

## **Analysis of Hand-Eye Coordination on Overhead Service Skills of BKMF Sparta FIKK UNM Volleyball Athletes**

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### **Abstract**

This study aims to analyze the relationship between hand-eye coordination and overhead service skills in BKMF Volleyball SPARTA FIKK UNM athletes. The research employed a quantitative approach with a correlational design. The population consisted of 30 male volleyball athletes from BKMF Volleyball Sparta FIKK UNM, with a sample of 20 athletes selected using total sampling technique. Data were collected through the Wall Pass test to measure hand-eye coordination and the Overhead Service Skills test to assess serving ability. Data analysis was performed using descriptive statistics, normality tests (Shapiro-Wilk), linearity tests (ANOVA), and simple correlation tests with SPSS Version 16 at a significance level of 0.05. The results showed that: (1) the hand-eye coordination of athletes was predominantly in the good category (45%); (2) overhead service skills were predominantly in the good category (40%); (3) the simple correlation test indicated a very strong and significant relationship between hand-eye coordination and overhead service skills, with a sig. (2-tailed) value of  $0.000 < 0.05$  and a Pearson correlation coefficient ( $r$ ) of 0.882. These findings confirm that the better an athlete's hand-eye coordination, the better their overhead service performance. Coaches are recommended to incorporate systematic hand-eye coordination training—such as ball throwing and catching, juggling, and ring tossing—into structured training programs to enhance overhead service skills.

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## INTRODUCTION

Volleyball is a team sport requiring a high level of physical conditioning and technical skill. Among the various fundamental techniques in volleyball, the overhead service occupies a critical role as the initial point of attack in every rally. A well-executed service can immediately place the opponent's team under pressure, potentially scoring a direct point or creating a difficult reception situation. Conversely, a poor service may concede the initiative to the opposing team.

One of the most essential biomotor components supporting effective overhead service execution is hand-eye coordination. Hand-eye coordination refers to the ability to synchronize visual perception with precise motor responses, allowing an athlete to track the ball accurately during the toss phase and strike it with optimal force and direction. This psychomotor capacity is fundamental not only in volleyball but across a wide range of sports that demand precise ball-handling skills.

Sport development in Indonesia is anchored in national legislation—specifically Law Number 3 of 2005 on the National Sports System—which positions sports as a vehicle for improving human quality, national unity, and international prestige. At the university level, extracurricular sports organisations such as BKMF (Biro Kegiatan Mahasiswa Fakultas) serve as important developmental platforms for student-athletes, providing structured training environments that bridge recreational participation and competitive performance.

Despite the established theoretical importance of hand-eye coordination in sport performance, limited empirical research has specifically examined its correlation with overhead service skills within university-level volleyball teams in South Sulawesi. Preliminary field observations at BKMF Volleyball Sparta FIKK UNM revealed that a number of athletes struggled with service accuracy—either sending the ball out of bounds or delivering easily-receivable services—suggesting possible deficiencies in hand-eye coordination. This study was therefore designed to address this empirical gap.

This study aims to analyze the relationship between hand-eye coordination and overhead service skills among male volleyball athletes of BKMF Volleyball Sparta FIKK UNM.

To what extent does hand-eye coordination correlate with overhead service skills in male volleyball athletes of BKMF Volleyball Sparta FIKK UNM?

The findings of this study are expected to contribute empirical evidence for volleyball coaches seeking to develop targeted training programs. By quantifying the relationship between hand-eye coordination and overhead service proficiency, coaches can more effectively prioritise coordination drills within their periodisation frameworks. Furthermore, this study contributes to the growing body of sport science literature on psychomotor determinants of volleyball performance in the Indonesian university context.

## **METHODOLOGY**

### **Research Design**

This research employed a quantitative approach with a correlational design. The correlational method was selected to determine the degree of association between the independent variable (hand-eye coordination) and the dependent variable (overhead service skills) without experimental manipulation. Statistical analyses were conducted using SPSS Version 16 at a significance level of  $\alpha = 0.05$ .

### **Samples and Sampling Techniques**

The population of this study comprised 30 male athletes from BKMF Volleyball Sparta FIKK UNM. A sample of 20 athletes was drawn using total sampling, meaning all available athletes who met the inclusion criteria were included. The decision to use total sampling was based on the manageable population size and the need to maximise statistical power within the available participant pool.

### **Instruments**

Two standardised instruments were employed in this study:

**Wall Pass Test (Hand-Eye Coordination):** Participants stood behind a throwing line placed 2.74 metres (9 feet) from a wall. A target area of  $2.44 \times 2.44$  metres ( $8 \times 8$  feet) was marked on the wall. Athletes threw a ball against the wall with their dominant hand and caught it with the non-dominant hand, alternating for 15 seconds. The total number of valid throws recorded across three attempts constituted the final score. Throws were invalidated if the athlete stepped over the line or vollied the ball.

**Overhead Service Skills Test:** A standard volleyball court was modified with target zones marked by numerical values. Athletes performed six service attempts from the service area. Scoring was determined by where the ball landed relative to the target zone and the height at which it crossed the net (multiplied by zone value). The sum of the four best scores constituted the final service score.

## Data Collection Procedures

Data collection was conducted between August and September 2024 at the volleyball court of the Faculty of Sport and Health Science, Universitas Negeri Makassar. Prior to testing, all participants received standardised instructions from the researcher. A structured warm-up was administered before both tests. The Wall Pass Test was administered first, followed by the Overhead Service Skills Test. All tests were supervised by trained assistants to ensure procedural consistency.

## Data Analysis

Data were analysed in four sequential stages using SPSS Version 16: (1) descriptive statistics—including mean, standard deviation, minimum, maximum, range, and frequency distributions—were computed to characterise the sample; (2) Shapiro–Wilk normality tests were applied to each variable to verify the assumption of normality required for parametric analysis; (3) ANOVA-based linearity tests were performed to confirm a linear relationship between variables; and (4) Pearson simple correlation analysis was used to test the hypothesis, with significance determined at  $p < 0.05$ .

## RESULT

The results are presented sequentially: descriptive statistics, frequency distribution, normality testing, linearity testing, and correlation analysis.

**Table 1.** Descriptive Statistics of Hand-Eye Coordination and Overhead Service Skills

| Variable                | N  | Range | Min | Max | Mean  | SD    |
|-------------------------|----|-------|-----|-----|-------|-------|
| Hand-Eye Coordination   | 20 | 7     | 18  | 25  | 21.80 | 2.262 |
| Overhead Service Skills | 20 | 9     | 15  | 24  | 20.35 | 2.621 |

**Table 1.** indicates that for hand-eye coordination, the 20 athletes produced a mean score of 21.80 (SD = 2.262), with values ranging from 18 to 25. For overhead service skills, the mean score was 20.35 (SD = 2.621), with values ranging from 15 to 24. The moderate standard deviations across both variables suggest reasonable within-group variability, indicating that athletes exhibit differing levels of both coordination and service proficiency.

**Table 2.** Frequency Distribution of Overhead Service Skills

| <b>Norm</b> | <b>Category</b> | <b>Frequency</b> | <b>Percentage</b> |
|-------------|-----------------|------------------|-------------------|
| 24.4 >      | Very Good       | 0                | 0%                |
| 24.3 – 21.8 | Good            | 8                | 40%               |
| 21.7 – 19.0 | Sufficient      | 7                | 35%               |
| 18.9 – 16.4 | Poor            | 3                | 15%               |
| < 16.3      | Very Poor       | 2                | 10%               |
| Total       |                 | 20               | 100%              |

As shown in Table 2, the majority of athletes (40%,  $n = 8$ ) demonstrated good overhead service skills, followed by 35% in the sufficient category ( $n = 7$ ), 15% in the poor category ( $n = 3$ ), and 10% in the very poor category ( $n = 2$ ). No athletes achieved the very good category, suggesting room for overall improvement.

**Table 3.** Frequency Distribution of Hand-Eye Coordination

| <b>Norm</b> | <b>Category</b> | <b>Frequency</b> | <b>Percentage</b> |
|-------------|-----------------|------------------|-------------------|
| 25.3 >      | Very Good       | 0                | 0%                |
| 25.2 – 23.0 | Good            | 9                | 45%               |
| 22.9 – 20.6 | Sufficient      | 5                | 25%               |
| 20.5 – 18.4 | Poor            | 4                | 20%               |
| < 18.3      | Very Poor       | 2                | 10%               |
| Total       |                 | 20               | 100%              |

Table 3 shows that 45% of athletes ( $n = 9$ ) demonstrated good hand-eye coordination, 25% were in the sufficient category ( $n = 5$ ), 20% in the poor category ( $n = 4$ ), and 10% in the very poor category ( $n = 2$ ). No athlete reached the very good category, consistent with the service skills distribution.

**Table 4.** Results of Normality Test (Shapiro-Wilk)

| <b>Variable</b>         | <b>N</b> | <b><math>\alpha</math></b> | <b>Sig.</b> | <b>P</b>              | <b>Ket.</b> |
|-------------------------|----------|----------------------------|-------------|-----------------------|-------------|
| Hand-Eye Coordination   | 20       | 0.05                       | 0.179       | $\text{Sig} > \alpha$ | Normal      |
| Overhead Service Skills | 20       | 0.05                       | 0.423       | $\text{Sig} > \alpha$ | Normal      |

The Shapiro-Wilk normality test results (Table 4) confirmed that both variables were normally distributed. Hand-eye coordination yielded a significance value of 0.179 ( $> 0.05$ ), and overhead service skills yielded 0.423 ( $> 0.05$ ). These results support the appropriateness of parametric statistical procedures.

**Table 5.** Results of Linearity Test (ANOVA)

| Variable          | N  | $\alpha$ | F-value | Sig.  | Ket.   |
|-------------------|----|----------|---------|-------|--------|
| $X \rightarrow Y$ | 20 | 0.05     | 2.504   | 0.083 | Linear |

The ANOVA linearity test (Table 5) produced  $F = 2.504$  and  $\text{Sig.} = 0.083$ . Since  $\text{Sig.} (0.083) > 0.05$  and  $F\text{-obtained} (2.504) < F\text{-table} (2.996)$ , the assumption of linearity between hand-eye coordination and overhead service skills was confirmed, warranting the use of Pearson correlation analysis.

**Table 6.** Results of Simple Correlation Analysis

| Variable                | N  | Sig. (2-tailed) | r (Pearson) |
|-------------------------|----|-----------------|-------------|
| Hand-Eye Coordination * | 20 | 0.000           | 0.882       |
| Overhead Service Skills |    |                 |             |

The simple correlation analysis (Table 6) revealed a Pearson correlation coefficient ( $r$ ) of 0.882 with a sig. (2-tailed) value of 0.000. Since  $0.000 < 0.05$ , the null hypothesis ( $H_0$ ) was rejected, confirming a statistically significant and very strong positive correlation between hand-eye coordination and overhead service skills in BKMF Volleyball Sparta FIKK UNM athletes.

## DISCUSSION

The results of this study demonstrate that hand-eye coordination is very strongly associated with overhead service skills among university-level volleyball athletes ( $r = 0.882$ ,  $p < 0.001$ ). This finding aligns with the theoretical premise that effective service execution requires precise visuomotor integration—athletes must track the ball during the toss and synchronise their striking motion to contact the ball at the optimal point above the head.

These results are consistent with previous studies examining the role of coordination in volleyball performance. Sovensi (2018) demonstrated that hand-eye coordination significantly influenced smash accuracy among senior high school volleyball players, noting that athletes with higher coordination scores produced more effective attack strikes. Similarly, Sugra et al.

(2023) found significant relationships between hand-eye coordination, arm explosive power, and overhead service performance among competitive players, further substantiating the multifactorial nature of service quality.

At a physiological and neuromuscular level, the correlation can be explained through the concept of the visuomotor loop. The visual system provides real-time feedback during the ball toss phase, guiding the timing and trajectory of the striking arm. Athletes with superior hand-eye coordination demonstrate faster processing of visual information and more accurate motor responses, resulting in more consistent and directed service execution. Natasya et al. (2024) confirmed this mechanism by reporting significant relationships between hand-eye coordination and pointing accuracy in petanque, a precision-demand sport with comparable visuomotor requirements.

The frequency distributions further contextualise these findings. The fact that most athletes fell in the good rather than very good category for both hand-eye coordination and service skills suggests that while a basic coordination foundation exists, there is substantial scope for performance enhancement through targeted training. The parallel distribution patterns across both variables provide indirect ecological validity to the correlation finding—athletes who scored higher on coordination also tended to score higher on service quality.

From a practical standpoint, these findings underscore the importance of incorporating hand-eye coordination exercises into volleyball training periodisation. Drills such as ball throwing and catching in pairs (with varied trajectories), juggling with multiple balls, and ring-tossing activities have been recommended as effective coordination-enhancement methods (Nur Amal Kadri, 2025). When implemented systematically and progressively, such drills can improve the neuromuscular efficiency underlying service execution.

## **CONCLUSION AND RECOMMENDATIONS**

This study confirms that hand-eye coordination has a statistically significant and very strong positive correlation with overhead service skills in BKMF Volleyball Sparta FIKK UNM male athletes ( $r = 0.882$ ,  $\text{Sig.} = 0.000 < 0.05$ ). The better an athlete's hand-eye coordination, the better their overhead service performance. The majority of athletes demonstrated good levels of both hand-eye coordination (45%) and overhead service skills (40%), with no athlete reaching the very good category, indicating potential for further development.

Based on these findings, the following recommendations are offered: (1) Coaches should integrate systematic hand-eye coordination training—including ball throwing and catching, juggling, and ring-tossing drills—into weekly training programs to enhance service performance; (2) Athletes are encouraged to engage in additional coordination exercises outside formal training sessions to accelerate individual development; (3) Future research should expand the scope of investigation to include female athletes, investigate additional variables such as arm explosive power and mental concentration, and employ experimental designs to establish causal relationships.

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