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The Effect of Sports Vision Training on Motor and Psychological Skills in Male Volleyball Players Under Psychological Pressure

Mahmood Qasim Ali Al-Wajedi[1], Hamid Zahedi[2*], Watheg Mdallal Obaid Al-Swaiedi[3], Rokhsareh Badami[4]

[1] PhD student, Department of Motor Behavior, Isfahan (Khorasgan) Branch, Islamic Azad University, Isfahan, Iran.
[2] Assistant Professor, Department of Sport Sciences, Najafabad Branch, Islamic Azad University, Najafabad, Iran.
[3] Assistant Professor, Department of Sports Education, Faculty of Political Science, Al-Mustansiriya University, Baghdad, Iraq.
[4] Professor, Department of Motor Behavior, Isfahan (Khorasgan) Branch, Islamic Azad University, Isfahan, Iran.

*** Corresponding author email address**: hamidzhd@yahoo.com

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ABSTRACT

Purpose: The aim of this study was to investigate the effect of sports vision training on motor and psychological skills in Iraqi male volleyball players under conditions of psychological pressure.

Methods and Materials: This research is a quasi-experimental study conducted in the field. A total of 45 participants who met the inclusion criteria and were interested in participating were purposefully selected and randomly assigned to three groups (15 participants each): sports vision, combined, and specialized/traditional training. To measure volleyball service and spike accuracy, a test adapted from Jarinuo et al. (2023) was used. For assessing psychological components, the Ottawa Mental Skills Test (OMST-3) was administered. Trait and state anxiety were measured using the Illinois SCAT questionnaire (Martens, 1997) and the Competitive State Anxiety Inventory-2 (CSAI-2; Martinez et al., 1990), respectively. To induce psychological pressure during the post-test, a combined monitoring and comparison method was utilized (Esmaeili et al., 2019). Data analysis was performed using multivariate analysis of covariance (MANCOVA) and Bonferroni post hoc tests. The sports vision training program was based on the methodology of Formenti et al. (2019).

Findings: The results indicated a statistically significant difference in favor of the sports vision group in the accuracy scores of service and spike under psychological pressure among Iraqi male volleyball players. Additionally, significant differences were observed in the psychological skills subscales among the three groups, favoring the sports vision training group ($p \leq 0.05$).

Conclusion: It is recommended that the target population utilize sports vision training programs to improve volleyball service and spike accuracy and to enhance psychological skills under conditions of psychological pressure.

Keywords: *sports vision, motor skills, psychological skills, psychological pressure, volleyball*

1. Introduction

Volleyball is a sport that combines advanced technical and tactical movements, characterized by frequent high-speed and power-based actions, imposing significant physical and psychological pressure on players during training and competition (Moa, 2024). Engaging in professional competitive sports like volleyball requires athletes to make decisions within seconds, coordinate their limbs across various degrees of freedom, and maintain precise motor control under psychological pressure (Mesagno & Mullane-Grant, 2010). Performance choking under pressure refers to observing suboptimal performance despite effort and motivation to excel (Pratama, 2023; Vaalayi et al., 2023). Various theories attempt to explain why performance sometimes deteriorates under pressure, all of which primarily focus on cognitive mechanisms related to attention and motor control changes (Aryanti et al., 2022; Trecroci et al., 2021).

Several theories, including drive theories, behavioral theories, and attentional theories, have been proposed to understand choking under pressure. Although drive theories align with skill degradation under pressure, they are limited in explaining the specific errors that occur during execution (Riahi Farsani, 2013; Taheri et al., 2017). Researchers have attempted to explain individual performance differences through the concept of individual zones of optimal functioning. According to this theory, each individual has an optimal level of pre-performance anxiety that leads to peak performance. However, if pre-performance anxiety is outside this optimal zone—whether too high or too low—performance declines (Hanin, 1980).

High motivation levels can reduce performance in real-life behaviors. This phenomenon, known as "choking under psychological pressure," highlights how psychological pressure can profoundly influence human behavior, either positively or negatively. Previous theories suggest that choking under psychological pressure might divert attention away from the task (distraction theory), focus attention on step-by-step skill processes (explicit monitoring theory), or increase arousal levels. Recent neuroimaging studies have demonstrated that several brain regions involved in top-down attention and motivation play key roles in pressure-induced choking, supporting theories of over-arousal and distraction (Yu, 2015).

At all levels of competition, athletes who typically perform without error may occasionally experience performance declines, seemingly disengaging from the flow of the game. What causes these performance changes? Part of this decline may stem from the body awareness and alertness reaction sequence (BAR). Edward Gooding, an optician from Concord, theorized that BAR is a bodily response to "an unwanted and sudden environmental change" (Davids et al., 2008; Hanin, 1980; Otten, 2009). Excess sympathetic load activates natural fight-or-flight responses. For athletes on the field, this fight-or-flight response is repeatedly triggered.

Increased anxiety stimulates a chain of psychological responses that negatively affect performance, especially when the consequences of failure are significant (Vine et al., 2016). Carver et al. (2012) found that the presence of video cameras increases self-awareness, which interferes with task execution by increasing the processing of related information (Carver & Scheier, 2012).

Competition is another factor used in research on choking. Competition can be divided into situations where performance is compared with others (explicit) or with one's previous performance (implicit). In most sports events (competitive situations), individuals are concerned about performance outcomes, and increased awareness of these situations leads to choking (Cheragh Birjandi & Cheragh Birjandi, 2012; Ghafouri Azar et al., 2017). At advanced levels of sports skills, where differences are measured in fractions of seconds or centimeters, mental and psychological attributes become decisive factors. Volleyball, as a sport, is no exception. Sports science researchers in various fields aim to enable athletes to perform with maximum strength, speed, efficiency, and confidence under different conditions, especially under high-pressure and stressful situations. Achieving this relies on correct action selection, attention to appropriate stimuli and cues, and the precise activation of the motor system. Many sports, including volleyball, require not only high physical skills but also psychological capabilities to manage stressful conditions (Abd El-Mahmoud, 2008; Appelbaum & Erickson, 2018).

Among the factors potentially influencing sports performance is the visual system, which must rapidly scan the environment, gather appropriate information, and prepare the best motor program to ensure optimal performance. Strengthening the ocular muscles is essential. One of the new training programs gaining attention among coaches is sports vision training. These programs focus on enhancing the muscles that move the eyes, likely facilitating quicker and better environmental scanning and gathering relevant task-related information and stimuli, which must be

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executed and decided upon in milliseconds. However, precise execution and the application of acquired psychological skills must occur under psychological pressure (Babaei & Badami, 2019; Buscemi et al., 2024; Nazari et al., 2021).

Sports vision is an interdisciplinary specialty aimed at improving the visual system's performance to achieve benefits in practiced sports. Developing visual skills can help athletes improve sports performance and motor skills at any age (Buscemi et al., 2024). An athlete with better visual reaction speed can effectively perceive environmental events almost in slow motion, allowing preemptive reactions and decisions within fractions of a second, positively influencing performance (Nascimento et al., 2020). Vision plays the most critical role among sensory systems in providing environmental information. Efficient visual skills are among the valuable advantages any player can have during sports competitions (Wilson & Falkel, 2004). Coordination, focus, balance, and precision are essential skills for any sports event, and some researchers believe they can be improved through vision training, as studies have shown that the visual system responds well to additional training loads (Buscemi et al., 2024; Kumar, 2011).

Sports vision training draws on sports physiology, visual rehabilitation, and various aspects of kinesiology and biomechanics (motor control). It enables athletes to enhance their visual skills, strengthen ocular muscles, and improve visual decision-making accuracy and performance (Abed, 2018; Alfailakawi, 2016; Babaei & Badami, 2019; Buscemi et al., 2024; Nascimento et al., 2020; Nazari et al., 2021; Schwab & Memmert, 2012; Wilson & Falkel, 2004; Wood & Abernethy, 1997; Zahedi & Yazdi, 2023). However, some studies have reported contradictory findings, indicating that sports vision training does not necessarily improve visual skills (Wood & Abernethy, 1997). More research in this area may enhance our understanding of sports vision training effects.

Although there is increasing interest in vision training for sports performance, it remains unclear whether this training translates to in-game environments. Schwab et al. (2012) reported that a group of hockey players participating in a six-week sports vision training program improved only in the specific visual tasks used in the training, with no improvements observed in transfer tasks (Schwab & Memmert, 2012). Similarly, Abernethy and Wood (2001) showed that generalized vision training improved some visual skill metrics, but these improvements were similar for control and placebo groups and did not translate to field-based tennis transfer tests (Abernehy & Wood, 2001).

The lack of evidence supporting sports vision training's effectiveness for improving performance has been attributed to methodological approaches that reduce the ecological validity of training stimuli. Consequently, the generalized and automated nature of the required motor responses might limit potential effects on sports performance. This lack of transfer aligns with the ecological framework proposed by Gibson, which suggests that perception and action are directly interconnected and mediated by information within the external environment (affordances) rather than internal representations. Given the aforementioned considerations and the limited information on the accuracy of motor (service and spike) and psychological skills in Iraqi male volleyball players under ecological and psychologically pressured conditions, this study seeks to answer whether there is a difference in the effects of sports vision, specialized, and combined training programs on motor (service and spike) and psychological skill components under psychological pressure. The findings of this study could significantly contribute to advancing knowledge in this domain for the target population. Furthermore, the results may provide valuable insights for coaches, athletes, and officials in the field of volleyball in Iraq.

2. Methods and Materials

2.1. Study Design and Participants

The present study is a quasi-experimental research in terms of data collection and is applied in terms of objectives and outcomes. It was conducted in the field using a pre-test and post-test design. The research population consisted of men familiar with volleyball skills who had at least five years of non-professional volleyball experience. A total of 68 participants who met the inclusion criteria (normal vision, at least five years of volleyball experience, no history of eye surgery or lens use, no use of glasses, male gender, right-handedness, no use of sedative medications, and no membership in professional volleyball teams) were initially selected. After completing the Illinois SCAT questionnaire to determine trait anxiety and excluding participants with a trait anxiety score above 15, 45 participants (age: M = 26.28 ± 0.48 years; height: M = 1.81 ± 0.04 m; weight: M = 88.93 ± 5.83 kg; trait anxiety: M = 16.73 ± 1.07) who met the inclusion criteria were purposefully selected and randomly divided into three groups (n = 15 each): sports vision, traditional, and combined training.

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Following participant selection and determination of trait anxiety, anthropometric characteristics (e.g., height, weight, and body mass index) were measured and recorded. From participants with moderate trait anxiety scores (15–20), 15 participants were randomly assigned to each group (total N = 45). During the pre-test, all participants underwent a maximal effort repetition test, and their scores were recorded.

In the post-test, psychological pressure was induced using a combination of monitoring and evaluation (Esmaili et al., 2020). Cameras were positioned around the volleyball court, and participants were informed their skills were being recorded for review (performance pressure). Additionally, four elite coaches from Iraq's volleyball federation observed the participants for potential selection, with a financial incentive of 300,000 Iraqi dinars offered to those selected.

2.2. Measures

Snellen Visual Acuity Scale: Before selecting participants, the visual acuity of volleyball players was assessed using the Snellen scale. Participants whose vision scores were normal and achieved a full score were allowed to enter the study.

Trait Anxiety Questionnaire: The Illinois SCAT questionnaire, consisting of 15 Likert-scale items (including five filler questions), was used to measure trait anxiety. Scores for items 6 and 11 were reversed. The total score determined the participant's anxiety level, ranging from 10 (low trait anxiety) to 30 (high trait anxiety). Scores above 20 indicated high anxiety, scores between 15 and 20 indicated moderate anxiety, and scores below 14 indicated low anxiety. Internal consistency, reliability, and validity of this questionnaire were evaluated using responses from 2,500 athletes, showing a test-retest reliability correlation of 73% to 88% (M = 81%). The Kuder-Richardson (KR20) formula indicated internal consistency coefficients ranging from 95% to 97% for children and adults. Cronbach's alpha coefficient for internal consistency was calculated as 0.79 for the Illinois SCAT questionnaire (Zahedi & Yazdi, 2023).

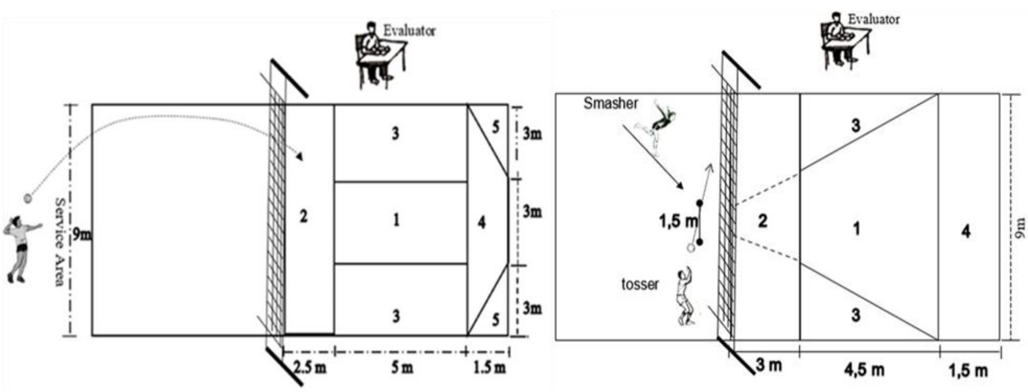
State Anxiety Inventory: State anxiety was measured using the Competitive State Anxiety Inventory-2 (CSAI-2). This inventory contains 29 items and three subscales: cognitive anxiety, somatic anxiety, and self-confidence (each with nine items). Scores for each subscale range from 9 to 36. This self-report inventory for athletes has demonstrated adequate validity and reliability (α = 0.82–0.89) . Subscale reliability coefficients based on Cronbach's alpha in this study were significant at the 1% level (cognitive anxiety: α = 0.78–0.80; somatic anxiety: α = 0.81–0.83; self-confidence: α = 0.87–0.91) (Zahedi & Yazdi, 2023).

Volleyball Service Accuracy Test: This protocol involved 10 service attempts per participant. Scores were recorded for each attempt, with higher scores assigned for hitting the boundary lines. A ball hitting the net or landing out of bounds scored zero. The participant's total score was the sum of scores across 10 tennis-style serves (Jariono et al., 2023).

Volleyball Spike Accuracy Test: A ball hitting the net or landing out of bounds scored zero, while higher scores were assigned for hitting pre-designed boundary lines on the volleyball court. Each participant executed 10 spikes from a marked area 1.5 meters from the center of the court. The total score was the sum of scores across the 10 spikes (Jariono et al., 2023).

Figure 1

Volleyball Service and Spike Accuracy Test Setup (Jariono et al., 2023)



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Ottawa Mental Skills Assessment Tool (OMSAT-3): The Ottawa Mental Skills Test-3 measures readiness in three dimensions: foundational skills, psychomotor skills, and cognitive skills. It consists of 48 items evaluating 12 mental skills on a seven-point Likert scale ranging from "strongly disagree" to "strongly agree." Zeydabadi et al. (2013) confirmed the validity and reliability of the Persian version through first- and second-order confirmatory factor analysis (Zeydabadi & Ebrahim, 2014). Cronbach's alpha coefficients ranged from 0.37 to 0.71, and test-retest reliability ranged from 0.64 to 0.92. Cronbach's alpha for this questionnaire was reported as above 0.70 (Riahi Farsani, 2013).

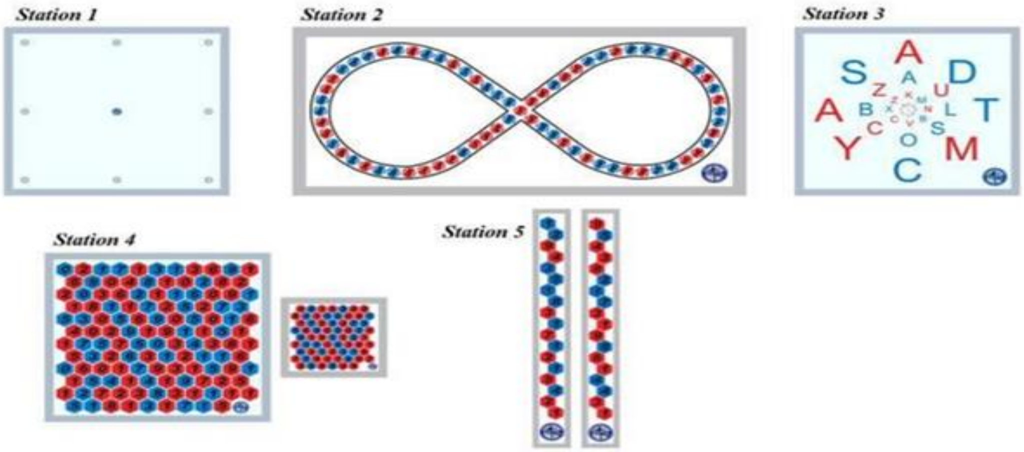
2.3. Interventions

The three training groups—sports vision, traditional, and combined—completed 27 90-minute sessions, each including 10 minutes of warm-up, 30 minutes of vision training or intervention, 20–30 minutes of volleyball-specific skill training, and 10 minutes of cooldown and stretching. Training stations focused on visual skills, such as peripheral vision, saccadic eye movements, and convergence. Difficulty levels were adjusted using variables like distance from the wall, standing position, and use of tools (e.g., foam) to gradually increase motor and cognitive challenges.

The combined training group performed the same vision training but incorporated volleyball-specific movements, using volleyballs and techniques aligned with the sport. Traditional training involved repetitive practice of volleyball skills in a sport-specific environment without vision training.

Figure 2

Screens used in sports vision and combined training groups



2.4. Data Analysis

Data were analyzed using multivariate analysis of covariance (MANCOVA) and Bonferroni post hoc tests in SPSS version 23, with significance set at $p < .05$.

3. Findings and Results

The highest service accuracy in the pre-test and post-test was observed in the combined group, while the lowest service accuracy in the pre-test was recorded in the sports vision group and in the post-test in the traditional group. For spike accuracy, the traditional group scored the highest in the pre-test, while the lowest score was recorded in the sports vision group. In the post-test, the combined group achieved the highest spike accuracy, and the traditional group recorded the lowest.

The highest basic mental skills score in the pre-test belonged to the traditional group, while the highest post-test score was achieved by the sports vision group. The lowest psychomotor skills score in the pre-test was observed in the combined group, and in the post-test in the traditional group. Cognitive skills were highest in the traditional group in the pre-test and in the sports vision group in the post-test.

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Table 1

Comparison of Means and Standard Deviations of Variables Across the Three Groups

Test	Group	Pre-Test Mean (SD)	Post-Test Mean (SD)
Competitive State Anxiety	Sports Vision	51.20 (2.95)	52.53 (3.11)
	Combined	49.46 (3.09)	52.33 (2.74)
	Traditional	50.00 (1.92)	54.13 (1.30)
Basic Mental Skills	Sports Vision	67.06 (3.89)	63.53 (3.64)
	Combined	67.06 (3.73)	60.80 (3.12)
	Traditional	67.66 (3.52)	58.20 (4.75)
Psychomotor Skills	Sports Vision	72.00 (5.05)	71.60 (4.06)
	Combined	70.60 (4.43)	71.73 (4.52)
	Traditional	70.80 (4.19)	66.93 (3.21)
Cognitive Skills	Sports Vision	90.13 (6.64)	88.86 (6.24)
	Combined	91.53 (6.44)	87.40 (5.27)
	Traditional	92.06 (6.34)	78.73 (5.70)
Service Accuracy	Sports Vision	41.20 (3.18)	39.46 (3.09)
	Combined	42.73 (2.15)	40.66 (2.43)
	Traditional	42.06 (1.57)	38.26 (1.48)
Spike Accuracy	Sports Vision	35.40 (2.02)	33.93 (2.18)
	Combined	35.66 (1.87)	34.33 (2.49)
	Traditional	35.73 (1.38)	32.20 (1.61)

After confirming the assumptions of normal data distribution, homogeneity of group variances, and the linear relationship of covariates with dependent variables (e.g., service accuracy × group: $p = 0.33$, $F(2) = 1.16$; spike accuracy × group: $p = 0.01$, $F(2) = 421.74$; basic mental skills × group: $p = 0.22$, $F(2) = 1.55$), and ensuring the validity of Box's test (BOX = 30.30; $p = 0.16$, $F(20, 6331.98) = 1.30$), multivariate analysis of covariance (MANCOVA) was used to analyze the data (Table 2).

Table 2

Results of MANCOVA Comparing the Effects of Training Type on Variables Under Psychological Pressure

Source	Variable	Sum of Squares	df	Mean Square	F	p	η²	Power
Pre-Test	Service Accuracy	170.77	1	170.77	476.70	.000	.92	1.00
	Spike Accuracy	96.92	1	96.92	228.48	.000	.86	1.00
	Basic Skills	126.54	1	126.54	109.29	.000	.74	1.00
	Psychomotor Skills	359.19	1	359.19	95.83	.000	.71	1.00
	Cognitive Skills	273.14	1	273.14	43.70	.000	.53	1.00
Group	Service Accuracy	33.98	2	16.99	47.43	.000	.71	1.00
	Spike Accuracy	43.92	2	21.96	51.77	.000	.73	1.00
	Basic Skills	237.78	2	118.89	102.68	.000	.84	1.00
	Psychomotor Skills	347.15	2	173.57	46.30	.000	.70	1.00
	Cognitive Skills	1014.61	2	507.30	81.16	.000	.81	1.00
Error	Service Accuracy	13.25	37	0.35				
	Spike Accuracy	15.69	37	0.42				
	Basic Skills	42.21	37	1.14				
	Psychomotor Skills	139.27	37	3.76				
	Cognitive Skills	243.21	37	6.57				

The results of the MANCOVA, as presented in Table 2, indicate significant differences across the groups for all variables examined under psychological pressure ($p < .001$). For service accuracy, the group effect was significant ($F(2, 37) = 47.43$, $p < .001$, $\eta^2 = .71$), indicating a large effect size. Similarly, for spike accuracy, the group effect was significant ($F(2, 37) = 51.77$, $p < .001$, $\eta^2 = .73$), also reflecting a large effect size. Basic mental skills showed a significant group effect ($F(2, 37) = 102.68$, $p < .001$, $\eta^2 = .84$), suggesting a very large effect size. The group effect for

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psychomotor skills was significant ($F(2, 37) = 46.30$, $p < .001$, $\eta^2 = .70$), and cognitive skills also demonstrated a significant group effect ($F(2, 37) = 81.16$, $p < .001$, $\eta^2 = .81$). These results confirm that the type of training program significantly influenced the performance and mental skills of participants across all measured variables under psychological pressure.

Except for service and spike accuracy comparisons between the sports vision and combined groups ($p \leq .05$), statistically significant differences were observed in all other pairwise comparisons across the variables examined ($p \leq .05$) (Table 3).

Table 3

Results of Bonferroni Post Hoc Tests for Pairwise Comparisons

Variable	Groups Compared	Mean Difference	Standard Error	p
Service Accuracy	Sports Vision vs. Combined	0.32	0.24	.57
	Sports Vision vs. Traditional	2.06	0.24	.000
	Combined vs. Traditional	1.73	0.22	.000
Spike Accuracy	Sports Vision vs. Combined	-0.19	0.26	1.00
	Sports Vision vs. Traditional	2.03	0.26	.000
	Combined vs. Traditional	2.23	0.24	.000
Basic Mental Skills	Sports Vision vs. Combined	2.56	0.46	.000
	Sports Vision vs. Traditional	5.88	0.41	.000
	Combined vs. Traditional	3.31	0.43	.000
Psychomotor Skills	Sports Vision vs. Combined	2.18	0.84	.04
	Sports Vision vs. Traditional	6.91	0.74	.000
	Combined vs. Traditional	4.73	0.77	.000
Cognitive Skills	Sports Vision vs. Combined	2.84	1.08	.03
	Sports Vision vs. Traditional	11.57	0.96	.000
	Combined vs. Traditional	8.72	1.00	.000

4. Discussion and Conclusion

The purpose of this study was to compare the effect of one period of sports vision training (general sports vision stimuli with general motor actions), combined training (general sports vision stimuli with specific motor actions), and specialized training (sport-specific visual stimuli in a specific sports context) on service and spike accuracy and mental skills among Iraqi male volleyball players under psychological pressure. The results of the multivariate analysis of covariance showed that there was a statistically significant difference across the three groups under psychological pressure in all variables studied ($P \leq 0.05$). The results of the Bonferroni post hoc test, based on Table (3), revealed that except for service accuracy and spike accuracy in comparing the sports vision group with the combined group ($p \geq 0.05$), there were statistically significant differences in all other pairwise comparisons ($p \leq 0.05$).

By comparing the mean service accuracy scores of the volleyball groups from pre-test to post-test, it was found that service accuracy in all three groups decreased under psychological pressure. However, when comparing them—controlling for pre-test service accuracy via ANCOVA—the smallest decrease in service accuracy under psychological pressure in the post-test was observed in the sports vision training group, and the greatest decrease in service accuracy occurred in the specialized/traditional training group.

Regarding spike accuracy, the scores in all three groups decreased, and under psychological pressure in the post-test, the lowest spike accuracy belonged to the specialized/traditional training group. The other two groups (sports vision and combined) appeared to perceive the psychological pressure similarly, resulting in almost the same adjusted mean for both groups (sports vision: 34.16 ± 0.16 and combined: 34.25 ± 0.16) in the post-test. In other words, the specialized/traditional training group was more influenced by psychological pressure and perceived the condition as more threatening, leading to reduced service and spike accuracy. The present study compared service and spike accuracy across three groups (sports vision, combined, and specialized/traditional) under psychological pressure. It seems that, for the specialized/traditional group, the presence of evaluation and monitoring by judges, as well as performance recording by video cameras, induced greater psychological pressure, prompting participants to focus on their own performance. In attempting to control their movements more precisely, according to the conscious

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processing hypothesis, they disrupted the automaticity of motor control, leading to performance deterioration.

Because the accuracy of volleyball service and spike depends on how the palm—particularly the fingertips—contacts the ball, psychological pressure likely significantly affected the transmission of motor commands to the delicate muscles of the fingers, consequently influencing service and spike accuracy. When athletes focus on non-task-related cues, they cannot attend adequately to task-relevant cues, resulting in performance decline (Moein et al., 2014, 2015). In other words, the type of attentional focus, the nature of the task (such as volleyball service and spike accuracy), and potential occurrence of choking under pressure all affect performance outcomes.

However, conditions differed when sports vision training was used. Given that the sports vision group's service accuracy score outperformed that of the combined training group, this finding aligns with many previous results (Ahmadi et al., 2020; Esmaili et al., 2020; Moein et al., 2014, 2015; Zahedi & Yazdi, 2023), but contradicts some other findings (Ghafouri Azar et al., 2017; Nazari et al., 2021) reported that sports vision training significantly affects decision-making and visual perception. Ahmadi et al. (2020) observed that psychological pressure increases self-awareness, which in turn heightens the performer's focus on the skill's components to ensure a favorable outcome (Ahmadi et al., 2020). Yet, the findings of the present study differ from the distraction theory, which suggests that psychological pressure fills the information-processing capacity with non-task-related stimuli such as anxiety and self-doubt.

Esmaili et al. (2019) reported that skilled individuals' performance decreases under psychological pressure, suggesting that they may engage in mechanisms of skill-focused attention and thus allocate fewer attentional resources to skill execution, consistent with the explicit monitoring theory (Esmaili et al., 2020). Moein et al. (2015) found that when participants are asked to adopt task-related attentional focus, they attempt to control their movements step by step, while irrelevant attentional focus allows them to rely on automated and unconscious control processes, leading to more effective performance (Moein et al., 2015). Moein et al. (2014) also reported that individuals with high skill levels who adopt task-related attentional focus under psychological pressure tend to choke, indicating that performance under pressure influences volleyball service accuracy (Moein et al., 2014). Zahedi et al. (2023) stated that, in conditions of external attentional focus under psychological pressure among highly skilled individuals, choking occurs and performance deteriorates due to the importance placed on the outcome (Zahedi & Yazdi, 2023). Ghafouri Azar et al. (2017) noted that in the post-test stage, both neurofeedback and under-pressure training groups improved significantly compared to the control group; nevertheless, there was no significant difference between the neurofeedback group and the under-pressure group despite the under-pressure group having a higher mean record (Ghafouri Azar et al., 2017).

Sports vision refers to loading or challenging the visual, perceptual-motor, and proprioceptive-visual systems during specific sports training to prepare athletes. Sports vision training is rooted in sports physiology, visual rehabilitation, and various aspects of kinesiology and biomechanics. It allows athletes to improve their visual skills to enhance their motor performance. Sports vision training develops eye movement skills, focusing abilities, visual alertness, and visual perception, enabling athletes to perform optimally within their respective sports level (Wilson & Falkel, 2004; Zahedi & Yazdi, 2023). Sports vision training enhances target areas such as visual memory, figure-ground perception, lateral dominance, and directionality, aiding the athlete in better understanding these concepts and applying them to specific sports as needed.

The visual system has a direct connection with proprioceptive centers, which control the body's awareness in space—a particularly important factor during sports and training. By combining visual perception and proprioceptive feedback, the athlete can maintain focused attention on the task at hand rather than being distracted by external factors such as spectators, environmental noise (Wilson & Falkel, 2004), the presence of key individuals (in this study, evaluators), or objects like cameras. This process prevents the intrusion of irrelevant factors that might divert attention. Davids et al. (2008) concur, stating that establishing an effective link between visual perception and motor performance is a critical component in developing successful athletic performance (Davids et al., 2008). These improvements may relate to the capacity of sports vision training to suppress attention to disruptive stimuli by activating brain areas responsible for cognitive functions. It has also been reported that visual attention is facilitated after sports vision training. Functional regions of the cortex associated with shifts in visual attention and eye movements become active following sports vision training, including the superior temporal areas, parts of the precentral sulcus, and the medial frontal gyrus. Simultaneous activation of these

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brain regions during sports vision training is sufficient to induce short-term neuroplasticity (Di Noto et al., 2013).

Hence, it can be inferred that the execution of sports vision training enhances cognitive performance related to maintaining attention. Such improvements may be associated with short-term changes in neural activity and/or short-term plasticity in the frontal regions responsible for visual attention, motor signaling that prepares the visuomotor system, and working memory (Malahi et al., 2014; Zahedi & Yazdi, 2023). Psychological pressure is among the typical conditions that athletes face. It appears that sports vision training, through its physiological and functional benefits for athletic performance, can indirectly help athletes better handle psychological pressure, ultimately leading to more accurate performance. It is therefore likely that sports vision training mitigates self-focus and distractions (Masters, 1992), attentional diversion, focus on execution, and task analysis, reducing the impact of the induced psychological pressure (Nieuwenhuys & Oudejans, 2012).

Nonetheless, considering the adjusted mean spike accuracy scores in the post-test for the sports vision (34.16 ± 0.16) and combined (34.25 ± 0.16) groups, both groups appear to have perceived the stressful conditions similarly, resulting in nearly identical performance outcomes and no statistically significant difference for this component.

It was shown that in the three dimensions of mental skills, there was a statistically significant difference favoring the sports vision training group over the other groups. As no research was found that compared the mental skills components of volleyball players with an emphasis on sports vision training under psychological pressure, the discussion draws on studies that have some relevance to the subject or have been conducted in other sports disciplines.

This finding aligns with the prior results (Babaei & Badami, 2019; Cheragh Birjandi & Cheragh Birjandi, 2012; Mohammadzadeh & Sami, 2014; Murayama & Sekiya, 2015). Murayama and Sekiya (2015) reported that while earlier studies attempted to explain choking solely in terms of attentional changes, their findings suggest another perspective: changes in psychological, physiological, and behavioral variables lead to performance decline. Specifically, the interaction between emotion and cognition and adopting a strategy involving low risk determines changes in motor control (Murayama & Sekiya, 2015). Mohammadzadeh et al. (2014), in a study comparing the psychological skills of elite and non-elite volleyball players, found that more experienced athletes with higher ability scored significantly higher on mental skills (Mohammadzadeh & Sami, 2014). Athletes utilize mental skills during both training and actual competition (Weinberg & Gould, 2007; Weinberg & Gould, 2014).

Mental skills are commonly divided into three categories, each of which is critical for optimizing performance in volleyball and other sports activities. The first category is basic mental skills, encompassing goal setting, self-confidence, and commitment (Jean, 2010). These are termed “basic” because if an athlete has not established these traits, the development of more advanced mental skills will not reach its maximum potential (Cox, 2007). They serve as personal resources, forming the foundation for acquiring other mental skills essential for success in sports.

The second category is psychomotor skills, including reaction to stress and psychological pressure, fear control, relaxation, and energetic activation, which relate to the athlete’s physiological characteristics (Landers et al., 1986). Mastering these psychomotor mental skills is key to achieving optimal performance in volleyball, as athletes must effectively handle demanding training and competition scenarios, overcome fear, and reduce tension during critical moments in matches, such as when the team is behind. Therefore, it is imperative for athletes to learn how to regulate anxiety to avoid performance deterioration. Stressful situations are crucial for most elite athletes because stress compels them to adopt a positive approach toward anxiety and worry. Sports events are inherently characterized by continual changes in the individual-environment relationship, creating intense stress even for elite athletes. Calmeiro et al. (2010) provided evidence suggesting that appraisal and coping during competitions depend on performance challenges experienced by the athlete (Calmeiro et al., 2010). The athlete’s response to stress—whether it involves psychological load, lack of training, competition environment, evaluation, or comparison—is termed the “reaction to stress” and is critical for success in sports. Clearly, an athlete’s reaction to the opposing crowd’s noise in a team or individual sport can be stressful, and how one responds to that stress is a determinant of success. Controlling stress is thus viewed as one of the key factors in athletic success (Taheri et al., 2017).

The third category is cognitive skills, comprising mental imagery, mental rehearsal, concentration, refocusing, and competition planning. These skills involve processes such as learning, perception, memory, and thinking, and they require reflection and planning for improved sports performance (Cox, 2007). Liao and Masters (2002) reported that an

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imminent stressful event can trigger a process in which the event demands are compared to one's coping resources, leading to heightened self-focused attention (Liao & Masters, 2002). Refocusing is the ability to concentrate on the present moment of performance rather than dwelling on past or future outcomes. A refocusing plan aims to help athletes shift their attention away from unwanted external distractions or internal distractions such as worry, self-doubt, or self-criticism.

A proposed theory holds that the factors influencing success in volleyball are tied to a set of visuomotor skills (Kluka & Love, 1991). Hence, it can be inferred that skilled visual perception and subsequent motor responses are pivotal for successful performance in sports like volleyball and serve as determining factors. In sports science literature, perception has been studied extensively through visual search patterns, believed to be part of an athlete's perceptual strategy (Moreno et al., 2002). Another theory posits that at least nine factors contribute to an individual's relative inability to execute volleyball skills successfully; of these nine factors, four are connected to the visual system and decision-making: (1) lack of recognition, (2) delayed recognition, (3) lack of internal focus, and (4) poor selection of internal options. Inadequate motor program execution is largely linked to a set of visual and perceptual skills. When combined with rapid-response decision-making, these skills enable volleyball players to anticipate upcoming events for proper timing of their actions and responses. It appears that in the sports vision training group, these elements were effectively facilitated, and perhaps implementing a sports vision training program served as a powerful tool for managing and mitigating psychological pressure. Sports vision training may help athletes gain precise situational awareness under pressure, thus improving clarity and focus to optimally handle environmental factors and their own responses. Consequently, it is logical that this training approach enabled them to cope better under psychological pressure and exhibit more robust mental performance.

The theoretical basis for sports vision training programs relies on three assumptions: (1) athletes have superior visual skills compared to non-athletes, (2) visual skills can be improved, and (3) improved visual skills can potentially transfer to enhanced sports performance. It can thus be surmised that sports vision training helps coordinate the trunk, arms, and legs (Babaei & Badami, 2019) during task execution under psychological pressure, preventing any detrimental effect on performance accuracy. Although, based on previous studies, one might expect individuals to be affected by psychological pressure (particularly in mental skills components), a plausible explanation is that sports vision training in the practice sessions imposed an additional visual load on the participants (Zahedi & Yazdi, 2023). In line with the "inoculation effect" theory in sports, sports vision training may have decreased the body awareness reaction (BAR) in athletes (Chu et al., 2019), permitting them to focus on essential matters and ignore disruptive factors.

Moreover, it can be inferred that implementing sports vision training improved participants' attentional flexibility and thus their executive control compared to the other two groups, as these abilities—often referred to as "sports intelligence"—are cognitive processes regulating thought and action (Zahedi & Yazdi, 2023). Because the ultimate goal of sports vision training is to transfer improved visual skills onto the playing field, when an athlete can perform a visual task at a high level under numerous demands, including sensory integration, distraction, and stress, it is more likely that participants' visual systems continued to function effectively in high-stress moments despite experiencing psychological pressure.

Performance under stress and psychological pressure is a common challenge for most athletes, especially in team sports such as volleyball. Accuracy in service and spike is critical to volleyball team success and is highly dependent on a robust visual system and efficient neuromuscular coordination, which are developed through appropriate training programs. The findings of this study demonstrated that the sports vision training group performed better under stressful and high-pressure conditions compared to the other two groups. Sports vision training seemed to help them adapt to the conditions more effectively, as reflected by better service accuracy than the other two groups, while the combined training group also outperformed the specialized/traditional group, indicating a positive effect from sports vision. Even though the service and spike movement patterns are similar, athletes typically perform spikes with more power and speed, which can affect accuracy. Thus, no difference was observed between the sports vision and combined groups in spike accuracy, despite both groups surpassing the specialized/traditional group, suggesting that incorporating sports vision training into spike drills can assist athletes in improving their performance under psychological pressure.

Finally, the OMSAT-3 results for the three mental skills subscales (basic mental skills, psychomotor skills, and cognitive skills) showed that the sports vision training group

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achieved the highest scores across all three dimensions, followed by the combined group, and finally the specialized/traditional group. These findings indicate that sports vision training can help Iraqi male volleyball players better manage psychological pressure and cope more effectively with stressful conditions.

Authors' Contributions

All authors significantly contributed to this study.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

In this study, to observe ethical considerations, participants were informed about the goals and importance of the research before the start of the interview and participated in the research with informed consent.

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