Profile of Visual Status among Soccer Players in Ilorin Metropolis, Nigeria

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ABSTRACT

Background: Examining visual parameters is crucial for enhancing athletic performance, particularly in competitive sports like soccer.

Objective: This study aimed to assess the visual status profile of both amateur and elite soccer players within the Ilorin metropolis, Nigeria.

Methods: A total of ninety-six participants who were soccer players took part in this cross-sectional survey study. Prior to its commencement, ethical approval, institutional permission, and informed consent were obtained. Each participant underwent three visual skill assessments: depth perception using the Stereo Fly test, visual acuity at both distance and near, and objective refraction to determine refractive status using an auto-refractometer and retinoscope. Additionally, a structured questionnaire was administered through face-to-face interviews to gather further information from the players. The collected data were analysed using SPSS version 23, with statistical significance set at $p < 0.05$.

Results: A total of 96 soccer players aged 18 to 35 were evaluated, with 74.2% found to have refractive errors in one or both eyes. The breakdown included 31.6% with hypermetropia, 16.8% with myopia, 25.8% with astigmatism, and 25.8% classified as emmetropic. Analysis by age and playing position (forward, midfielder, defender, goalkeeper) revealed that visual skills generally improve with age, while positional roles did not significantly influence visual skill levels.

Conclusion: The findings of this study indicate that visual skills tend to improve with age. A notable prevalence of refractive errors, including astigmatism and myopia, was observed among the athletes. Additionally, positional differences in visual profiles revealed that goalkeepers possess superior peripheral vision compared to outfield players.

Keywords: Visual-acuity, Soccer-player, dynamic-visual-acuity, Depth-perception, Player-position.

INTRODUCTION

Soccer, often referred to as the 'beautiful game', is a globally popular sport that demands a unique combination of physical strength, technical skills, tactical understanding, and exceptional visual skills. Soccer has successfully attracted the attention of global audiences and is currently the most popular sport in the world. Controlling the ball on the ground requires accurate motor and visual skills in order to keep opposing players away from the ball and advance it from one end of the of pitch to the next.

However, an often-underestimated aspect of soccer performance is vision. Soccer player's face a lot of vision challenges, these include the need for excellent peripheral vision to see teammates and opponents, dynamic visual acuity to track the fast-moving ball, and depth perception to judge distances accurately (Zwierko, 2007).

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Additionally, the ability to quickly shift focus between near and far objects is vital in a game that constantly changes in pace and direction (Vestberg *et al*., 2012).

The importance of vision in soccer cannot be overstated. A player's visual acuity, depth perception, peripheral vision, and eye-hand coordination all play a crucial role in their ability to perform at a high level. For instance, a striker needs excellent depth perception and timing to connect with a cross, while a goalkeeper requires superior peripheral vision and reaction times to save shots from various angles (Williams *et al*., 2011). In soccer, players must be able to track the ball, their teammates, and opponents, all while moving at high speeds and often in unpredictable directions. This requires excellent dynamic visual acuity, depth perception, and peripheral vision (Ando *et al*., 2001).

Soccer players, like anyone else, can face various vision challenges. These can range from common refractive errors like myopia and hypermetropia to more complex issues like strabismus and amblyopia. Such vision challenges can significantly hinder a player's performance, affecting their ability to track the ball, judge distances and make split-second decisions (Zwierko, 2007).

Reading a soccer game requires the player to maintain a constant vision of his or her surroundings. With soccer vision, the player sees the next phase of the game before others. Soccer players know that to reach a higher level requires practice and adjustment. Well-trained players focus on game preparation, but they also have what ordinary players lack: excellent visual skills and excellent timing and athletic skills. Soccer vision enables players to discover teammates and opportunities within a fraction of a second, and make decisions to change the game. However, the eyes can also be trained just like other parts of the player's body through the football vision training program, ordinary players can acquire the visual skills needed to enter the next level of competition (Millard *et al*., 2022)

In the case of visual acuity, the ability to see clearly and distinguish details, is fundamental in soccer. Players with optimal visual acuity can accurately identify teammates, opponents, and the ball, allowing for more precise decision-making. The ability to discern fine details, such as the spin on the ball or contributes to the cognitive aspect of the game (Gegenfurtner *et al*., 2016). Inadequate visual acuity may compromise a player's ability to make split-second decisions, impacting crucial aspects of the game, including passing accuracy, shooting precision and defensive manoeuvres.

Depth perception, which is an integral component of vision, is vital for gauging the distance between objects in the player's field of view. Accurate depth perception is crucial for successful ball control, heading, and intercepting passes. Deficits in depth perception may lead to mistimed movements and compromised spatial awareness, influencing a player's positioning and interaction with the ball and opponents (Ryu *et al*., 2018).

Peripheral vision, the ability to perceive visual information outside the central field of view, is essential for maintaining awareness of the entire playing field. Soccer players rely on peripheral vision to anticipate the movements of teammates and opponents, contributing to effective team coordination and strategic positioning. Impaired peripheral vision may result in a limited awareness of the surrounding environment, affecting a player's ability to make informed decisions during gameplay (Abernethy *et al*., 2000).

Visual tracking, the capacity to follow the trajectory of moving objects, is particularly relevant in soccer for tracking the ball's movement. Successful ball tracking is fundamental for precise ball control, accurate passing, and effective shooting. Players with suboptimal visual tracking abilities may struggle with coordinating their movements in alignment with the ball, leading to performance limitations (Hüttermann *et al*., 2019).

Despite the clear impact of vision challenges on soccer performance, there is a lack of comprehensive research in this area. This project aims to fill this gap, providing an analysis of the various vision challenges faced by soccer players and how these impact their performance.

METHODS

Ninty six participants responded to this cross-sectional survey study. Ethical approval was sought from the

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ethics committee in the Faculty of Life Science and Department of Optometry and Vision Science. Also approval was given from the management of the football academy in Ilorin metropolis, Kwara State, Nigeria. The players signed an informed consent form to participate voluntarily.

Description of Procedure

For the purpose of this study, the participants were tested on three visual skill tests, namely: depth perception using stereo fly, visual acuity at both distance and near and also objective refraction to determine their refractive status using Auto refractometer/retinoscope and also questionnaires is distributed to the players to get more information from them. A structured questionnaire was given to the players through face-to-face interview. The aim of doing this was to gather information on visual challenges and how they impact their performance.

Measurement of Visual Acuity

Distance Visual Acuity (VA) was measured at 6 meter with the use of a Snellen's VA chart and taken monocularly. To measure VA of the right eye (OD), the player was asked to cover their left eye (OS) first while they read at the chart from distance. The test was repeated in the left eye. The near visual acuity is measured at 40cm with the use of the near chart. It is important to take the visual acuity before commencing any eye examination in case of legal reasons.

Measurement of Depth Perception

Stereo depth-perception tests, such as the Stereo Fly, have proven to be an effective and easy-to-use method of screening vision for all ages. A stereo fly test booklet (Original Stereo Fly Stereotest, Stereo Optical company) was used to test for depth perception. Each participant had to identify the 3-D fly after wearing goggles. For stereotests and 3-D viewers/glasses, clean and disinfect the surface area gently with disinfectant wipes or a soft, slightly damp, and lint-free cloth with 70% isopropryl alcohol. The result was noted as present if the players were able to pick the stereo fly as popping out and absent if they are unable to see the popping out fly.

Refractive Status

Refractive status was assessed using auto-refractometer (Topcon Auto Kerato-Refractometer KR-8900). The auto refraction was done in a mesopic (i.e. dimly lit) room. It was ensured the participant sat in a comfortable position in front of the auto-refractometer with their chin on chinrest, and forehead against the headrest. The participant was asked to look a target (a red light) inside the refratometer. The right eye was first aligned to look through the refratometer, then the left eye. The auto-refractometer send a light beam into the eye and measured the reflection, yielding the refractive error reading. An average of three readings was taken for each eye Thus the refractive status was determined for every participating player. Statistical package for social science (SPSS) version 27 was used to analyze the data. Data were presented as means and standard deviations to compare player's visual skills according to their different field positions.

RESULTS

General characteristics of the participants

Table 1a showed that the age range 18 – 25 has the highest frequency (48), constituting 49.5% of the study's total population. And, the midfield position has the highest number of respondents, 46, constituting 47.5% of the study's total population. The goalkeeping position has the lowest number of respondents, 7, constituting only 7.2% of the study's total population (table 1b). Also, players who have been playing professionally for 6 – 10 years have the highest frequency, constituting 44.5% of the study's total population while players who've been playing professionally for 11 – 15 years have the lowest frequency, constituting only 4.1% of the study's total population. Moreover, presented the frequency and percentage of respondents who do and do not experience any colour vision deficiencies (colour blindness). 6 respondents (7.2%) experience a colour vision deficiency (colour blindness) while 90 respondents (92.8%) do not experience colour vision deficiency (Table 1c).

Table 1d presents the frequency and percentage of respondents who have and have not participated in visual

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training exercises specifically designed for soccer players. 16 respondents (16.8%) have participated in a visual training exercise specifically designed for soccer players. On the other hand, 80 respondents (83.2%) have never participated in a visual training exercise specifically designed for soccer players.

Table 4.6 presents the visual skill that the respondents deem to be most crucial for soccer players using frequencies and percentages. 24 respondents (24.8%) consider Visual Tracking as the most important skill for soccer players, 10 respondents (10.8%) consider Depth Perception as the most important visual skill a soccer player should possess, 21 respondents (21.9%) consider Peripheral Vision as the most valuable visual skill of a soccer player, and 41 respondents (42.5%) consider Visual Screening to be the most crucial for soccer players. zero respondents (0.0%) selected the "Others" option and therefore, no other visual skills were identified by the respondents to be most crucial to soccer players asides the aforementioned visual skills. "Others" recorded the least responses 0 (0.0%) while the "Visual Screening" recorded the most responses, with 41 respondents selecting this option, which amounts to 42.5% of the study's total population.

Table 1: General Characteristics of the Participant

Age of respondents

Age	Frequency	Percentage (%)
Under 18	25	25.8
18 – 25	48	49.5
26 – 35	23	24.7

What position do you play on the field?

Position	Frequency	Percentage (%)
Goalkeeper	7	7.2
Defender	21	21.6
Midfielder	46	47.5
Forward	22	23.7

How many years have you been playing professional soccer?

Duration	Frequency	Percentage (%)
Less than 1 year	16	16.5
1 – 5 years	33	34.9
6 – 10 years	43	44.5
11 – 15 years	4	4.1

Do you experience any colour vision deficiencies (colour blindness)?

	Frequency	Percentage (%)
Yes	6	7.2
No	90	92.8

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Have you ever participated in visual training exercises specifically designed for soccer players?

	Frequency	Percentage (%)
Yes	16	16.8
No	80	83.2

In your opinion, which specific visual skills are most crucial for soccer players?

Visual Skills	Frequency	Percentage (%)
Visual Tracking	24	24.8
Depth Perception	10	10.8
Peripheral Vision	21	21.9
Visual Screening	41	42.5
Others	0	0.0

Frequency distribution of Visual Acuity

Table 2 presents the visual acuity of respondents' right eyes (OD) using frequencies and percentages. The visual acuity is categorized based on the Snellen notation, indicating the ability to see letters or symbols from a certain distance. The most common visual acuity among the respondents is 6/4, with 43 respondents, constituting 43.7% of the total population. On the other hand, the least common visual acuity is 6/12, with only 7 respondents, accounting for 7.4% of the total population (Figure1)

	Frequency	Percentage (%)
6/12	7	7.4
6/9	8	8.5
6/6	17	17.7
6/5	22	22.7
6/4	42	43.7

Table2: frequency distribution of Visual Acuty-OD

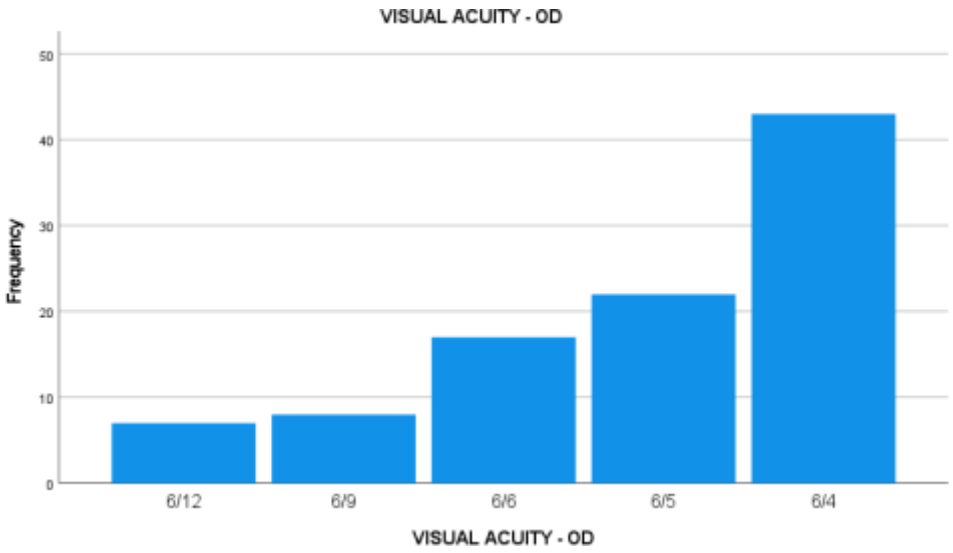

Figure 1: Bar Chart presentation of frequency distribution of Visual Acuity (OD) among the participants

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Table three (3) presents the visual acuity of respondents' left eyes (OS) using frequencies and percentages. Similar to Table 5, the visual acuity is categorized based on the Snellen notation, indicating the ability to see letters or symbols from a certain distance. The most common visual acuity among the respondents is 6/4, with 39 respondents, constituting 40.2% of the total population. On the other hand, the least common visual acuity is 6/12, with only 6 respondents, accounting for 6.2% of the total (Figure 2).

Table 3: Frequency of distribution of Visual Acuity - OS

	Frequency	Percentage (%)
6/12	6	6.5
6/9	11	11.9
6/6	21	21.6
6/5	19	19.8
6/4	39	40.2

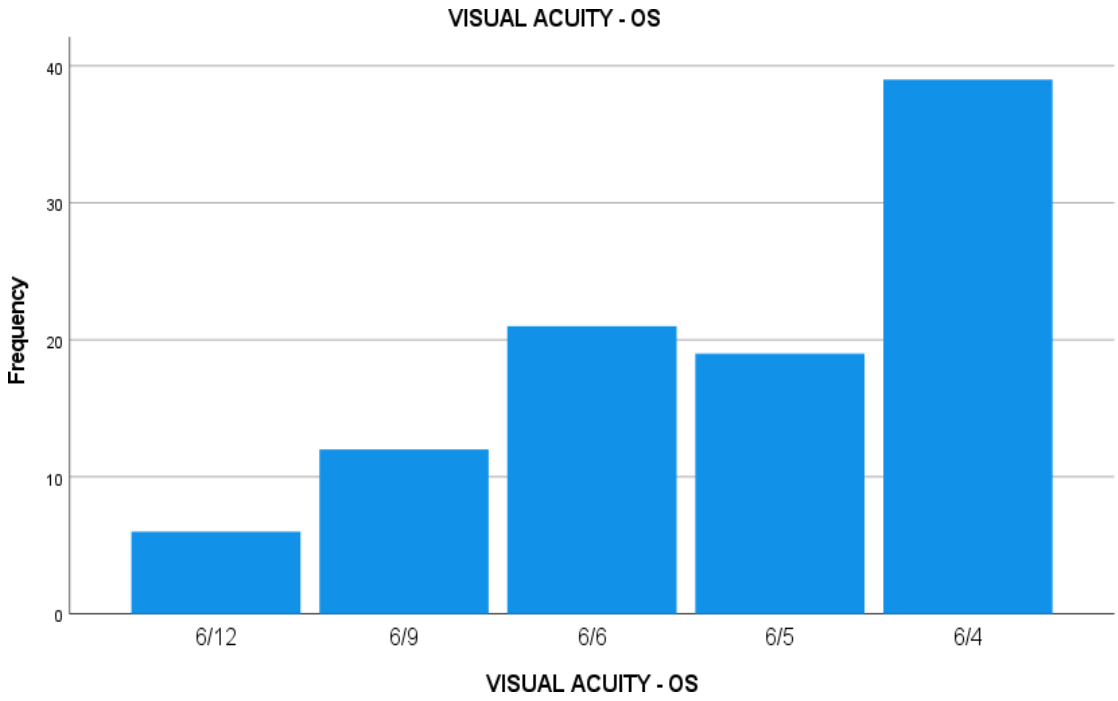


Figure2: Visual Acuity (OS) of the participants

Frequency distribution of refractive status among the participants

Table 4 presents the refractive status of respondents, indicating the various visual conditions they have, along with frequencies and percentages. Hypermetropia is the most common condition (31.6%), while myopia (16.8%) is the least prevalent among the surveyed population (Figure 3).

Table 4: Refractive Status of Respondents

Refractive Status	Frequency	Percentage (%)
Emmetropia	25	25.8
Myopia	16	16.8
Hypermetropia	30	31.6

Astigmatism	25	25.8
Total	**96**	**100.0**

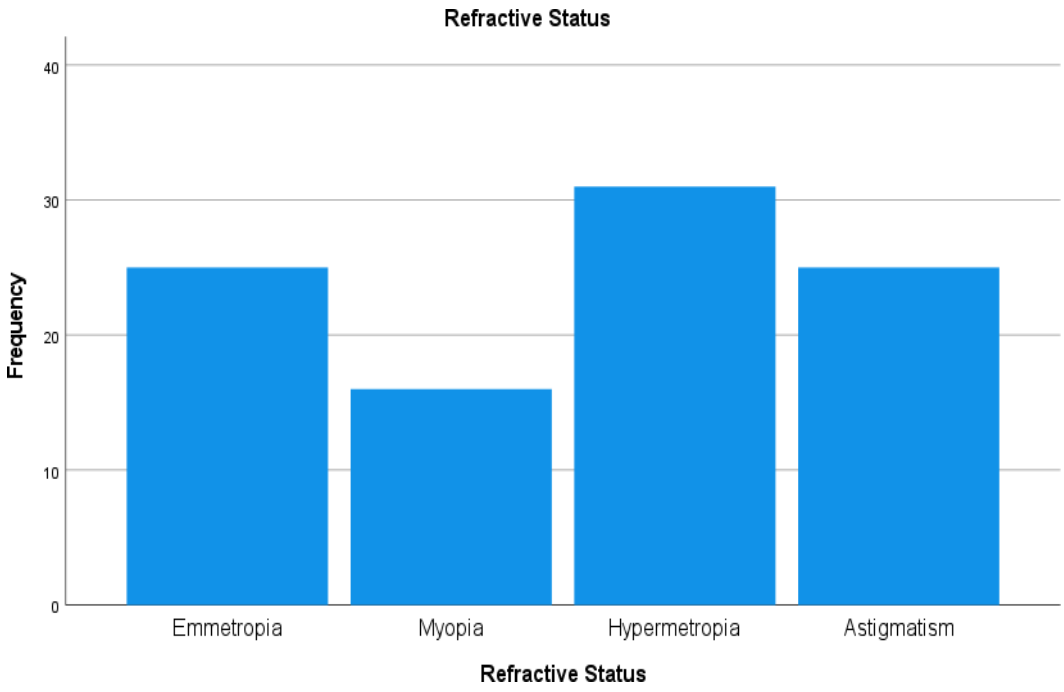


Figure3: Refractive Status of the participants

Frequency distribution of Depth Perception

Table five (5) presents the depth perception of respondents, indicating whether they perceive depth or not, along with frequencies and percentages. 68 respondents (70.1%) have present depth perception, indicating that they can perceive the distances between objects accurately in three dimensions. On the other hand, 28 respondents (29.9%) do not have depth perception, suggesting that they may have difficulty accurately judging distances in three dimensions.

Table 5: Depth Perception of Respondents

Depth Perception	Frequency	Percentage (%)
Present	68	70.1
Absent	28	29.9

Mean distribution of players' visual acuity, refractive status and depth perception according to age groups.

Table 6 presents the mean and standard deviation of players' visual acuity, visual status, and depth perception according to the different age groups of the study's sampled population.

For Visual Acuity (OD), players aged under 18 years recorded an average score of 3.76 and a standard deviation of 1.234, players aged between 18 – 25 years recorded an average score of 3.71 and a standard deviation of 1.304, players aged between 26 – 35 years recorded an average score of 4.27 and a standard deviation of 1.135.

For Visual Acuity (OS), players aged under 18 years recorded an average score of 3.76 and a standard deviation of 1.332, players aged between 18 – 25 years recorded an average score of 3.50 and a standard deviation of 1.288, players aged between 26 – 35 years recorded an average score of 4.25 and a standard deviation of 1.073.

For Visual Status, players aged under 18 years recorded an average score of 2.76 and a standard deviation of .970, players aged between 18 – 25 years recorded an average score of 2.71 and a standard deviation of 1.110, players aged between 26 – 35 years recorded an average score of 2.12 and a standard deviation of 1.262.

For Depth Perception, players aged under 18 years recorded an average score of 1.16 and a standard deviation of .374, players aged between 18 – 25 years recorded an average score of 1.27 and a standard deviation of .449, while players aged between 26 – 35 years recorded an average score of 1.50 and a standard deviation of .511.

Table 6: Mean and standard deviation of players' visual acuity, refractive status and depth perception according to age groups.

AGE GROUP	N	VISUAL ACUITY				REFRACTIVE STATUS		DEPTH PERCEPTION	
		OD		OS					
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Under 18	25	3.76	1.234	3.76	1.332	2.76	.970	1.16	.374
18 – 25	48	3.71	1.304	3.50	1.288	2.71	1.110	1.27	.449
26 – 35	23	4.27	1.135	4.25	1.073	2.12	1.262	1.50	.511

Scale: Visual Acuity (OD & OS); 1 = 6/12, 2 = 6/9, 3 = 6/6, 4 = 6/5, 5 = 6/4. Visual Status; 1 = Emmetropia, 2 = Myopia, 3 = Hypermetropia, 4 = Astigmatism. Depth Perception; 1 = Present, 2 = Absent.

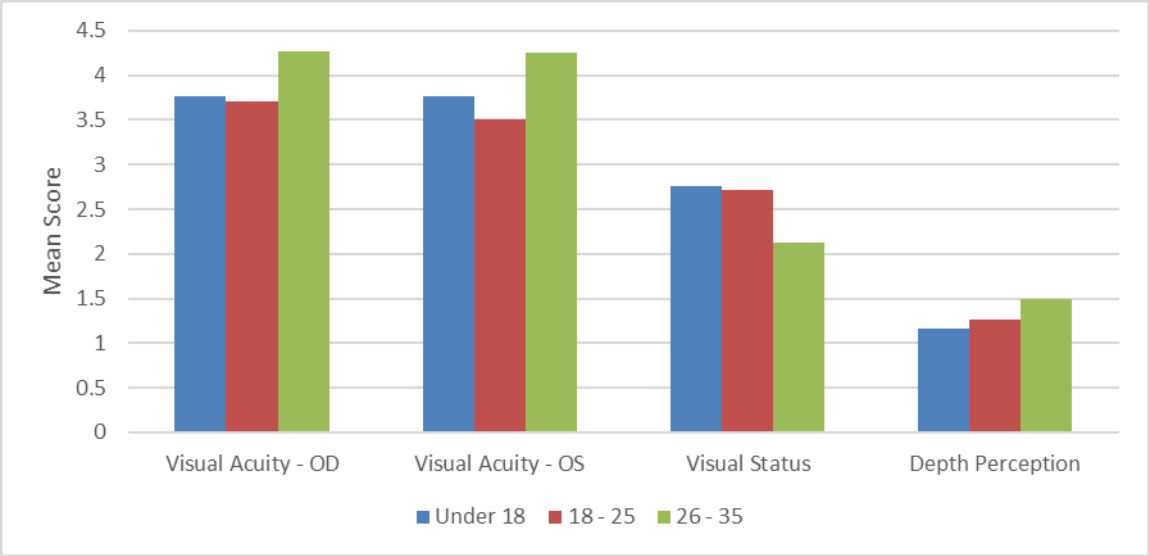


Table 4.12 presents the mean and standard deviation of players' visual acuity, visual status, and depth perception according to the different player positions of the study's sampled population.

For Visual Acuity (OD), goalkeepers recorded an average score of 4.29 and a standard deviation of .951, defenders recorded an average score of 4.10 and a standard deviation of 1.044, midfielders recorded an average score of 3.70 and a standard deviation of 1.428, forwards recorded an average score of 3.95 and a standard deviation of 1.174.

For Visual Acuity (OS), goalkeepers recorded an average score of 4.14 and a standard deviation of 1.215, defenders recorded an average score of 3.76 and a standard deviation of 1.044, midfielders recorded an average

score of 3.60 and a standard deviation of 1.393, forwards recorded an average score of 3.95 and a standard deviation of 1.253.

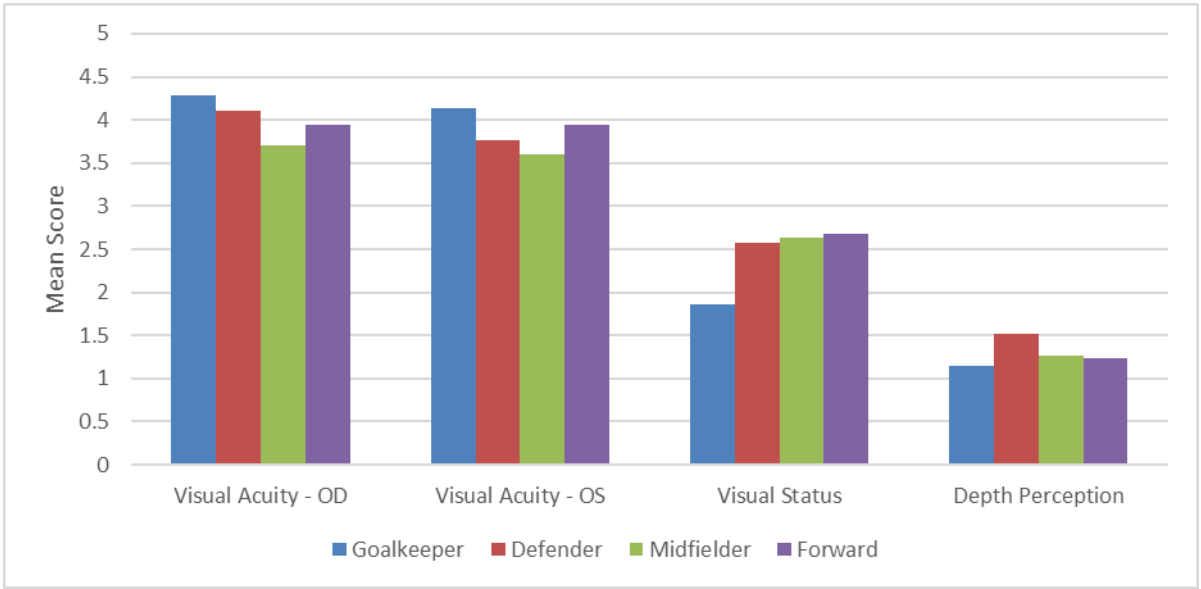
For Visual Status, goalkeepers recorded an average score of 1.86 and a standard deviation of 1.215, defenders recorded an average score of 2.57 and a standard deviation of 1.165, midfielders recorded an average score of 2.64 and a standard deviation of 1.150, forwards recorded and average score of 2.68 and a standard deviation of 1.041.

For Depth Perception, goalkeepers recorded an average score of 1.14 and a standard deviation of .378, defenders recorded an average score of 1.52 and a standard deviation of .512, midfielders recorded an average score of 1.26 and a standard deviation of .441, forwards recorded an average score of 1.23 and a standard deviation of .429.

Table 7: Mean and standard deviation of players' visual acuity, refractive status and depth perception according to the position they play on the field.

POSITION	N	VISUAL ACUITY				REFRACTIVE STATUS		DEPTH PERCEPTION	
		OD		OS					
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Goalkeeper	7	4.29	.951	4.14	1.215	1.86	1.215	1.14	.378
Defender	21	4.10	1.044	3.76	1.044	2.57	1.165	1.52	.512
Midfielder	46	3.70	1.428	3.60	1.393	2.64	1.150	1.26	.441
Forward	22	3.95	1.174	3.95	1.253	2.68	1.041	1.23	.429

Scale: Visual Acuity (OD & OS); 1 = 6/12, 2 = 6/9, 3 = 6/6, 4 = 6/5, 5 = 6/4. Visual Status; 1 = Emmetropia, 2 = Myopia, 3 = Hypermetropia, 4 = Astigmatism. Depth Perception; 1 = Present, 2 = Absent.



DISCUSSION

This study assessed the visual status among soccer players to further understand their visual abilities and any potential limitation that might have an impact on performance. As a way of determining whether the visual skills

were common throughout the study population, a comparison was done according to age groups (Table 1). The general trend that was noted was that visual skills seem to improve with age (Table 1). Visual acuity and depth perception improved with age (from under 18 to 35 years), while refractive status does not improved with age. This is significant because it suggests that as a player ages, his visual abilities may advance, potentially leading to an improvement in his on-field performance. In correlation with Du toit *et al*. (2009), the results show that participants' visual skills improve with age.

In soccer, players are not only divided into age groups but are also categorised by the positions they play. A comparison between the different positions would be fair as this would help to identify the different skills that are required by each position (Table 1.). Table 1 compares the skills of the participants according to the position played. Certain visual skills improved more in some position such as visual acuity in goalkeepers; refractive status in forward and depth perception in defenders.

The results have also shown that different positions do not necessarily have different levels of visual skills. This reinforces the suggestion that visual skills are not necessarily a function of the position one plays. However, the roles and duties that are expected from each position seem to require certain visual skills to be more acute in some positions (Pesce *et al*., 2007). This could be attributed to the type of training that is being received and to the number of years that the player has been playing in his position because having accumulated visual skills his performance will be enhanced (Chow *et al*., 2008).

Goalkeepers would need to possess peripheral awareness, which is the ability to notice everything around them, as well as memory recall of their players' positions. Additionally, they must to be able to quickly adjust from far-off things to close-by objects (Du Toit *et al.,* 2009, Treadwell, 1995).

A defender needs to be aware of where his teammates are on the field in order to pass the ball accurately (Treadwell, 1995). Defenders, like the goalkeeper, need to have good visual acuity, depth perception and peripheral awareness skills as confirmed by the results in table 4. Midfielders are required to follow the ball wherever it is, meaning they must maintain eye contact with it. Because they manage the game's flow, they are the team's decision-makers (Treadwell, 1995). Thus, midfielders need to have sharp visual acuity, visual memory and peripheral awareness skills so as to make decisions that will best suit the situation, they will find themselves in. The midfielders in this study can concentrate a bit more on their peripheral awareness, refractive status and depth perception as confirmed by table 5.

The striker needs to be able to determine when and how to take a shot at goal. The visual skills they need to master would be depth perception and peripheral awareness and have a good visual acuity as seen by the results in Figure 4.

Studies exploring the link between visual acuity and shooting accuracy underscore the need to address astigmatism by optical correction through prescription spectacles or contact lenses such as toric lenses in order to ensure player’s optimal performance in goal-scoring situations. These lenses are designed to correct the irregular curvature associated with astigmatism, providing players with clearer vision and potentially enhancing their performance on the field.

CONCLUSION:

The findings of this study indicate that visual skills tend to improve with age. A notable prevalence of refractive errors, including astigmatism and myopia, was observed among the athletes. Additionally, positional differences in visual profiles revealed that goalkeepers possess superior peripheral vision compared to outfield players.

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