of falls was recorded and averaged for the following analysis. For YBT, the measurement tool can be adjusted by taping or utilizing a ruler fixed to the floor at a 135-degree angle, which separates the posteromedial and posterolateral regions, with a 90-degree angle defining this division. Before starting the test, the subject's limb length is measured. With hands resting on their hips, the subject stands in a middle position on the platform. Following instructions, participants were needed to reach forward in each direction and return to the starting point. Trials are considered invalid if the subject touches the ground, loses contact with their hips, or fails to maintain a single-leg posture. After completing three trials, a mean composite score is obtained for statistical analysis.

Data analysis

All data were analyzed using SPSS version 26. The normal distribution was determined using the Shapiro-Wilk test and the result shows that the data is not normally distributed for FBT score but normally distributed for YBT score for both groups. Thus, The Mann-Whitney U test would be appropriate to compare the static balance performance between netball and volleyball players for the FBT, as it does not assume normality ($p < 0.05$). On the other hand, the Y-Balance Test (YBT) scores for both the netball and volleyball groups mostly followed a normal distribution (all $p > 0.05$). As a result, a parametric test which the Independent Samples t-test was used to compare the YBT scores between the two groups, as this test assumes that the data follows a normal distribution. The statistical significance was assigned at $p<0.05$. The study protocol was reviewed and approved by the UniKL RCMP Research Ethics Committee on June 2024, and informed consent was obtained from all participants prior to data collection.

RESULT

The A total of subject (N=62) female players had participated in this study, consisting of (N=31) netball players and (N=31) volleyball players from UniKL RCMP. The demographic characteristics, including age, height, bodyweight, and BMI, are summarized in Table 1. The mean age of netball players was 21.13 years (SD = 0.35), ranging from 18 to 23 years, while volleyball players had a mean age of 21.39 years (SD = 0.38), ranging from 18 to 24 years. Netball players had an average height of 1.584 meters (SD = 0.011), compared to 1.565 meters (SD = 0.010) for volleyball players, with both groups ranging from 1.5 to 1.7 meters. For body weight, netball players averaged 53.91 kg (SD = 1.92), ranging from 38 to 78 kg, while volleyball players were heavier, averaging 56.20 kg (SD = 2.09), ranging from 41 to 91 kg. The mean BMI for netball players was 21.46 kg/m² (SD = 0.71), with a range of 16.3 to 32.1 kg/m², compared to volleyball players, who had a mean BMI of 22.91 kg/m² (SD = 0.77), ranging from 17.4 to 34.7 kg/m².

Table 1. Demographic characteristics

Variables	Group	Mean±SD	Range
Age (Years)	Netball	21.13±0.352	18-23
	Volleyball	21.39±0.382	18-24
Height (m)	Netball	1.584±0.0107	1.5-1.7
	Volleyball	1.565±0.0096	1.5-1.7
Bodyweight (kg)	Netball	53.919±1.9247	38-78
	Volleyball	56.200±2.0911	41-91
BMI (kg/m²)	Netball	21.461±0.7142	16.3-32.1
	Volleyball	22.916±0.7715	17.4-34.7

Table 2 shows the data analyzed for the Flamingo Balance Test which was done by Mann-Whitney U test to find the difference of static balance between groups. For Right FBT score, the netball group, with a sample size of 31, has a mean rank of 28.16 and a sum of ranks of 872.96. In contrast, the volleyball group, also with the same sample size of 31, has a higher mean rank of 34.84 and a sum of ranks of 1088.04. The Mann-Whitney U value for this comparison is 584.000, and the p-value is 0.141. Since the p-value is greater than 0.05, ($p>0.05$), it indicates no significant difference between the groups for this variable. Similarly, for the Left FBT score, both groups have a sample size of 31. The netball group has a mean rank of 31.69 and a sum of ranks of 982.39, while the volleyball group has a mean rank of 31.31 and a sum of ranks of 970.61. The Mann-Whitney U value is 474.500, with a p-value of 0.932, again showing no significant difference between the groups. In conclusion, since both p-values are above 0.05, ($p>0.05$), there is no significant difference in static balance between netball and volleyball players based on this data. For static balance, volleyball players showed slightly higher right-leg FBT scores (mean rank = 34.84) compared to netball players (mean rank = 28.16), though not significant ($p = 0.141$). Left-leg FBT scores were almost equal between groups ($p = 0.932$). Overall, volleyball players demonstrated slightly better static balance.

Table 2. Comparison of static balance between netball and volleyball group

Variables	Groups	N	Mean Rank	Sum of Rank	Mann-Whitney-U value	p-value
Right FBT score	Netball	31	28.16	872.96	584.000	0.141
	Volleyball	31	34.84	1080.04		
Left FBT score	Netball	31	31.69	982.39	474.500	0.932
	Volleyball	31	31.31	970.61		

Table 3 shows the data on the dynamic balance of participants for both groups, using Right YBT (Y Balance Test) and Left YBT scores as variables. These variables were analyzed by Independent-t-test to find the difference between groups. For the Right YBT score, both the netball and volleyball groups have a sample size of 31. The netball group has a mean score of 95.9184 with a standard deviation of 18.86390, (95.9184±18.86390) while the volleyball group has a mean score of 95.3097 with a standard deviation of 16.99413, (95.3097±16.99413) The p-value for this variable is 0.894, indicating no significant difference between the groups for this variable. Similarly, for the Left YBT score, both groups have a sample size of 31. The netball group has a mean score of 96.5619 with a standard deviation of 19.66413, (96.5619±19.66413) and the volleyball group has a mean score of 93.2890 with a standard deviation of 19.14252, (93.2890±19.14252). The p-value for this variable is 0.509, also indicating no significant difference between the groups. According to independent t-test, a p-value of less than 0.05 would signify a significant difference between the groups. However, since both p-values are above 0.05, ($p>0.05$), there is no significant difference in dynamic balance between netball and volleyball players based on this data. For dynamic balance, netball players showed slightly higher YBT scores on both legs compared to volleyball players even though the differences were not statistically significant ($p = 0.894$ and $p = 0.509$, respectively). Overall, netball players showed slightly better dynamic balance, though none of these differences reached statistical significance ($p>0.05$).

Table 3. Comparison of dynamic balance between netball and volleyball

Variables	Groups	N	Mean±SD	p-value
Right YBT score	Netball	31	95.9184±18.86390	0.894
	Volleyball	31	95.3097±16.99413	
Left YBT score	Netball	31	96.5619±19.66413	0.509
	Volleyball	31	93.2890±19.14252	

DISCUSSION

The demographic data, including age, height, body weight, and BMI, revealed minimal differences between netball and volleyball players. Both groups had similar age ranges, with netball players having a mean age of 21.13 years and volleyball players 21.39 years, a difference unlikely to impact balance performance. Netball players were slightly taller (mean = 1.584 m) than volleyball players (mean = 1.565 m), though height alone does not significantly affect static or dynamic balance, as other factors like core strength and proprioception are more influential (Eom et al., 2022). The mean body weight for netball players was 53.91±1.92 kg, while volleyball players averaged 56.20±2.09 kg, with similarly small differences observed in BMI (netball = 21.46 kg/m²; volleyball = 22.91 kg/m²). While body composition can influence movement and stability, the differences between these groups were too small to significantly impact balance performance. Balance is primarily influenced by neuromuscular control, proprioception, and sport-specific training, which both groups undergo. Functional training in netball and volleyball emphasizes agility, coordination, and stability, which likely standardizes balance skills regardless of slight differences in body composition (Trajkovic et al., 2020; Mikhalik et al., 2024).

This study found no significant differences in static or dynamic balance performance between netball and volleyball players ($p > 0.05$). These findings align with prior research showing no significant balance differences among athletes from team and individual sports (Çelenk et al., 2018) or between groups with different sport-specific demands (Riemann et al., 2020). The lack of differences may result from shared athletic characteristics and training regimens. Both sports require agility, frequent jumps, and rapid directional changes, leading to similar balance adaptations. Balance involves coordination, neuromuscular control, and stability, which are pointed through sport-specific training in both groups. Studies suggest that athletes in sports with comparable movement patterns develop similar balance abilities (Bressel et al., 2007; Gonçalves et al., 2021). Another reason is the sensitivity of the balance tests used. Traditional tests, such as the Flamingo Balance Test and Y Balance Test, may not detect subtle distinctions between athletes with well-developed balance abilities (Johnston et al., 2016). Advanced tools like motion sensors or force plates could provide more sensitive assessments, capturing better differences in balance performance (Yamatata et al., 2024). Lastly, the demographic similarities between groups such as age, height, weight, and BMI further minimize detectable differences. Studies indicate that shared physical profiles and training routines result in similar balance abilities (França et al., 2022). This homogeneity likely contributes to the null findings, as both netball and volleyball players exhibit comparable baseline balance skills shaped by their sports' overlapping demands. In conclusion, the absence of significant balance differences highlights the role of shared training backgrounds and movement requirements in determining balance abilities, emphasizing balance as a learned skill rather than one influenced just by physical attributes. Thus, these findings suggest that coaches and trainers may consider similar balance training approaches for both netball and volleyball athletes, as neither group demonstrated greater balance performance so there is no need to design completely different balance training programs for both sports.

CONCLUSION

This study found no significant difference in static and dynamic balance abilities between netball and volleyball players. Statistical analysis revealed no significant results for static balance ($p = 0.141$ for the right leg, $p = 0.932$ for the left leg) or dynamic balance ($p = 0.894$ for the right leg, $p = 0.509$ for the left leg). These findings indicate that athletes from both sports performed similarly in balance assessments, likely due to shared movement demands such as agility, directional changes, and jumping, which are essential in both sports. Additionally, the similarity in balance performance may be attributed to the homogeneity of the participants in terms of age, training backgrounds, and physical attributes, which likely minimized measurable differences. These findings highlight the importance of balance as a fundamental skill across sports with similar movement requirements, such as netball and volleyball. Future studies should include male athletes and employ advanced balance assessment tools, such as force plates or motion sensors, to detect subtle differences in postural control.

AUTHORS' CONTRIBUTION

Fakhrul Haqimie Bin Mazelan – Conducted the data collection, data analysis, and main writing of the research.

Vijayamurugan Eswaramoorthi – Supervised throughout the research process.

CONFLICTS OF INTEREST

The authors wish to confirm there is no known conflicts of interest associated with this publication.

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