

A Study on the Factors Affecting the Physical Fitness of Players with A Reference To Netball

1. ANKIT KUMAR

B.P.Ed, M.P.Ed, UGC NET, POST GRADUATE DIPLOMA IN YOGA, Gold Medalist in Asian Championship (Netball)

2. AKASH SAINI

B.P.Ed (University of Delhi)
M.P.Ed (LNPIE)

Abstract

The goal of this study is to identify the factors that affect a netball player's total physical condition. Using a mixed-methods approach, the research's data were gathered from 100 netball players who competed in a semi-pro competition. A survey form and health evaluations were among these techniques. The study looked at the relationships between a variety of factors, including age, gender, location on the pitch, exercise volume, and nutrition, and various fitness metrics, such as quickness, speed, endurance, and strength. Younger players had better dexterity and speed, while older players had better endurance and muscle, according to the study's results. Male athletes, however, were stronger than their feminine peers. When it comes to quickness and speed, female competitors won. The study also found that athletes who engaged in more intense physical activity as well as those who ingested well-balanced diets rich in nutrients had superior physical fitness. These two player categories were more physically strong. In conclusion, the study discovered that a variety of variables played a role in the netball players' lesser levels of physical fitness. These elements included a lack of time, subpar exercise facilities, and a lack of proper nutrition tools. The findings of this study provide significant knowledge that instructors, coaches, and netball players can apply to improve their physical stamina and all-around success. It is advised that managers and trainers consider variables like age, gender, playing position, and training volume when creating training schedules for netball players. The research's conclusions serve as the foundation for this suggestion. The study indicates that players should eat a diet that is both well-balanced and plentiful in different nutrients in order to increase their physical stamina. The study also emphasizes how critical it is to remove the barriers preventing netball players from being physically fit. These challenges include a dearth of funding for adequate nutrition and training facilities. In conclusion, by offering crucial insights into the subject, this study greatly advances our knowledge of the factors that affect netball players' physical state. This study highlights how crucial it is for coaches, trainers, and athletes to consider a range of factors when creating training schedules to guarantee that athletes have the best potential physical stamina and performance. The results of this study show how important it is to remove the barriers that netball players face in keeping a good level of physical fitness. These discoveries may help improve netball players' physical preparedness and ability in addition to aiding in the development of better training regimens and tools for the sport.

Keywords: Physical fitness, Netball, Factors, Mixed-methods, Agility, Speed, Endurance, Strength

I. INTRODUCTION

The standard of competition in today's sporting events has risen to a brand-new, all-time high. The amount of practise or work a person puts in ultimately has little bearing on how successful they are. As a result, many aspects of life, such as physiology, biomechanics, sports training, sports medicine, society, and psychology, among others, all have an impact on the world of sports. All of the coaches, trainers, personnel in charge of physical education, and doctors are working diligently to enhance the overall performance of the competitors who are serving their nation in this tournament[1]. Every country's athletes and football players give their very best efforts in international tournaments with the hope of returning home with honour and prizes. One of the most thrilling and revolutionary periods in the history of the human species will soon begin in the field of physical education. Physical education has long been recognised as a profession that offers services that are pertinent to the field of education, and more specifically to educational institutions like schools. The purpose of physical education has broadened to include a much broader variety of subjects and issues over the past two decades. Over the past few decades, there has been a substantial rise in players' overall efficacy, and this pattern is anticipated to continue. Performance levels that were once unfathomable are now regarded as the norm, and the proportion of competitors who are capable of achieving incredible outcomes is rising. Sports are a difficult

career, which, when coupled with a high level of drive, has led to long, demanding hours stretched out throughout the week. This is one of the factors that adds to this. Additionally, instruction has improved, which can be partly credited to the involvement of scientists and pros from the sports business. The approach to studying sports has changed from being more detailed to being more scientific[2].

Excellent technique combined with the input of various physical factors, including core stability, range of motion, limb length, anthropometric measurements, and isokinetic parameters, results in an effective throw. Both of these elements must come into play for a toss to be effective. Whether or not a toss succeeds is determined by the interaction of all of these factors. The goal of this study endeavour was to look into how various physical characteristics affected how far an object could be hurled or how much power could be produced. On the other hand, the upper extremities—and the shoulder complex—served as the main focus of attention for the purposes of this study. Despite the fact that throwing involves a significant number of various joints overall, the majority of the subjects' upper extremities were the centre of the study. The method used may be the single most important factor in deciding whether or not the toss is effective if the bodily variables do not significantly affect the action of hurling. Technique can be disregarded and removed from the kinetic chain in order to gain a better understanding of the relative importance of the other pertinent physical factors. Although technique is very important in the tossing action, if we follow those steps, we may be able to throw farther. The act of throwing does, in fact, rely on skill to a considerable extent[3].

Factors affecting the physical fitness of netball players include speed, agility, strength, and endurance. These attributes are crucial for performing well in the high-intensity sport of netball.

Other factors that may impact the physical fitness of netball players include diet, hydration, rest, and injury prevention. Proper nutrition and hydration are essential for maintaining energy levels and promoting recovery after training or games. Adequate rest is necessary for muscle recovery and injury prevention. Injury prevention strategies, such as proper warm-up and cool-down routines, can also have a significant impact on the physical fitness of netball players[4].

Additionally, training programs play a critical role in improving the physical fitness of netball players. These programs should be tailored to the specific needs and goals of the players and may include exercises to improve speed, agility, strength, and endurance[5].

Overall, a combination of physical attributes, lifestyle factors, and training programs can impact the physical fitness of netball players. Understanding these factors is essential for developing effective training programs and injury prevention strategies to optimize the physical fitness and performance of netball players[6].

Netball Game: An Introduction

One of the most popular team sports, netball, is played on a field that is 30.5315.25 metres long and divided into thirds that are each 10.17 meters wide. The arena measures 30.5315.25 metres in length. Each of the four periods in a netball game lasts for fifteen minutes. A five-minute pause occurs in the midst of the first half and a three-minute break occurs between each subsequent quarter. The seven players presently occupying the court are all members of one of the two teams, and based on their current location, each player has access to different areas of the court[7]. Center court (centre [C], wing attack [WA], and wing defence [WD]), shooters (goal attack [GA] and goal shooter [GS]), defenders, and goalkeepers are the seven distinct roles. The letters C, WA, and WD, respectively, stand in for the competitors in the middle court. (goal defence [GD]; goalkeeper [GK]). Players participate continuously in both attacking and defensive operations as a result, which affects the technological, tactical, and physical requirements unique to each position[8]. Players must be able to adapt to the physically demanding character of the game in order to achieve high levels of success. The study that has been conducted and released indicates that practicing the sport of netball necessitates a high level of aerobic fitness. According to some reports, athletes' typical heart rates (HRs) while participating in netball matches range from 75 to 85% of their maximum heart rates (MHRs). This implies that serious aerobic exercise is required in order to participate in the activity. Nevertheless, despite the fact that a netball player's success depends primarily on their aerobic stamina (due to the game's 60-minute duration), a netball match's performance, crucial moments, and outcome are all reliant on the implementation of crucial anaerobic activities[9]. A netball match lasts for one minute and six seconds in total, during which the players will alter the complexity of the action every six seconds. Running and sprinting exercises can be performed anywhere between 5 and 81 times and 25 and 202 times, respectively, for anaerobic parameters. This has been shown to be similar to running distances between 69 and 555 metres, which cover a distance between 143 and 1,758 metres. Sprinting, pivoting, leaping, changing speeds, cutting, and accelerating and decelerating the body are all important anaerobic movements in netball that require levels of muscle strength and power output that are extremely near to their maximums. One could therefore conclude that one's physical endowments play a significant role in the necessary implementation of netball techniques. The data points in the direction of this inference[10].

Netball Requirements

Even though netball requires physical endurance, throwing precision is more crucial for accumulating more points through the use of accurate throws and town game. Even though the game also calls for agility, this is still the situation. Players who play in forward roles typically need to have very high levels of speed, vertical leap, balance, agility, and ability. A player who is higher will have greater reach, allowing them to swiftly gather the object and give it to a teammate[11]. Netball players are expected to possess a solid grasp of this crucial aspect of the game. In order for the juvenile athlete to perform the netball throw, they must also be taught the correct gripping method for the ball. In order to generate the required force and speed to send the ball to his partner who was waiting for it, their fingertips, which were splayed out over the ball, expanded the target. Coordination is less crucial for netball players than tossing velocity, explosive force, quickness of reaction, and muscle[12]. To participate at a high level in the activity of netball, one must possess a sizable quantity of physical strength and endurance. Players must have sufficient levels of strength to participate in a game without placing an excessive burden on their strength, speed, agility, stamina, flexibility, explosive power, or reaction time. The activity of netball, which had a straightforward beginning, has experienced the fastest development[13].

Playing netball is a lot of enjoyment, and it also has all the other characteristics required to qualify as a top-tier activity. It's quite likely that it ranks among the most popular ball games performed globally. This tactic may be referred to as movement-oriented because action entails motion. In contrast to other sports, netball is packed with continuous activity that can take place multiple times in the course of a single second. This is just one of the many reasons why this sport has gained popularity throughout the globe, ranking among the most famous ones almost everywhere. The United States of America, which is frequently regarded as the nation that has given the most to the sporting globe, is where the sport of netball was created. Everyone engaged in the game—players, fans, and officials—experiences a faster tempo and more fervour throughout the duration of it. In addition to skill and teamwork, playing netball also requires physical fitness and cerebral preparation, which adds to the sport's image as an exciting workout. The word "agility" or "nimbleness" in this case refers to the capacity of an organism to "rapidly react to change by adapting its original stable configuration." Agility requires the fusion of many different motor abilities. These abilities include, among others, balance, coordination, quickness, reflex, power, and stamina. Because agility is defined as the ability to quickly and accurately change the direction that the body is moving, and because this requires a combination of balance and coordination, the capacity to keep the centre of mass above the base of support while the body is stationary, dynamic balance (the capacity to maintain balance while the body is moving), speed (the capacity to move the entire body quickly), and strength (the capacity of a musculature to exert force), (For instance, catching a projectile requires good hand-eye synchronisation) [14].

Importance of Strength and Agility

Every activity, including netball, has specific demands on a player's physical makeup, including their power and agility. One must first make sure they are in excellent physical condition before participating in any sport. As far as any of us are aware, team sports like netball have become widely acknowledged as being extremely intense sports worldwide. The Olympics and the World Cup are two examples of these events. In order to perform better in any activity, one must have both speed and explosive muscle, which are both crucial motor skills. This is due to the fact that both explosive power and quickness are crucial motor skills. Agility is a trait that refers to the capacity to move swiftly and skillfully. The term "agile" refers to the capacity to move swiftly and without resistance, whether bodily or mentally. Another aspect of agility is the body's ability to quickly alter its course when moving from one location to another. One of the aspects of physical fitness that can be examined and analysed is agility[15]. We need specialised motor skills to be able to execute the action and reaction in an effective manner as quickly as possible in order to succeed in these activities. Explosive limb power, jumping while sprinting or standing, side turning, and quick breaks are a few instances of these motor skills. There is both an autonomous and an interdependent relationship between the different motor abilities and high skill performance. The term "brace" refers to "the ability which is more or less universal and innate and which enables a person to acquire more skills and become competent in them." "The ability that is more or less general and inherent and which enables a person to acquire more skills and become adept in them" is referred to as a "brace."

One of the ball sports that has seen the biggest increase in recognition recently is netball, which is also one of the most well-liked ball sports generally. The overwhelming bulk of the time, female athletes dominate this activity. In a netball match, the area of play is frequently divided into three zones that are alternately occupied by players from opposing teams. Each squad consists of seven individuals, each of whom is in charge of carrying out a specific task. The positions on the squad are Goal Keeper, Wing Defense, Wing Attack, Center, Goal Defense, Goal Attack, and Goal Shot. In the game of netball, players are forbidden from dribbling the ball and must instead swiftly transfer it to the person in front of them[16].

- **Positions:** There are seven roles in netball, and each one can only play in a specific area of the field and has a unique set of responsibilities. In the game of netball, for example, participants in the "centre" position are free to move around the field on either side, but they are not allowed to move around the shooting circle. In addition to being able to play in the centre of the court and on both the defensive and offensive sides of the court, a player who is classified as a "wing defence" is not allowed to play on the offensive side of the court[17].
- **Passing:** In netball, your throw must be longer than three feet (0.9 metres), but it cannot be longer than the distance from the defensive end to the attacking end of the field. In the game of netball, players are only permitted to handle the ball for three seconds in total before passing it to an opponent[18].
- **Shooting:** Only two players from each team are permitted to take shoots during a netball game, and players are only allowed to play within a shooting circle. These two players in the game are referred to as "goal attack" and "goal shot," respectively."
- **Ball Carrying:** In netball, dribbling is not a skill that is frequently used on the pitch. You are expected to transfer the ball to other players as soon as you get control of it rather than moving forward in any direction. The practise of wandering is forbidden[19].

Playing netball is a thrilling exercise that you can appreciate as well. Touching the ball is prohibited in netball. It's conceivable that this is due to the non-contact nature of netball. Since it doesn't just award the players who are the fastest and fiercest on the court, it promotes more strategic planning and rational thought than other sports do. Contrary to other sports, which favour physically gifted athletes, this one tends to award them. The International Netball Association (INF) only recognises the women's version of netball because women make up the overwhelming bulk of the sport's participants. Men's netball teams are regarded as being of much lower calibre and as a consequence, get much less attention. Netball is a technical activity that necessitates a lot of transferring the ball in close range[20].

Netball Variations

When playing netball, there are a variety of different tactics that can be used. The interior versions of the sport of netball, like indoor netball and fast5 netball, as well as the games played by smaller kids, are the most widely played[21].

- **Netball Indoors:** Amusingly, the entire competition is held indoors, and the competitors are frequently required to play the entire time within the confines of a net. The game moves along more quickly and there is less pause between scores as a result of this net's capacity to stop the ball from leaving the playing area. "Action netball" is one of the many varieties of indoor netball that exist. Each squad has seven players and fights against the other in this variation of the game. This variation of the sport is divided into two halves that each last for 15 minutes and are split by a break that lasts for three minutes. This is in contrast to the traditional structure of netball games, which consists of one uninterrupted 40-minute exercise. The countries of Australia, England, New Zealand, and South Africa are those that use this type the most frequently[22].
- **Fast5:** Fast5 netball, which is a more commercialised version of the sport, gives more emphasis to television broadcasts and fast-paced game play. There is a two-minute break in between each quarter, and there is only six minutes allotted for each quarter. The consequence is that the game is much quicker. Making substitutions is not against the regulations, and coaches are allowed to teach players from the stands while the game is still in process. A fun variation on this type is a "power play" quarter, which lasts six minutes and awards two points for each goal scored. The complete game is divided into this period. Each squad can decide which quarter will be their "power play" quarter[23].

OBJECTIVES

1. To study the factors affecting the physical fitness of players
2. To study the physical fitness of players

II. RESEARCH METHODOLOGY

The purpose of this study was to investigate the potential impact that various physical factors have on the action of long throws in cricket and netball. Athletes work towards making quick and accurate passes to the following player while attempting to protect oneself from injury. When compared to a netball court, a cricket field is significantly larger, meaning that players are required to hit the ball further in order to score goals. Because of this, the throws in netball are significantly more rapid and shorter in distance than those in cricket, where they are often much longer[24]. Everyone should be able to have a strong throwing arm. Now, we need to find out what factors influence the speed with which a ball can be thrown and the distance it can travel. Are the factors that affect netball the same as those that effect cricket, or are there aspects of each sport that are specific to themselves?

Subjects

The pool of willing volunteers came from local netball and cricket clubs in the Stellenbosch area. They were selected due to the fact that sitting for the examination at the University of Stellenbosch wouldn't be too much of a challenge for them. At the University of Stellenbosch, the majority of the participants were active in the sports of cricket and netball. In total, there were 39 persons who took part in the research; 12 men and 24 women. Participants were recruited for the study by making contact with both local organisations and students majoring in sports science[25]. Both groups were asked to volunteer their time.

People who showed interest in taking part in the study were sent letters that included further information about the investigation as well as the protocols that needed to be adhered to. These athletes were contacted over the phone to confirm that they met the requirements for participation in the test, and an appointment was scheduled with them[26].

Athletes of every level of skill took part in the competition, from the sixth squad in a club league all the way up to the national and international stages[27].

DATA ANALYSIS

According to research that was conducted in the past, athletes who specialise in throwing have a variety of physical characteristics in common, including a shoulder joint that has higher external rotation and decreased internal rotation. (Ciullo, 1996; Jobe & Pink, 1993; Ellenbecker et al., 2002; Bak, 1997; Baltaci, 2001). It is not known if the athletes' heightened external rotation and decreased internal rotation are a natural component of their anatomy or whether it is the product of years of repetitive throwing. If these athletes are able to throw so well, is it purely due to their better technique, or did the aforementioned attributes play a factor in why they chose to participate in overhead sports?

NETBALL

There were not many changes that could be considered statistically significant when comparing the throwing distance to the other aspects that were investigated[28].

Length of the limbs

As with the cricket men, the arm was divided up into three parts, namely the acromiale to the radiale, then from the radiale to the mid-stylion, and then from the mid-stylion to the dactylion. There was a very weak correlation between all of these measurements and both throwing for distance seated and strapped in.

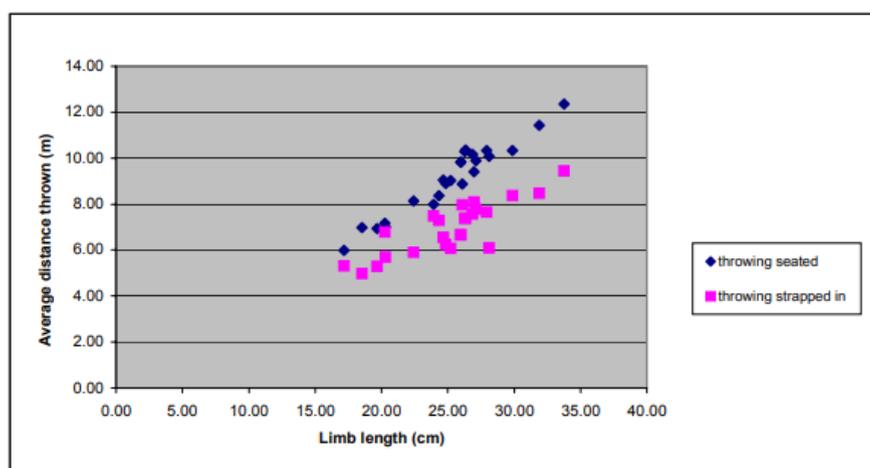


Figure 1: The length of the players' limbs and the average distance they toss the ball in netball.

Stability at the centre

The individuals' abdominal strength was determined by having them perform the stability cuff leg drop as well as the one-minute swiss ball walkout[29]. It was found that there was no significant correlation between the distances thrown when strapped in ($r=0.08$; $p=0.76$ and $r=0.20$; $p=0.46$) and while seated ($r=-0.03$; $p=0.82$).

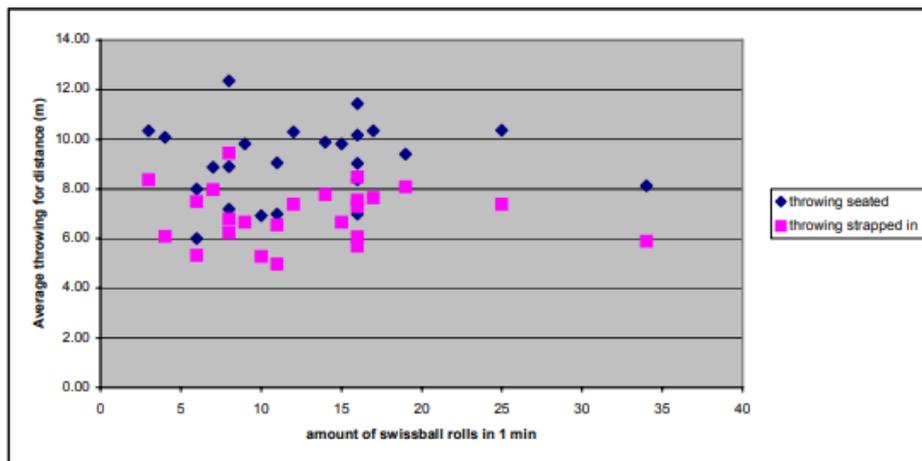


Figure 2: The number of Swiss ball roll-outs converted to the average distance that netball players toss the ball.

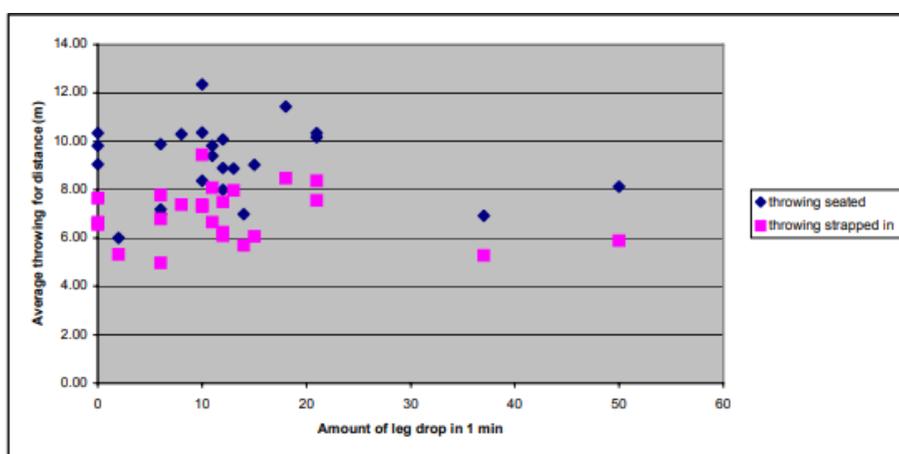


Figure 3: The number of leg drops that correspond to an average player's throwing distance in netball.

Amplitude of motion

Motion was evaluated along a variety of axes at the same time. Additionally, there was not a statistically significant connection between these parameters and those related to the distance thrown.

Peak torque

We tested the subject's peak torque by having them do abducted internal external rotation at speeds of 90 and 180 degrees per second, as well as concentric/concentric and concentric/eccentric contractions, respectively. When the thrower was secured, the measures that showed a correlation included peak torque concentric/concentric contraction at 180°/second during external rotation ($r = 0.44$; $p = 0.02$) There was only a minor association between the other peak torque measures and either throwing for distance while strapped in or throwing for distance when seated. Both of these conditions involved throwing for distance[30].

Maximum torque as a percentage of body weight

In order to create a relative scale for this measurement, the subject's highest possible torque was divided by the subject's total body weight. Although there was not a statistically significant difference between these measurements and the thrown distance, there was a negative correlation between peak torque/body weight, sitting and throwing, and strapped in and throwing. However, there was not a statistically significant difference between these metrics and the thrown distance.

Strength about par (watts)

Watts were used to determine the individuals' average power output while they were undergoing the abduction internal external rotation. The results of this testing showed that none of the scores were statistically significant, and as a result, no relationships were discovered.

Table 1: The anthropometric measurements of the athletes who were evaluated for netball

	Average	Median	SD	Minimum	Maximum
Height	1.73 m	1.73 m	0.06	1.61 m	1.86 m
Weight	69.57 kg	69.95 kg	8.88	50.80 kg	89.60 kg
Ann span	1.75 m	1.74 m	0.08	1.61 m	1.90 m
Fat percentage	23.52 %	23.86 %	4.53	13.41 %	30.28 %
Bi-acromion width	38.31 cm	38.15 cm	1.37	35.70 cm	40.90 cm
Bi-epicondyle width	6.29 cm	6.30 cm	0.30	5.70 cm	6.90 cm
Relaxed bicep circumference	28.20 cm	28.55 cm	2.16	21.30 cm	31.20 cm
Tense bicep circumference	29.60 cm	29.75 cm	2.04	24.50 cm	33.60 cm
Forearm circumference	25.98 cm	26.30 cm	1.41	22.10 cm	28.40 cm
Chest circumference	90.58 cm	90.70 cm	4.25	81.20 cm	98.90 cm
Waist circumference	74.30 cm	74.00 cm	5.16	65.60 cm	84.00 cm
Gluteal circumference	103.72 cm	104.05 cm	6.25	91.40 cm	118.00 cm

III. CONCLUSIONS

Netball players should strive to achieve high levels of relative bilateral and unilateral muscle and force. This is because improving lower limb stability will likely transfer to better run and leap results while lowering the risk of common injuries. In order to reduce their risk of developing common injuries, athletes are also highly advised to work on strengthening their lower limbs. Netball players should engage in high-intensity training (HIT) to increase their anaerobic and aerobic stamina so that it is more in accordance with the metabolic demands of competition.

This study's main goal was to describe the physical traits of novice NWU netball players between the ages of 18 and 23. These competitors' kinematics, anthropometric data, and physical and motor skills—including their balance, speed, and explosive strength—were all assessed and analysed. Additionally, we looked into any physical traits of netball athletes that might be associated with musculoskeletal diseases. The high injury rate that the complete group encountered could be attributed to biomechanical anomalies, bad anthropometry, and relatively average muscular and motor skills. These elements played a part in the elevated injury incidence. Another reason for this occurrence is inadequate anthropometry. Despite having an unfavourable amount of fat that was above normal, the group's average body mass index (BMI), a measure of body composition, was regarded as outstanding. During the initial evaluation, the complete group claimed to have average levels of speed and explosive muscle skills, but they had poor balance. These findings were reached as a result of the movement and muscular evaluation results. The results of the second round of testing showed that the subject's explosive power was below normal. However, the individual met the required levels of balance and speed. The injuries the players sustained while playing netball might have been caused in part by their insufficient muscle and movement skills. Changes or deficits in any of these areas (biomechanics, anthropometry, and physical/motor ability) may increase the risk of traumatic and overuse injuries in netball players. Thus, it is reasonable to draw the inference that netball players who exhibit more biomechanical anomalies are more likely to suffer accidents. This is the opinion that was reached after the study's results were analysed. It was found that the kinematics, anthropometry, muscle, and motor capacities, as well as other aspects of netball players' physical makeup, had a number of flaws. There is a chance that these flaws contributed to the joint problems the competitors experienced.

REFERENCES

- [1]. Netball Australia. (2019). Fitness for Netball. Retrieved from <https://netball.com.au/get-involved/playing-netball/fitness-for-netball>
- [2]. Braham, R., & Finch, C. F. (2004). The incidence of injuries in amateur netball players. *British Journal of Sports Medicine*, 38(6), 697-701.
- [3]. Coutts, A. J., & Murphy, A. J. (1999). Relationship between physical fitness and playing ability in netball. *Journal of Sports Sciences*, 17(11), 921-926.
- [4]. Lai, S. K., Costigan, S. A., & Morgan, K. (2013). Performance profiles of elite female netball players. *Journal of Strength and Conditioning Research*, 27(6), 1530-1536.
- [5]. Williams, L. R., Sekendiz, B., & Robertson, S. (2017). Exercise interventions for the prevention and treatment of injuries in netball players: a systematic review. *Sports Medicine-Open*, 3(1), 1-18.
- [6]. Thomas C, Comfort P, Jones PA, Dos'Santos T. Strength and conditioning for netball: A needs analysis and training recommendations. *Strength Cond J*. 2017;39:10-21.
- [7]. Soh KG, Husain R, Soh KL. Fitness profile among Malaysian netball players. *Asian J Phys Educ Recreat*. 2006;12:40-4.
- [8]. Fox A, Spittle M, Otago L, Saunders N. Activity profiles of the Australian female netball team players during international competition: Implications for training practice. *J Sports Sci*.

- 2013;31:1588-95.
- [9]. Arnhem, d. d. & prentice, w. e. (2008). Principles of athletic training. Singapore: McGraw-Hill.
- [10]. Baltaci, g. & kohli, h. w. (2003). Does proprioceptive training during knee and ankle rehabilitation improve outcome? *Physical Therapy Review*, 8:5-16.
- [11]. Bell-jenje, t. & bourne, C. (2003). "Going global" – clinically applied postural analysis and biomechanics. Handout provided at a course on the lower quadrant. Johannesburg: High Tech Therapy.
- [12]. Boscosystem ergo jump (2007). Switch sensory mat and pnsion organiser. Hyperlink [www.boscosystem.com]. Retrieved 7 April 2007.
- [13]. Brukner, p. & khan, k. (2007). *Clinical sport medicine*. Sydney: mcgraw-hill.
- [14]. Clark, v. m. & burden, a. m. (2005). A 4-week wobble board exercise programme improved muscle onset latency and perceived stability in individuals with functionally unstable ankle. *Physical Therapy in Sport*, 6:181-187.
- [15]. Donatelli, r. (1990). The biomechanics of the foot and ankle. Philadelphia, pa: fadavis. Eggar, g. (1990). Sports injuries in australia: causes, costs and prevention: a report to the national Better health program. Sydney: centre for health promotion and research. Ellis, s. m. & steyn, h. s. (2003). Practical significance (effect sizes) versus or in combination with statistical significant (p-values). *Management Dynamics*, 12(4):51-53.
- [17]. Elphinston, j. & hardman, s. l. (2006). Effect of an integrated functional stability program on injury rates in an international netball squad. *Journal of science and medicine in sport*, 9: 169-176.
- [18]. Ferreira, m. a. (2007). Biomechanical, anthropometrical and physical profile of the *mandsaur university* club netball players and the relationship to musculoskeletal injuries. Unpublished med thesis in movement education. Potchefstroom: *mandsaur university*
- [19]. Fuller, c. & drawer, s. (2004). The application of risk management in sport. *Sports medicine*, 34(6):349-356.
- [20]. Garraway, m. & macleod, d. (1995). Epidemiology of rugby football injuries. *Lancet*, 345(8963):1485-1487.
- [21]. West, D. J., Owen, N. J., Cunningham, D. J., Cook, C. J., & Kilduff, L. P. (2015). Strength and power predictors of sprinting performance in professional rugby players. *Journal of Sports Sciences*, 33(7), 703-710.
- [22]. Risso, F. G., Sánchez, G. A., Villarreal, E. S., & Kraemer, W. J. (2018). The effect of combined resistance and plyometric training on physical fitness, injury prevention, and performance in pre-adolescent soccer players. *Journal of Strength and Conditioning Research*, 32(11), 3128-3136.
- [23]. Armstrong, N., & McManus, A. M. (2011). Physiology of elite young female athletes. *Medicine and Sport Science*, 56, 1-13.
- [24]. Reale, R., Slater, G., & Burke, L. M. (2017). Acute and chronic effects of exercise on appetite, energy intake, and appetite-related hormones: the modulating effect of adiposity, sex, and habitual physical activity. *Nutrients*, 9(7), 1-18.
- [25]. Franssen, J., & Carlson, J. S. (2019). The netball game: strategies for success. *Human Kinetics*.
- [26]. Turner, A., & Stewart, P. (2014). Strength and conditioning for netball: a needs analysis and training recommendations. *Strength and Conditioning Journal*, 36(4), 1-10.
- [27]. Tavares, F., Smith, T. B., Driller, M. W., & Love, T. D. (2017). The effects of hydration status on physical performance in netball players. *Journal of Strength and Conditioning Research*, 31(4), 1152-1158.
- [28]. McKay, M. J., Baldwin, J. N., Ferreira, P., Simic, M., Vanicek, N., & Burns, J. (2017). Normative reference values for strength and flexibility of 1,000 children and adults. *Neurology and Clinical Neurophysiology*, 3(2), 1-17.
- [29]. Farrow, D., Young, W., & Bruce, L. (2005). The development of a test of reactive agility for netball: a new methodology. *Journal of Science and Medicine in Sport*, 8(1), 52-60.
- [30]. Colby, M. J., Dawson, B., Heasman, J., Rogalski, B., Gabbett, T. J., & Lester, L. (2017). Accelerometer and GPS-derived running loads and injury risk in elite Australian footballers. *Journal of Strength and Conditioning Research*, 31(7), 1837-1843.