

HIP AND TRUNK FLEXIBILITY DIFFERENCES AMONG UNIVERSITY FEMALE ATHLETES IN SOUTHWESTERN NIGERIA: IMPLICATION FOR INJURY

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Abstract

This study examined hip and trunk flexibility differences among university female athletes in Southwestern Nigeria. Flexibility is basic to motor ability and directly proportional to injury sustenance. Some studies reported good flexibility for female offspring while others reported sustainability to injuries specific to their sport. The ex-post-facto research type was adopted. 1320 female players of basketball, soccer, handball, volleyball and hockey from 5 federal and 5 state universities in Southwestern Nigeria were selected using a purposive sampling technique. Players' age, height, weight and the modified sit and reach test results were recorded. Data were analyzed using the descriptive statistics, ANOVA and Schéffe Post hoc analysis. Hockey and volleyball players recorded the highest mean of 41.4cm each in flexibility. The ANOVA result of $F 3.2, p < 0.05$ indicated that by type of game, a significant difference existed for all participants. Schéffe Post hoc analysis result indicated no significant difference in hip and trunk flexibility score of participants by type of game. All groups ranked at the same threshold irrespective of the type of game played. This may be due to similar movement patterns peculiar to ball games. It is recommended that similar test could be conducted on different group of athletes irrespective of age and sex to establish any difference.

Key Words: Hip and trunk flexibility, Athletic injuries, Female athletes, Ball games, Southwestern Nigeria

Introduction

This study assessed the hip and trunk flexibility differences by type of game among university female athletes in Southwestern Nigeria. The study attempts to establish possible injury sustenance risks among participants. The ability to move in smoothly and easily throughout a full range of motion is certainly an indispensable index of healthy living, excellent athletic performance and decrease in sports injuries. An individual who has a restricted range of motion will probably realize a decrease in performance capabilities. Flexibility as a basic motor ability is mostly explained in terms of free movements with maximal amplitudes joint/angular body systems. Performance efficiency of typical movements structures in most sports is determined by the flexibility of joints and the strength of muscles (Igor, Katarina and Dinko, 2011). Flexibility is determined basically by how much a muscle can stretch its fibers and as the fibers can stretch more, the muscles becomes more flexible (Katiyah & Rastogi,2013). A sprinter with tight inelastic hamstring muscles probably loses some speed, because the hamstring muscles restrict the ability to flex the hip joint, thus shortening stride length.

Flexibility is an important, yet often neglected component of health-related fitness indices. It is so important because it reduces the chance of the risk of injury in any sport tenfold and will also improve sports performance (Katiyah & Rastogi,2013). Adequate levels of flexibility are needed for maintenance of functional independence and performance of activities of daily living such as bending to pick up a newspaper or getting out of the back seat of a two-door cars (Heyward, 2002). It allows for better performance when playing sports or exercising, and during day to day activities, it makes bending, walking, and lifting easier (Ricketts, 2019). Lack of flexibility has been associated with musculoskeletal injuries and low back pain. The improvement of flexibility is important not only for performance but also for the prevention of muscle-tendon injuries (Fagnani, Globini, Dicesare, Figozzi and Di.salvo,2006). Flexibility is the ability of a joint or series of joints to move through a full range of motion (ROM) without injury (Heyward,2002). According to her, the range of motion is not only specific to the joint; but also depends on geometry and joint capsules, ligaments, tendons and muscles spanning the joint. Scott (2019) expressed flexibility as the range of motion in a joint or group of joints or the ability to move joints effectively through a complete range of motion.

Marshall & Llewellyn (2017) reported that, the separation of axial rotation of the trunk and pelvis requires significant flexibility. The joint structure determines the planes of motion and may limit the ROM at a given joint. The triaxial joint (ball-and-socket joint of the hip and shoulder) afford a greater degree of movement in more directions than either the uniaxial (hinge or biaxial joints (condyloid and saddle); with limited flexibility one may experience “tightness” or “stiffness” at joints and have difficulty performing some movements in sport skills such as throwing and catching the ball, marking, passes, shooting, gymnastics, karate, yoga, ballet and diving (Adeloye,2007). Experts in the field of training and development of physical fitness would agree that good flexibility is essential for successful physical performance and the prevention of injuries to the musculo-tendinous.

Flexibility is specific to a type of movement, sport and even positions within a sport: the degree of flexibility can vary around the body (Wood, 2019). For example, in many sports, including ball games, good flexibility is an important part of overall fitness profile as well as in injury prevention. Germion (2005) and Adeloye (2007) reported that activities like volleyball, basketball, handball,

soccer; hockey, jogging and tennis may not require more than normal flexibility whereas a great deal of flexibility is required in other activities like gymnastics, dancing hurdling, taekwondo and diving.

In addition, Ingraham (2003) opined that the use of stretching to enhance flexibility, prevent injury, offset muscle soreness, and improve performance has been widely accepted and promoted in sport. Hence stretching exercises should be included as part of warm-up before engaging in strenuous activity to improve flexibility. Consequently, stretching is regularly included in warm up and cooling down (Gremion, 2005). Witvrouw, Mahieu, Danneels and Mcnair (2004) in their own view stated that, in sport activities of low-intensity or limited stretching shortening cycles (SSCs), there is no need for a very compliant muscle tendon unit since most of its power generation is a consequence of active muscle work that needs to be directly transferred by tendon to the articular system to generate motion. Therefore, stretching may not be advantageous.

Ingraham (2003) and Gremion (2005) reported that stretching, which increases flexibility beyond that needed for sport-specific movements may cause injury and decrease performance. Several authors believed stretching has a beneficial effect on injury prevention; clinical evidence suggesting that stretching before exercise does not prevent injuries has been reported (Witvrouw, Mahieu, Danneels and Mcnair (2004). Part of these contradictions could be explained by considering the type of sport activity in which an individual is participating. For example, sports involving bouncing and jumping activities with a high intensity of stretching shortening cycles (SSCs) like soccer or football require a muscle-tendon unit that is compliant enough to store and release high amount of elastic energy that benefit performance in such sports.

On the other hand, if the participants of these sports have an insufficient compliant muscle-tendon unit, the demands in energy absorption and release may rapidly exceed the capacity of the muscle-tendon unit and this may lead to an increased risk for injury. Genevra (2012) believed not warming up or stretching enough can lead to injuries, but there is no scientific data showing a positive effect of stretching. Hence, there are contradictory findings in the literature about the inclusion of stretching in warm up and in cooling down activities (Germion,2005). Whereas, Anderson (2019) stated that, dynamic stretching has been shown to decrease muscle tightness which may be associated with an increased risk of muscle tears. In addition, muscle tears can be reduced before training or competing with dynamic stretching. Dynamic stretching can also be used as part of warm up and static stretches is used for increasing range of motion.

Flexibility is highly related to body type, age, gender and level of physical activity. Individual with large hypertrophied muscles or excessive amount of subcutaneous fat may score poorly in range of motion (ROM) tests. This is because adjacent body segments in this category of people contact each other sooner than in those with smaller limb or trunk girths. However, many body builders and obese individuals who routinely stretch their muscles have adequate levels of flexibility (Adeloye 2007). Older individuals have increased stiffness and lower stretch tolerance compared to younger individuals. They have greater difficulty in performing basic skills and have aches and pains after physical activity; flexibility is strongly correlated with age (Davis, 2019). Flexibility training can also help to counteract age- related decreases in ROM. It is well documented that inactive persons tend to be less flexible than active persons, and that exercise increases flexibility. Disuse, due to lack of physical activity or immobilization (if a leg or arm is put in a cast after an injury) produces

shortening of the muscles (contracture) and connective tissues, which in turn restricts joint mobility (Adeloye, 2007).

Mastroianni (2018) reported that muscles of women have more fibers of the kind that gives them the ability to stretch more easily and to repair faster. This connotes that females generally are more flexible than males at all ages and are more resistance to fatigue. The greater flexibility of women is usually attributed to gender differences in pelvic structure and hormones that may affect connective tissue laxity. Females tend to have more hip flexion and spinal flexion than males of the same age. On the other hand, testosterone expands muscle and bone size in males, therefore they are bigger than females (Amiewalan,2017). Males have greater ROM in hip extension, spinal flexion and extension in the thoracolumbar region. Nevertheless, female athletes are known to be at higher risk of anterior cruciate ligament (ACL) tears. Whereas, most soccer players can return to the field after surgery to repair torn knee ligaments (Genevra,2012).

An orthopedic surgeon-Dr. Brophy and his colleagues carried out a study on 100 athletes who had surgery on their Anterior Cruciate Ligament (ACL). Females and older players were less likely than younger men and boys got back into the game; 72 of the athletes returned to playing soccer out of which were 30 female athletes after surgery. Regardless of gender, ACL tears are typically thought of as season-ending injuries because rehabilitation take months of working to regain strength and range of motion (Genevra, 2012). Whereas, most soccer players can return to the field after surgery to repair torn knee ligaments. He stated further that, there are many reasons why athletes may never return to their sport of choice after an ACL tear. They may not get their conditioning back to where it was, or they feel good with running but have trouble with the type of knee function required for soccer or football. They may also be afraid of re-injury or feel like it's not worth the risk.

Female offspring constitute a special case in the realm of sports particularly in Nigeria (Adeloye, 2007). In the past, female offspring had fewer opportunities in life compared to their male counterparts. Hence, sports had been restricted to male offspring traditionally in Nigeria. Adeyanju (2012) reported that, Nigerian women's active involvement in sports had to contend with several problems which range from psycho-social and cultural factors which exert pressure on them through the immediate family, community, religion, media, peer groups and other sources of socialization to reinforce expected behaviour and teaching gender roles. However, there had been a constant growth and development in female sports since Atlanta Olympics, 1996, where Nigerian female athlete-Chioma Anjuwa won the first Gold medal in long jump after 38 years of Olympic participation (Shirlina,2002) and Adeyanju, 2012).

Nigerian women have continued to boost the country's international image by their achievement in continental and global competitions where they have won medals for the country. In football, the female national team, the Falcons have become a major face not only in Africa where they are perennial champion, but also globally. Perpetual Nwocha of the Falcons was declared African footballer of the year after FIFA women's world cup in Germany 2011, having scored two goals (Olakunle, 2011). The Nigerian Women Championship, founded in 1990, is another top flight of women football association which is equivalent to the premier league in Nigeria. The Super Falcons has qualified for the African Women Cup of Nation (AWCON) 2019 (alcsport.com,2018). Goal.com (2019) reported Nigeria women football team as two-time winner of All African Games and are already qualified for 2019 group B league in Morocco. Other successful Nigeria women

clubs among 16 include the Pelican Stars with 7 titles, Ufoma babes, Bayelsa Queens, River Angels, Jegede babes (Wikipedia .org. 2018).

According to Wikipedia.org. (2018), the Nigeria women's national basketball team- D' Tigers ranked number 1 in the African continent and in the top 20 in the world. They qualified for the 2009 African Cup of Nations held in Libya. However, they only appeared once in Olympic Games. They went undefeated in group play during the 2007 All-African Games, got to semi-final and lost to Mozambique with 57-46 point. FIBA. basketball (2018), reported excellent performance by top Nigeria women Basket players-Evely Akhator, Ezinne Kalu and team, in FIBA Women's World Cup in Spain. Nigeria volleyball players were not represented at the Olympic games-London 2012 (Sportstart.com,2013) and were not among the top 30 in the 2013 world volleyball ranking (Wikipedia.org,2018). The Nigeria women's handball team was founded in 1973 after the 2nd African Games in Lagos, Nigeria and has been taking part in international competitions. At the all African Games-1995, women handball team bagged bronze, the only medal. The team also participated at the 1992 Olympics. They banked 8th position at the Barcelona summer games. The team ranked number 5 with 1 gold medal-1991, 1 silver- 1983 and 1 bronze in1981 and participated at the African women's Handball Championship in Sale Morroco, 2012 (Wikipedia.org, 2018). According to Wikipedia .org (2019), the women National handball team are scheduled to compete in handball at the 2019 All African Games. Infact,155 women in 22 sports represented Nigeria All African Games in Rabat, Morroco between 19 August – 31 August 2019.

The female hockey team is represented in almost the 36 states in Nigeria and the capital territory, Abuja. The organizing body of the game of hockey in Nigeria is Nigeria Hockey Federation (NHF). This body is affiliated with International Hockey Federation (IHF) and the African Hockey Federation (AHF) (Nigeria Hockey Federation, 2012). News24nigeria, 2012 reported the victory of Delta female hockey in Eko2012, Lagos. The team won gold having defeated their Rivers counterparts 2-1 in the finals. According to Vanguard (2012), coach Collins Ifeanyi of Rivers attributed the team's victory in her pool to longtime preparation and adequate support from the government. Oyo State and Adamawa were in the same pool with Rivers at the festival. Lagos defeated Kaduna 1-0 to settle for the bronze medal. However, Ondo team was disqualified for fraudulent practices as announced by the general manager, games services, Gen. Emmanuel Okaro (Rtd) at the 18th National Sports Festival (Leadership Newspapers,2012 and Nigeria Tribune, 2012). However, the Nigeria female Hockey team does not have any record of London 2012 Olympic participation (Pushhockey.co.uk 2012).

Moreover, measuring flexibility is important in the assessment of health and overall quality of life. The sit-and-reach test is a common measure of the lower back and hamstring muscles flexibility (Topendsports,2019). Flexibility is necessary in the improvement and maintenance of postural alignment, the enhancement of proper and graceful movement. It is essential in facilitating and developing motor skills. It should be stressed that flexibility is especially important for female athletes, aiding not only performance but also in the prevention of unnecessary injuries. Movement and training patterns differ among games, so is the type of injury peculiar to each sport. Many muscular and skeletal problems are the result of poor flexibility, especially in adults and athletes, especially females. It is against this background that this study examined the hip and trunk flexibility differences among university female athletes in Southwestern Nigeria by type of game.

Purpose of the Study

1. To determine the hip and trunk flexibility status among university female athletes in Southwestern Nigeria by type of game.
2. To identify any significant difference in hip and trunk flexibility among the university female athletes in Southwestern Nigeria by type of game.

Research Method

This study is an ex-post-facto research type. All female players in five federal and five states universities in Southwestern Nigeria (Oyo state, Ogun state, Osun state, Lagos state, Ekiti state and Ondo state) constituted the population. One thousand, three hundred and twenty (1,320) female players of volley ball, basketball, handball, hockey and soccer including others who regularly practice with them in these universities were selected using a purposive sampling technique. The hypothesis (Ho) postulated was tested at 0.05 alpha level.

Hypothesis (Ho)

The type of game played will not be a significant determinant of any difference in hip and trunk flexibility of the university female athletes in Southwestern Nigeria.

Procedure

There were three stations. Participants' age was recorded as at the last birthday. Heights were recorded in meters using calibrated walls (0 -7.0 m). Body weights were measured using Hana bathroom scale, calibrated from 0 -180 kilogram. Body mass index (BMI) was calculated by dividing body weight score by the height squared (Kg/h^2). The hip and trunk flexibility assessment were determined by the modified sit-and-reach test developed by Hoeger (1989), as reported by Heyward (2002). Topendsports, (2019) also reported Woods, (2012) sit and reach test for norms developed with the same procedure used in this study as the best. Quinn (2019) and Quora.com (2018) opined that it is a simple measurement of lower back and hamstring flexibility. The test considered the distance between the end of the fingers and the sit-and-reach box by using the finger-box distance as the relative zero point. A 12 in (30.5cm) high sit-and-reach box and a wooden meter rule were used.

After a brief warm up, participants sat on the floor with buttocks, shoulders, and head in contact with the wall; knees extended and soles of the feet against the box. The meter rule was placed on top of the box with the zero ends towards the participant. Keeping the head and shoulders in contact with the wall, the participants reached forward with one hand on top of the other, and the meter rule was positioned so that it touched the finger tips. As the researcher firmly held the meter rule in place, she reached forward slowly, gliding the fingers along the top of the meter rule. The score (in meters) was the most distant point on the meter rule contacted by the finger tips. The reach was repeated three consecutive times and the best of the three trials was recorded to the nearest 0.1 centimeters.

The sit- and- reach test have an established reliability. Heyward (2002), reported a reliability of $r=0.66$ for women while Adeloje (2007), stated a reliability of $r=0.65$ using the Pearson moment product correlation. It measures the flexibility of the lower back and hamstring muscles. It does not allow for variation in the difference in length of arms and legs of participants. The test was conducted at each test location in the gymnasium, using four trained research assistants. All

participants were well informed about the nature and purpose of the test before commencement. They were given informed consent forms to complete.

Data Analysis

The data were analyzed using the descriptive statistics of mean, standard deviation and percentages. The analysis of variance (ANOVA) was applied to determine the significant difference in hip and trunk flexibility among players by type of game. The Schéffe type Post-hoc analysis was applied to determine the mean scores that were significantly different. Results were presented in tables and bar charts for easy interpretation of findings. Hypothesis was tested at 0.05 alpha level.

Results

Table 1. Age distribution of participants.

Age range (year)	Frequency	%
15-19	299	22.7
20-24	878	66.5
25-29	141	10.7
30>above	2	0.1
Total	1320	100

Table 2. Descriptive statistics for physical characteristics and hip- trunk flexibility of participants

Variable N=1320	Mean	SD	Range
Height (M)	1.6	0.1	1.1-1.9
Weight (Kg)	58.8	6.7	40.0-100.0
Body mass index (BMI Kg-m)	22.5	2.9	9.5-53.8
Hip-trunk flexibility (cm)	40.1	4.4	12.0-57.0

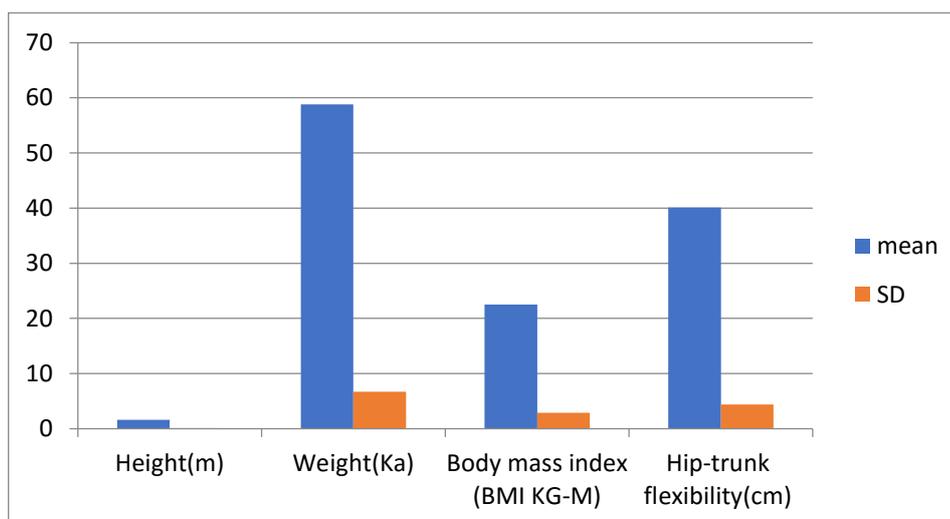


Fig 1. Bar chart showing the descriptive statistics of hip and trunk flexibility for participants.

Table 3. Frequency distribution of participants by type of game.

Type of game N=1320	frequency	Percentage (%)
Soccer	294	22.3
Volleyball	303	23
Basketball	180	13.6
Handball	270	20.5
Hockey	273	20.6

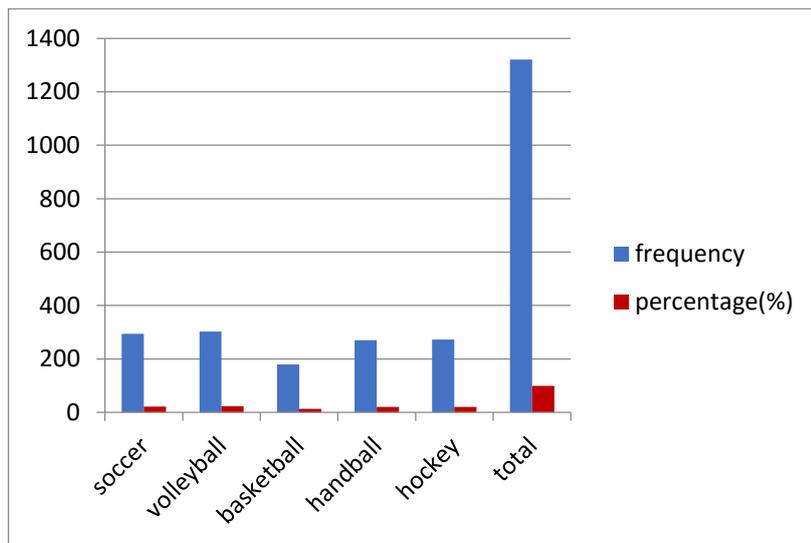


Fig 2. Bar chart showing the frequency distribution of participants by type of game

Table 4. Descriptive statistics of participants' hip and trunk flexibility score by type of game.

Game	N=1320	Mean	Standard	Range
Basketball	180	40.4	10.7	29.3-50.1
Hockey	273	41.4	8.0	31.6-29.8
Handball	270	40.6	10.4	30.2-51.4
Soccer	294	40.2	9.5	30.2-49.2
Volleyball	303	41.4	11.4	29.9-52.5

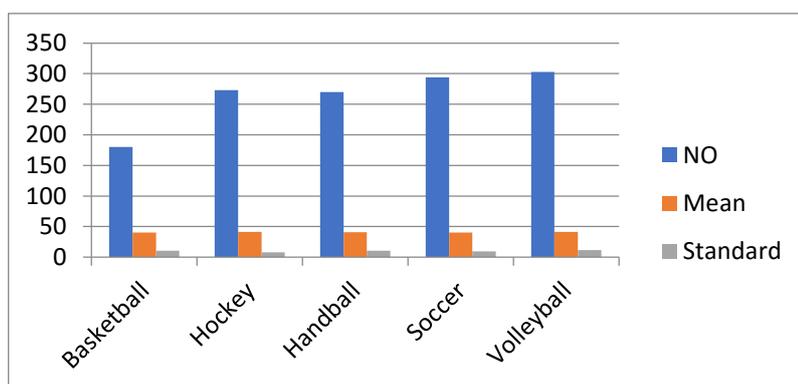


Fig3. Bar chart showing participant's hip and trunk flexibility score by type of game.

Table 5. Participants' ANOVA in hip and trunk flexibility by type of game.

Dependent variable		Sum of square	Mean square	F	Sig*
Hip and trunk flexibility (cm)	Between groups	0.03	0.01	3.2*	0.01*
	Within groups	3.40	0.01		
	Total	3.43			

P<0.05

Table 5 shows the ANOVA result in hip and trunk flexibility of participants and it is significant.

Table 6: Schéffe Post-hoc analysis of participants' hip and trunk flexibility by type of game.

Dependent variable	(i)type of game	(j)type of game	Mean difference	SE	Sig*
Hip and trunk flexibility	Soccer	Volleyball	0.01	0.004	0.1
		Basketball	0.001	0.005	1.0
		Handball	0.003	0.004	1.0
		Hockey	0.01	0.004	0.1
	Hockey	Basketball	0.01	0.01	0.1
		Handball	0.01	0.01	0.5
		Hockey	0.001	0.01	1.0
	Basketball	Handball	0.1	0.001	1.0
		Hockey	0.01	0.004	0.3
	Handball	Basketball	0.1	0.1	1.0
		Hockey	0.1	0.1	0.5

P<0.05

Table 6 shows the Schéffe Post-hoc analysis results of participants' hip and trunk flexibility by type of game and it is not significant.

DISCUSSION

The physical characteristics of the athletes showed an age range of 15-30 years while 66.5% accounts for those within the age range of 20-24 years. The Australian female athletes on whom similar test was carried out were within the age range of 15-24 (Australian Bureau of Statistics, 2015). Katiyaah & Rastogi (2013), also reported the age range of 20-25 years for female university students subjected to sit- and- reach test for flexibility. The average height of 1.6 ± 0.1 m, body weight of 58.8 ± 6.7 kg and the BMI of 22.5 ± 2.9 kg-m obtained from the study were lower than those reported for Australian athletes which were: height, 1.7 ± 0.1 m, body weight. 62.5 ± 6.1 and BMI, 21.6 ± 1.4 . The result shows that the female athletes in Southwest Nigeria had normal body weight in accordance with the WHO classification of weight and obesity based on Body Mass Index value which is 18.5-24.9 in agreement with Heyward, 2002. This could reflect less restriction at the hip and trunk joints' range of motion. All participants recorded a mean score of $40.1 \text{ cm} \pm 4.4$ in hip and trunk flexibility (Table 2 and figure1) while Bourbon, Savage and Done, 2000 reported a mean score was 13.4 ± 5.7 cm for their Australian counterparts. Anderson (2019) reported a higher score of 61cm on 99 percentile rank for American college of Sports Medicine in women sit and reach test. The participants' score in this study falls on 20 percentile rank, this implies that the

participants are low in hip and trunk flexibility. On the contrary, Topendsports (2019) reported the sit-and-reach norm of $>+30\text{cm}$ as super performance and $+21- +30$ as excellent. This disparity might be due different levels and intensity of athletes' physical activities or preparedness for the test. The sit-and -reach test is a common measure of flexibility and specifically measures the flexibility of the lower back and hamstring muscles (Topendsports,2019).

Volleyball game recorded the highest number of participants (303;23%). Soccer had (294; 22.3%), hockey obtained 273; 20.6%, handball recorded 270; 20.5% while basketball game had the lowest number of 180; 13.6%. The hip and trunk flexibility scores by the type of game played were in the following order-hockey players had a score of $41.4\pm 8.0\text{cm}$ with a range of 31.6-29.8. Volleyball players equaled hockey players with a score of $41.4\pm 11.4\text{cm}$ and range of 29.9-52.5. Handball players obtained a score of $40.6\pm 10.4\text{cm}$ with a range of 30.2- 51.4 while basketball players had a score of $40.4\pm 10.7\text{cm}$ with a range of 29.3-50.1. The lowest score of 40.2 ± 9.5 with a range of 30.2- 49.2 were recorded by soccer players (Figure 3).

The ANOVA result of $F 3.2, p<0.05$ indicated that by type of game a significant difference existed for all participants. Therefore, the null hypothesis (H_0) which stated that the type of game played will not be a significant determinant of any difference in hip and trunk flexibility of the university female athletes in Southwest Nigeria is rejected. This is not in line with Katiyah & Rastogi (2013) ANOVA results that there is no significant difference found in flexibility among volleyball, basketball and handball players. The difference in results might be due to their lower number of participants=30 females. However, the Schéffe post hoc result shows no significant difference by type of game at 0.05 alpha level. Therefore, the null hypothesis (H_0) which stated that the type of game played will not be a significant determinant of any difference in hip and trunk flexibility of the university female athletes in Southwestern Nigeria is accepted.

Conclusion

Based on the results of this study, there is no significant difference in the hip and trunk flexibility of female university students in Southwest Nigeria by type of game. Dynamic flexibility training is recommended for female athletes, to reduce tightness in the lower back and hamstring which may be responsible for poor sports performance and many sport injuries. However, it is advisable to seek advice from the health provider or exercise physiologist before embarking on flexibility training to avoid muscle tear, joint pull or related injuries.

References

- [1] Adeloye,E.O. (2007).Assessment and standardization of norms on selected health and performance fitness indices for university female athletes in southwestern Nigeria. Ph.D Thesis. Department of human kinetics and Health Education university of Ibadan. Ibadan. Nigeria.
- [2] Adeyanju, F.B. (2012). Women and sport in Nigeria: problems and prospects in the 21st century. Retrieved August 2018 from [https:// www.onlinenigeria.com/nigeriawomen](https://www.onlinenigeria.com/nigeriawomen)
- [3] Alcsports.com. (2018). AWC0M 2018. Teams qualify for 2019 All African Games. Retrieved September 2018 from [https://www. Acl sports>awcom-2018](https://www.Acl sports>awcom-2018).

- [4] Amiewalan,S. (2017). Hereditary qualities: The female body shape has impacts on portability. Retrieved September 2018 from [https:// www. quora.com](https://www.quora.com)
- [5] Anderson, J. (2019). Flexibility test. Retrieved July 2019 from [https:// www.jensreview.com](https://www.jensreview.com)
- [6] Anderson, J. (2019). Flexibility training. Retrieved July 2019 from [https:// www.jensreview.com](https://www.jensreview.com)
- [7] Australian Bureau of Statistics. (2015). 4177.0-Participation in sport and physical recreation. Retrieved March 2020 from <https://www.abs.gov.au>ausstats>
- [8] Davis,B. (2019). Age affecting flexibility. Retrieved July 2019 from <https://www.salthyliving.azecentral.com>
- [9] Fagnani, F.,Globini,A.,Dicesare,A., Figozzi, F. and Di,Salvo,V. (2006). The effects of a whole body vibration program on muscle performance and flexibility in female athletes *American journal of Physiology, Medicine and Rehab.* 85: 956-965. (12) lipp. In Williams & Nilkins. Pub. Retrieved July 2016 from [https://www. scholar.Google .com/scholar-url?hl.en&q:r](https://www.scholar.Google.com/scholar-url?hl.en&q:r).
- [10] Fiba. Basketball (2018). Nigeria women's world cup Sept 22-30 2018 in Spain. Retrieved August 2019 from [https://www.fiba. Basketball](https://www.fiba.Basketball). International Basketball Federation.
- [11] Geneva, P. (2012). Soccer players often recover fully from ACL surgery. Retrieved July 2016 from <https://www.reuters.com/article/us-soccer-players-often-recover-fully-fr-iduSBREBBQIPK20120927>
- [12] Germion, G. (2005). Is stretching for sports performance still useful? A review of the literature *pubmed.Rev.Med .Suisse*:1(28): 1830-4. Retrieved July 2016 from [www.ncbi. nim.nih.gov/pubmed/16130528](http://www.ncbi.nlm.nih.gov/pubmed/16130528)
- [13] Gleium, G.W. and Mcitogh, M.P. (1997). Flexibility and its effects on sports injury and performance. Nicholas Institute of Sports Medicine and Athletes Trauma. Lenox hill hospital, New York. USA. Retrieved July 2016 from www.ncbi.nlm.nih.gov/pubmed/9368275
- [14] Goal.com. (2019). All African Games 2019 draw: Nigeria, South Africa rekindle rivalry in Morocco. Retrieved July 2019 from [http://www. goal.com>en-ng>team>nigeria](http://www.goal.com>en-ng>team>nigeria)
- [15] Heyward, V. H. (2002). Advanced fitness assessment and exercise prescription. 4th ed. USA. University of Mexico. Human Kinetics.34,124-125.
- [16] Igor, G., Katarina, O., and Dinko, W. (2011). Comparison and analyses of differences in Flexibility among top-level male and female handball players of different ages.

Fact a universities series; Physical Education and Sport. I (1),1-7. VDC 796.322.2:539.55
Retrieved July 2016 from <http://www.facta.junis.ni.ac.rs/pe/pe201101/pe201101-OLPDF>.

- [17] Ingraham, S.I. (2003). The role of flexibility in injury prevention and athletic performance: Have we stretched the truth? Retrieved July 2016 from <https://www.ncbi.nlm.nih.gov/pubmed/15495679>
- [18] Katiyah, V. and Rastogi, N.K. (2013). Comparison of cardiorespiratory endurance and flexibility among volleyball, basketball and handball players. *International Journal of Behavioural Social and Movement Sciences*. [ISSN:2277-7547] Retrieved August 2016 from <https://www.ijobsms.in>.
- [19] Leadership Newspaper. (2012). Ondo female Hockey team disqualified. Retrieved August 2018 from <https://www.nigeria22.com/2012/12/03/ondo.Female.team-disqualified>
- [20] Marshall, K.J. and Llewellyn, T.L. (2017). Effects of flexibility and balance on driving distance and club head speed in collegiate golfers. *International Journal of Science*. Western Kentucky University. 10 (7):954-063. Retrieved July 2018 from <https://www.ncbi.nlm.nih.gov>.
- [21] Mastroianni, M. (2018). Is the female body more flexible than the male body? Retrieved July 2019 from <https://www.quara.com>
- [22] News24nigeria. (2012). Eko.2012: Delta female hockey teams win gold. Retrieved from July 2018 from <http://m.news24.com/nigeria/sport/general/eko2012>.
- [23] Nigeria Tribune. (2012). Ondo hockey team disqualified. Retrieved July 2016 from <http://www.tribune.com.ng/..0/492>.
- [24] Olakunle, O. (Tues, July 5, 2011). Desire opera nozie-super faclcons striker determined that the match is a must to be won. *Nigeria Tribune Sport Report*. Germany. 15, 237.
- [25] Pushhockey.co.uk. (2012). Australia named Hockey roos squad for London Olympic. Retrieved July 2013 from <http://www.pushhockey.co.uk/london.2012>.
- [26] Quinn, E. (2019). How to perform the flexibility test. Retrieved September 2019 from <https://www.verywellfit.com>
- [28] Quora.com. (2018). Does losing weight makes you more flexible? <https://www.Quora.com>
- [29] Scott, J.R. (2019). Definition and benefits of flexibility. Retrieved August 2019 from <https://www.verywellfit.com>

- [30] Shirlina, L. (2002). The physical work capacity of female athletes and its determining factors. Physical education and sport, review. Retrieved June 2007 from <http://www.coachr.org/femath.htm>.
- [31] Topendsports.com. (2019). Sit and reach flexibility test. Retrieved August 2019 from <https://www.topendsport.com/testing/test/sit-and-reach-presidents.htm>
- [32] Topendsports.com. (2019) Sit and reach test norms. Retrieved August 2019 from <https://www.topendsports.com/testing/norms/sit-and-reach.htm>
- [33] Vanguard. (2012). Rivers female Hockey team defeat Adamawa 1-0. Retrieved April 16, 2013 from <https://www.allafrica.com/stories/2012/13005.html>.
- [34] Wikipedia.org. (2019) Nigeria at the 2019 African Games. Retrieved December 2019 from <https://en.m.wikipedia.org>
- [35] Wikipedia.org. (2018). 2012 African women's handball championship. Sale Morocco. Retrieved September 2019 from https://en.m.wikipedia.org/wiki/2012_African_women%27s_Handball_Championship
- [36] Witvrouw, E., Mahieu, N., Danneels, L. and McNair, P (2004). Stretching and injury prevention; An obscure relationship. *Journal of Sports Medicine*. 34, 443-449. doi: 10.2165/0007256-2004 34070-00003
- [37] Wood, R. (2019). Flexibility and fitness. Retrieved September 2019 from <https://www.topends.com/fitness/flexibility.htm>