Rahedin

2070-Article Text-8686-1-18-20260611 (1).pdf

Universitas Sembilanbelas November Kolaka

Document Details

Submission ID
trn:oid:::3618:142570205

Submission Date
Jun 11, 2026, 2:13 PM GMT+8

Download Date
Jun 11, 2026, 2:15 PM GMT+8

File Name
2070-Article Text-8686-1-18-20260611 (1).pdf

File Size
4.0 MB

15 Pages

7,014 Words

41,003 Characters

12% Overall Similarity

The combined total of all matches, including overlapping sources, for each database.

Filtered from the Report

- Bibliography
- Quoted Text
- Methods and Materials

Exclusions

- 8 Excluded Matches

Match Groups

61 Not Cited or Quoted 10%
Matches with neither in-text citation nor quotation marks

15 Missing Quotations 3%
Matches that are still very similar to source material

0 Missing Citation 0%
Matches that have quotation marks, but no in-text citation

0 Cited and Quoted 0%
Matches with in-text citation present, but no quotation marks

Top Sources

10% Internet sources
8% Publications
0% Submitted works (Student Papers)

Integrity Flags

0 Integrity Flags for Review

No suspicious text manipulations found.

Our system's algorithms look deeply at a document for any inconsistencies that would set it apart from a normal submission. If we notice something strange, we flag it for you to review.

A Flag is not necessarily an indicator of a problem. However, we'd recommend you focus your attention there for further review.

Match Groups

- **61** Not Cited or Quoted 10%
  Matches with neither in-text citation nor quotation marks
- **15** Missing Quotations 3%
  Matches that are still very similar to source material
- **0** Missing Citation 0%
  Matches that have quotation marks, but no in-text citation
- **0** Cited and Quoted 0%
  Matches with in-text citation present, but no quotation marks

Top Sources

10% Internet sources
8% Publications
0% Submitted works (Student Papers)

Top Sources

The sources with the highest number of matches within the submission. Overlapping sources will not be displayed.

1	Internet	public-pages-files-2025.frontiersin.org 1%
2	Internet	www.mdpi.com <1%
3	Internet	journal.unucirebon.ac.id <1%
4	Internet	www.frontiersin.org <1%
5	Publication	Mirosław Pawlak, Mariusz Kruk. "Investigating the Effects of Grammar Learning S... <1%
6	Publication	Thomas Reilly, Jan Cabri, Duarte Araújo. "Science and Football V - The Proceeding... <1%
7	Internet	sasportssience.blob.core.windows.net <1%
8	Publication	Sophia Terwiel, Sarah Kritzler, John Rauthmann, Maike Luhmann. "Person-enviro... <1%
9	Internet	core-varnish-new.prod.aop.cambridge.org <1%
10	Internet	pmc.ncbi.nlm.nih.gov <1%

11	Internet	
www.kif.unizg.hr		<1%
12	Publication	
Fernandes, Rui António de Almeida Duarte. "Sports Specialization in Young Male ...		<1%
13	Internet	
journals.lww.com		<1%
14	Internet	
journals.researchsynergypress.com		<1%
15	Publication	
Xiaoyi Yang, Yuqi He, Shirui Shao, Julien S. Baker, Bíró István, Yaodong Gu. "Gend...		<1%
16	Internet	
journals.cambridgemedia.com.au		<1%
17	Internet	
www.pure.ed.ac.uk		<1%
18	Internet	
www.researchsquare.com		<1%
19	Internet	
ijhsrd.com		<1%
20	Internet	
oss.signavitae.com		<1%
21	Internet	
www.agriculturaljournals.com		<1%
22	Internet	
academic.oup.com		<1%
23	Internet	
odontologos.com.co		<1%
24	Internet	
peac.org.ph		<1%

25 Internet
www.journal.unucirebon.ac.id <1%

26 Internet
exbulletin.com <1%

27 Internet
journal.nsa.bg <1%

28 Internet
link.springer.com <1%

29 Publication
Fabiola Haas, Timo Klein-Soetebier, Stefanie Klatt. "Erforschung der Beinarbeitste... <1%

30 Internet
bmcinfectdis.biomedcentral.com <1%

31 Internet
efsupit.ro <1%

32 Internet
www.stemmpress.com <1%

33 Publication
Ödemiş, Hasan. "Growth and Maturity Status of Medal-Winning Young Table Ten... <1%

34 Publication
Liye Zou, Liu Ji, Fabian Herold, Aiguo Chen. "The Handbook of Physical Activity an... <1%

35 Internet
hrcak.srce.hr <1%

36 Internet
s3-ap-southeast-2.amazonaws.com <1%

37 Internet
wicherts.socsci.uva.nl <1%

38 Internet
www.db-thueringen.de <1%

39 Publication

Amat Komari, Fadli Ihsan, Rezha Arzhan Hidayat. "Вплив високоінтенсивного т... <1%

40 Publication

Tomáš Válek, Adrián Agricola, Petr Konečný, Robert Vysoký, Jiří Zháněl. "Handgrip... <1%

41 Internet

dergipark.org.tr <1%

42 Internet

e.bangor.ac.uk <1%

43 Internet

ejournal.pnc.ac.id <1%

44 Internet

jmpo.stkippasundan.ac.id <1%

45 Internet

mediatum.ub.tum.de <1%

46 Internet

oa.upm.es <1%

47 Internet

www.springermedizin.de <1%

48 Publication

Jess C. Dixon, Sean Horton, Laura Chittle, Joe Baker. "Relative Age Effects in Sport ... <1%

49 Publication

Moon, Jongho. "Three Studies Investigating Comprehensive School Physical Activi... <1%

IJPESS
Indonesian Journal of Physical Education and Sport Science
p-ISSN 2775-765X | e-ISSN 2776-0200
Volume 6, No. 2, June 2026. Page. x-xx
http://journal.unucirebon.ac.id/index.php ijpess

Analysis of Differences in Serve, Smash, Block, and Chop Skills between Male and Female Student Table Tennis Athletes in Kolaka Regency

Rahedin Suwo[1*], Nofi Marlina Siregar[2], Novri Asri[3]

[1]Faculty of Teacher Training and Education, Universitas Sembilanbelas November Kolaka, Indonesia

[2,3]Faculty of Sports Science, Universitas Negeri Jakarta, Indonesia

*Corresponding Author: Rahedin Suwo, e-mail: rahedinsuwou76@gmail.com

Received: xx Month 2023, Approved: xx Month 2023, Published: xx Month 2023

Abstract

Study purpose. This study aimed to describe the basic table tennis skill profile of student athletes in Kolaka Regency and to compare the performance of male and female athletes across four fundamental technical components: serve, smash, block, and chop.

Materials and methods. This study employed a descriptive quantitative approach with a cross-sectional design. A total of 25 student athletes (13 males and 12 females) from table tennis training programs in Kolaka Regency participated in the study. Basic technical skills were assessed using a validated instrument covering four components: serve, smash, block, and chop. Descriptive statistics were used to identify the overall skill profile, while independent sample t-tests were conducted to compare male and female athletes in each component. Effect sizes were calculated using Cohen's *d*, and 95% confidence intervals were reported to complement the significance testing.

Results. The results showed that the athletes were generally at an intermediate level of basic technical proficiency. Among the four components, serve had the highest mean score, whereas chop was the weakest skill component. Significant differences between male and female athletes were found in smash ($p = .031$, $d = 0.92$) and chop ($p = .021$, $d = 0.99$), with male athletes obtaining higher scores in both components. In contrast, no significant differences were observed in serve ($p = .231$) and block ($p = .598$). The total score comparison showed a medium-to-large effect size ($d = 0.67$), although the difference did not reach statistical significance ($p = .109$), indicating that the result should be interpreted cautiously.

Conclusions. Student athletes in Kolaka Regency generally demonstrated intermediate-level basic table tennis skills, with stronger performance in serve and weaker performance in chop. Differences between male and female athletes were not evident across all skill components, but were more pronounced in smash and chop. These findings provide an initial empirical basis for evaluating athlete performance and for supporting more targeted coaching practices in the

local context. However, the results should be interpreted with caution due to the relatively small sample size and the cross-sectional design of the study..

Keywords: Table Tennis, Basic Techniques, Student Athletes, Gender Differences, Coaching Program, Skill Evaluation
DOI: https://doi.org/10.52188/ijpess.v3i1

Introduction

Table tennis is a fast-paced and highly demanding sport that requires the integration of technical accuracy, perceptual-cognitive processing, rapid reaction, movement coordination, and tactical adaptability. Unlike many other sports in which performance may be sustained through isolated physical or technical attributes, successful table tennis performance depends on the ability to execute precise motor actions in extremely limited time and space. Athletes are required to respond quickly to changing ball trajectories, spin variations, and opponent strategies while maintaining stroke control and positional balance throughout rallies. Therefore, table tennis performance cannot be understood only as physical ability or isolated stroke execution; it reflects the integration of cognitive-motor efficiency and sport-specific technical competence (Fuchs et al., 2018; Guarnieri et al., 2025; Tian et al., 2025). Recent work has further emphasized that table tennis-specific performance assessments must reflect these integrated demands, because conventional general fitness testing alone is insufficient to capture the sport's cognitive–motor complexity (Guarnieri et al., 2025). In addition, service execution itself has been shown to involve distinct kinematic demands depending on tactical intention, reinforcing the idea that even apparently basic strokes in table tennis require advanced technical organization and control (Bańkosz et al., 2025).

For student athletes, the mastery of basic techniques is particularly important because these skills form the foundation for subsequent tactical development and long-term competitive progression. Core technical components such as serve, smash, block, and chop are not merely isolated movements; they represent the operational basis of attacking and defensive play in real match situations. Serve enables players to initiate rallies strategically and create early advantages, smash reflects offensive power and finishing ability, block is central to controlling pace against incoming attacks, and chop supports defensive stability and variation. Because these four components are fundamental to both learning and competition, evaluating them provides a useful picture of the athlete's current developmental profile. In addition, a youth-focused technical skill assessment study emphasized that table tennis evaluation should consider ecologically valid technical elements rather than relying only on isolated or single-skill outcomes (Faber et al., 2021). More recent research on elite players has similarly underlined the importance of comprehensive technical and tactical evaluation for understanding actual playing performance, suggesting that systematic skill profiling is valuable not only at elite levels but also during the formative stages of athlete development (Z. Chen et al., 2025).

In youth sport settings, the need for accurate assessment becomes even more important because performance differences cannot be interpreted solely as differences in current technical ability. Growth, biological maturation, training age, and exposure to coaching all influence how athletes acquire and express sport-specific skills. This is particularly relevant in table tennis, where slight differences in coordination, reaction speed, limb control, and movement efficiency may substantially affect performance outcomes. Research on young table tennis players has shown that developmental status and maturity-related variation remain relevant considerations in understanding youth performance profiles (Coelho-e-Silva et al., 2022). At the same time, recent evidence suggests that training interventions targeting agility, strength, balance, and movement efficiency can improve performance-related capacities in young table tennis players,

highlighting the close interaction between physical development and technical execution (Q. Chen et al., 2025; Y. Liu et al., 2026). Therefore, when evaluating student athletes, it is important not only to document performance levels but also to generate evidence that can guide age-appropriate and development-sensitive coaching decisions.

Within this broader framework, comparing the performance of male and female student athletes is also an important area of inquiry. Existing sport science literature has frequently reported differences between male and female athletes in variables related to strength, speed, power production, and movement patterns, all of which may shape the execution of technical skills in sport. In table tennis specifically, recent analysis of high-level players has shown that technical–tactical actions may differ between the sexes, with female players tending to use more defensive strokes while male players more often display patterns associated with more aggressive play (Pradas de la Fuente et al., 2023). However, such evidence has largely emerged from elite competitive settings and not from school-age or regional athlete populations. Consequently, the extent to which similar tendencies appear among student athletes remains uncertain (Abenza Cano et al., 2017). This distinction matters because student athletes are still in the process of skill acquisition, physical maturation, and tactical learning; thus, findings derived from senior elite players cannot automatically be generalized to younger or developing athletes. In other words, although prior studies provide a useful conceptual background, there remains a clear need to investigate whether male and female student athletes demonstrate comparable or divergent profiles in basic table tennis techniques within local developmental contexts.

Another problem emerging from the present research title concerns the possibility of differences between male and female athletes. In sport science, sex-related differences may appear in strength, speed, power, movement patterns, and tactical behavior, especially during adolescence. In table tennis, high-level match analysis has shown that male and female players may differ in technical-tactical patterns, including rally characteristics and the use of attacking or defensive strokes (Pradas de la Fuente et al., 2023). Nevertheless, most evidence on sex differences in table tennis has been generated from elite or adult players. It remains unclear whether similar patterns are already visible among regional student athletes who are still in the process of skill acquisition and physical development. This uncertainty provides a strong empirical reason to analyze male and female athletes separately rather than assuming that their technical profiles are identical or uniformly different.

The local context also strengthens the relevance of this topic. Athlete development in Indonesian regional settings often faces practical challenges, including unequal access to facilities, limited systematic monitoring, variation in coaching quality, and restricted competition exposure. In such conditions, coaches may depend heavily on informal observation rather than structured evidence regarding athletes' strengths and weaknesses. Previous Indonesian studies on sport coaching and achievement development have indicated that regional sport programs still need stronger evaluation systems, better resource management, and more evidence-based planning (Maghfiroh et al., 2022; Suparno et al., 2020). For Kolaka Regency, empirical information on the technical profile of student table tennis athletes remains limited, although such information is necessary for designing more targeted coaching programs.

The choice of the present title is therefore based on three main considerations. First, serve, smash, block, and chop are core technical variables that directly represent offensive and defensive demands in table tennis. Second, male and female student athletes may show different skill profiles because of differences in maturation, training exposure, confidence, tactical habits, or physical readiness; however, these differences need to be tested empirically. Third, Kolaka Regency requires local evidence that can help coaches identify priority areas for training rather than applying a generic program to all athletes. By combining these three considerations, the study is positioned not merely as a descriptive comparison, but as an analysis of practical

and measurable technical differences that can inform coaching decisions. Moreover, recent systematic evidence in youth table tennis indicates that training programs can improve speed, strength, agility, endurance, and flexibility, but the magnitude and consistency of those improvements vary across studies and populations (Y. Liu et al., 2026). This suggests that technical evaluation should be conducted with enough detail to identify which skill domains require greater attention and whether these needs differ across athlete groups. Such information is especially valuable when training design aims to become more targeted, efficient, and context-sensitive.

Based on these considerations, the present study was conducted to examine the basic table tennis skills of student athletes in Kolaka Regency and to compare the performance profiles of male and female athletes across four essential technical components: serve, smash, block, and chop. Specifically, this study aimed: (1) to describe the overall profile of basic table tennis skills among student athletes; (2) to compare the basic table tennis skills of male and female student athletes in each technical component; and (3) to identify the distribution of skill levels within the two groups. By focusing on a regional student-athlete population, this study seeks to contribute context-specific empirical evidence to the literature on table tennis development, which has so far been dominated by elite or non-Indonesian samples. The findings are expected to provide a more grounded basis for evaluating current athlete ability and for supporting the design of more targeted coaching programs in local settings. In this way, the study contributes not only to the academic understanding of basic skill profiles in youth table tennis, but also to the practical improvement of athlete development systems in regions where such evidence is still scarce.

Materials and methods

Research Design

This study uses a descriptive quantitative method with a cross-sectional design to analyze the basic table tennis skills profile of student athletes. This method was chosen because it allows researchers to obtain a comprehensive picture of the athletes' skills at a given time without changing the variables (Creswell & Creswell, 2022). The cross-sectional design is also useful for identifying patterns of differences between groups, especially in the context of gender differences, which is the main focus of this study (Field, 2018).

Participant

Participants consisted of 25 student athletes, comprising 13 males and 12 females, who were actively engaged in table tennis training programs in Kolaka Regency, Southeast Sulawesi, Indonesia. The participants were aged 12–17 years, with a mean age of 14.3 years and a standard deviation of 1.5 years. All participants had at least one year of competitive playing experience. Participants were aged 12–17, with a mean age of 14.3 years and a standard deviation of 1.5 years. All participants had at least one year of competitive gaming experience. Participants were identified using an anonymous code to protect their confidentiality. The distribution of participant codes by sex and age is presented in Table 1. Inclusion criteria were: (a) registered as an active student athlete; (b) training regularly at least three times per week; (c) free from injury that could interfere with performance; and (d) voluntary participation with written informed consent from participants and parents/guardians. In more detail, the characteristics of the research sample can be described in the following table:

Table 1. Distribution of Participant Codes by Sex and Age

No.	Male Participant Code	Age	Female Participant Code	Age
1	M01	13	F01	12
2	M02	13	F02	12
3	M03	13	F03	12
4	M04	14	F04	13
5	M05	14	F05	13
6	M06	14	F06	14
7	M07	14	F07	15
8	M08	14	F08	15
9	M09	15	F09	16
10	M10	15	F10	16
11	M11	15	F11	17
12	M12	16	F12	17
13	M13	16	—	—

Note. M = male participant code; F = female participant code. Codes are used to preserve participant confidentiality.

Table 2. Mean Age and Standard Deviation by Sex

Sex	n	%	Age Range	Mean Age	Standard Deviation
Male	13	52	13–16 years	14.31	1.03
Female	12	48	12–17 years	14.33	1.92
Total	25	100	12–17 years	14.32	1.49

Instruments

Basic skill abilities were measured using a validated table tennis skill test instrument adapted from previous studies (Malagoli Lanzoni et al., 2014; Tian et al., 2025). This instrument assesses four fundamental components:

1) Serve: Ability to execute serves with spin variation and accurate placement (score range: 0-100);
2) Smash: Ability to perform attacking shots with speed and accuracy (score range: 0-100);
3) Block: Defensive skills using efficient blocking techniques against opponents' attacks (score range: 0-100);
4) Chop: Ability to execute defensive shots with stable backspin (score range: 0-100).

Prior to data collection, the instrument underwent cultural and contextual adaptation for Indonesian student athletes following the International Test Commission (ITC) guidelines for test adaptation (International Test Commission, 2018). The adaptation process involved: (1) Forward-backward translation of assessment protocols by bilingual sport science experts (English-Indonesian); (2) Content validity assessment by a panel of three certified Indonesian national table tennis coaches and two sport psychology experts, yielding a Content Validity Index (CVI) of 0.92; (3) Pilot testing with 15 student athletes (not included in main study) to verify cultural appropriateness of instructions and scoring rubrics; and (4) Minor adjustments to terminology to match local coaching vernacular (e.g., "chop" adapted as "chop/defensif backspin" to align with Indonesian coaching terminology).

This validation process ensured that the instrument captured skill components relevant to the local training context while maintaining equivalence with the original instrument's psychometric properties. Each skill component was evaluated by three independent assessors

certified as national table tennis coaches. Inter-rater reliability was excellent (Cronbach's α = 0.92).

Data Collection

Data collection was conducted in two separate sessions with a minimum 48-hour rest interval to avoid the effects of fatigue. All athletes underwent a standard 15-minute warm-up before the test. The test was conducted by three independent assessors certified as national table tennis coaches, and the final score was obtained from the average of the three assessors' scores (inter-rater reliability α = 0.92). Each skill element was tested 10 times, and the highest and lowest scores were discarded to reduce the influence of outliers, so that the final score was calculated from the average of the 8 best trials (R. Liu et al., 2025).

Data Analysis

Descriptive statistics (mean, standard deviation, minimum, maximum) were calculated for each skill component. Skill levels were classified according to the following criteria (Kondrič et al., 2013): Beginner (0-50), Intermediate (51-70), and Advanced (71-100). Prior to conducting independent sample t-tests, assumptions of normality and homogeneity of variances were examined. The Shapiro-Wilk test was used to assess normality of distribution for each skill component by gender. Levene's test for equality of variances was conducted to verify homogeneity assumptions. Where assumptions were violated ($p < .05$), Welch's t-test (robust to heterogeneity) was applied as an alternative to the standard independent sample t-test.

To examine gender differences, independent sample t-tests were conducted for each skill component. Effect sizes were calculated using Cohen's d, with interpretations of negligible (<0.2), small (0.2-0.5), medium (0.5-0.8), and large (≥0.8) (Cohen, 2013). To complement null hypothesis significance testing (NHST), 95% confidence intervals (CI) for mean differences were calculated to provide information about the precision and range of plausible effect magnitudes. Post-hoc power analysis (G*Power 3.1) was conducted to determine observed power for detecting medium effects ($d = 0.5$) given the sample size of n=25, with results interpreted cautiously to avoid power-based error bias (Hoenig & Heisey, 2001). Statistical significance was set at $p < .05$. All analyses were performed using IBM SPSS Statistics version 26.0.

Results

Overall Skill Profile

Analysis revealed that the overall average basic technical ability of student athletes in Kolaka Regency was in the intermediate range ($M = 55.55$, $SD = 10.04$). Among the four assessed components, serving demonstrated the highest average score ($M = 59.86$, $SD = 9.14$), followed by smash ($M = 57.28$, $SD = 12.47$), block ($M = 55.76$, $SD = 9.37$), and chop ($M = 49.24$, $SD = 9.28$). These findings indicate that student athletes demonstrated better mastery of attacking techniques (serve and smash) compared to defensive techniques (block and chop).

The distribution of skill levels across the entire sample showed that 36% of athletes were classified as beginners, 56% as intermediate, and only 8% achieved advanced level. This distribution highlights the need for enhanced training programs to support more athletes in reaching higher skill levels.

Gender Differences in Skill Components

Comparison between male and female athletes revealed notable differences across skill components. Preliminary assumption testing confirmed that all skill components satisfied the assumption of normality (Shapiro-Wilk $p > .05$ for all variables) except for male smash scores ($p = .032$), which showed slight positive skewness (1.24). However, given the robustness of t-

tests to moderate non-normality with equal sample sizes (Field, 2018), parametric tests were retained. Levene's test indicated homogeneity of variances for all components ($p > .05$), satisfying the equal variance assumption. Table 1 presents the descriptive statistics and inferential test results for each component.

Table 1. Comparison of Basic Table Tennis Skills by Gender

Component	Male (M±SD)	Female (M±SD)	t	p	Cohen's d	95% CI
Service	62.15±10.36	57.58±7.91	1.23	.231	0.49	[-3.24, 12.38]
Smash	62.31±13.02	52.25±7.99	2.30	.031*	0.92	[0.78, 17.34]
Block	56.69±10.73	54.67±7.85	0.54	.598	0.21	[-5.47, 9.51]
Chop	54.08±10.83	44.67±7.85	2.47	.021*	0.99	[1.68, 17.14]
Total	58.81±11.19	52.29±7.89	1.67	.109	0.67	[-1.52, 14.56]

Note. * $p < .05$. CI = confidence interval; M = mean; SD = standard deviation.

Independent sample t-tests revealed statistically significant gender differences in two components. Male athletes scored significantly higher than female athletes in smash ($t(23) = 2.30$, $p = .031$, $d = 0.92$) and chop ($t(23) = 2.47$, $p = .021$, $d = 0.99$), with both demonstrating large effect sizes and 95% CIs not crossing zero. For the total composite score, while the mean difference (6.52 points) suggested a moderate-to-large practical advantage for males ($d = 0.67$), the 95% confidence interval [-1.52, 14.56] included zero and the effect did not reach conventional statistical significance ($p = .109$), indicating uncertainty regarding the true population effect. No significant differences were observed in service ($p = .231$) and block ($p = .598$) skills.

Post-hoc power analysis revealed that with the current sample size (n=25) and alpha = .05, the observed power for detecting a medium effect ($d = 0.5$) was 0.35 (below the conventional threshold of 0.80). For large effects ($d = 0.9$), observed power was 0.78, approaching adequate levels. This indicates that the non-significant finding for total score likely reflects insufficient statistical power rather than the absence of a true effect, given the medium-to-large observed effect size.

Figure 1. Data Collection Documentation

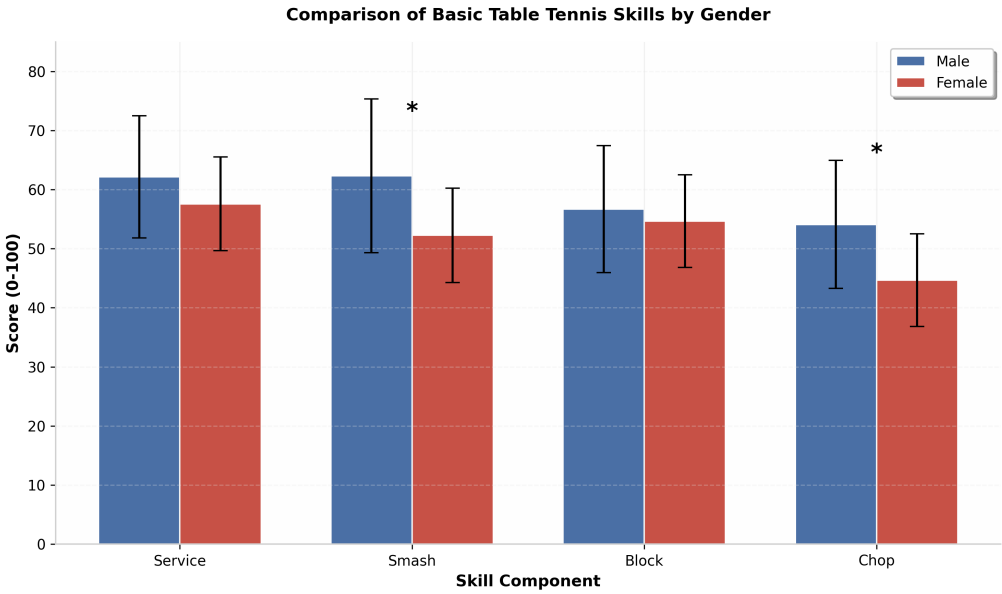

Figure 2. Comparison of basic table tennis skills by gender. Error bars represent standard deviations. * $p < .05$

Skill Level Distribution by Gender

Analysis of skill level distribution revealed distinct patterns between male and female athletes. Among male athletes (n = 13), 30.8% were classified as beginners, 53.8% as intermediate, and 15.4% as advanced. In contrast, among female athletes (n = 12), 41.7% were

beginners, 58.3% were intermediate, and notably, no female athletes (0%) achieved advanced level.

Table 2. Distribution of Skill Levels by Gender

Gender	Beginner n (%)	Intermediate n (%)	Advanced n (%)
Male (n=13)	4 (30.8%)	7 (53.8%)	2 (15.4%)
Female (n=12)	5 (41.7%)	7 (58.3%)	0 (0.0%)

Figure 2 presents the skill level distribution for male and female athletes, highlighting the disparity in advanced-level achievement.

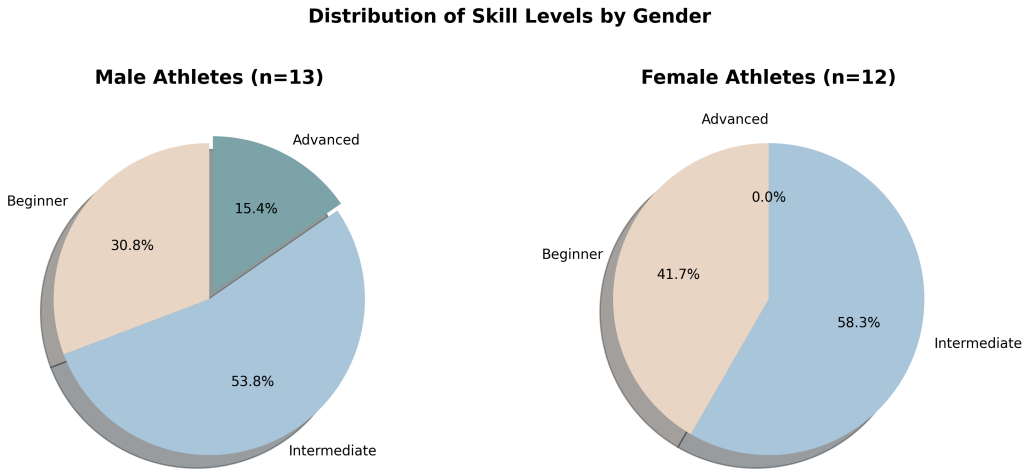

Figure 2. Distribution of skill levels by gender

Effect Size Analysis

37

Figure 3 displays the effect sizes (Cohen's d) for gender differences across all skill components. The largest effects were observed for chop (d = 0.99) and smash (d = 0.92), both indicating large practical significance.

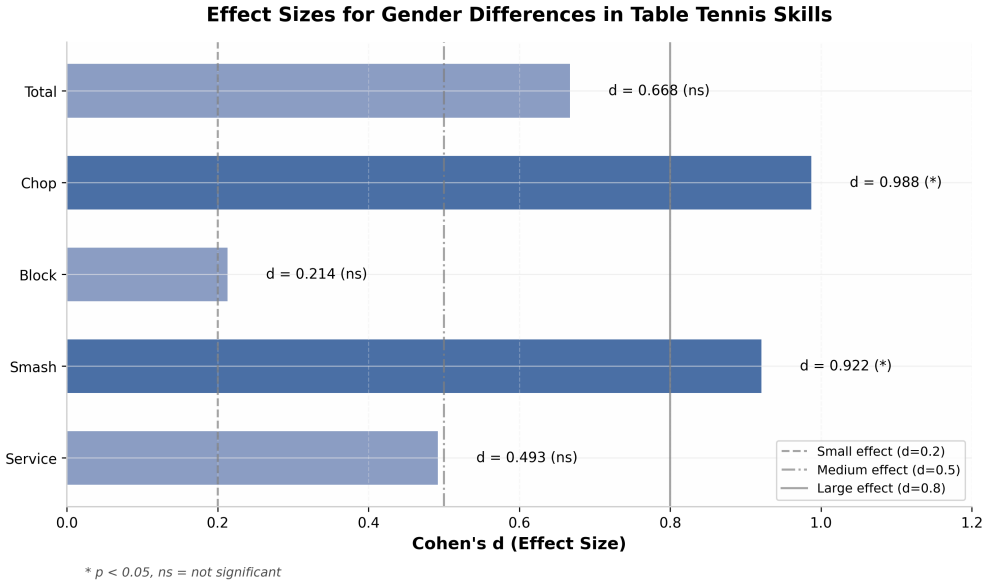

Figure 3. Effect sizes (Cohen's d) for gender differences in table tennis skills. * p < .05, ns = not significant

Discussion

Overall Technical Skill Profile of Student Athletes

The present study examined the basic table tennis skill profiles of student athletes in Kolaka Regency and compared the performance of male and female athletes across four fundamental technical components: serve, smash, block, and chop. Overall, the findings indicate that the athletes were generally at an intermediate level of performance. Among the four components assessed, serve showed the highest mean score, while chop emerged as the weakest component. This pattern suggests that the participants had developed a relatively better foundation in initiating play than in managing defensive situations, particularly those requiring greater control of spin, timing, and reactive stroke execution.

The relatively high performance in serve may reflect the central place of service practice in routine training. In table tennis, serve is a unique technical component because it is performed under complete player control, without direct interference from the opponent. This allows athletes to focus on refining ball placement, spin variation, and consistency through repeated practice. As a result, serve may be acquired and stabilized earlier than other technical skills that depend more heavily on rally dynamics and opponent pressure. Previous studies have similarly highlighted the strategic importance of serve in shaping rally initiation and creating early tactical advantage during competition (Bańkosz et al., 2025; R. Liu et al., 2025; Malagoli Lanzoni et al., 2014). In this context, the strong performance in serve among the present sample may indicate that current coaching practices have been relatively successful in developing this foundational skill.

In contrast, chop was identified as the weakest skill component in the overall sample. This finding is meaningful because chop is a complex defensive technique that requires not only technical knowledge, but also refined perceptual-motor coordination, control of racket angle, timing, and the ability to generate stable backspin under reactive conditions. Unlike serve, chop is performed in response to incoming shots and therefore depends strongly on anticipation, touch, and the capacity to regulate force against variable ball trajectories. Earlier research has shown that defensive table tennis techniques are highly sensitive to coordination quality and repeated exposure to representative game situations (Tian et al., 2025; Yongtawee et al., 2022). The relatively low scores in chop therefore suggest that defensive skill development may still receive less emphasis than attacking skill practice in the local coaching context. From a developmental perspective, this imbalance is important because effective performance in modern table tennis requires the capacity to transition smoothly between attacking and defensive play according to match demands (Fuchs et al., 2018; Zagatto et al., 2010).

The predominance of athletes in the intermediate category also deserves attention. Although this pattern indicates that the athletes have acquired basic technical competence, it also suggests that a substantial proportion have not yet progressed to a more advanced level of execution. This may reflect the reality of athlete development in regional settings, where training opportunities and performance support systems may still be limited. In such contexts, athletes may receive enough practice to achieve functional technical proficiency, but not always the individualized and progressive training needed to refine performance to a higher standard. Therefore, the overall skill profile revealed in this study can be interpreted as both a sign of developmental potential and an indicator of the need for more systematic skill progression within local table tennis programs.

Differences between Male and Female Athletes in Technical Components

A central finding of this study is that the differences between male and female athletes were not consistent across all technical components. Statistically significant differences were found only in smash and chop, whereas no significant differences were observed in serve and

block. This result is important because it suggests that the performance profiles of male and female student athletes cannot be generalized as uniformly different across all basic skills. Instead, the differences appear to be component-specific and may be influenced by the distinct technical and physical demands of each stroke.

The higher scores achieved by male athletes in smash may be partly related to the physical and biomechanical demands of this stroke. Smash is an attacking skill that relies on explosive force production, coordination of trunk and upper-limb movement, timing of contact, and the ability to accelerate the racket rapidly while maintaining directional accuracy. Sport science literature has frequently shown that male athletes tend to demonstrate higher levels of strength, anaerobic power, and movement explosiveness, especially during adolescence, which may contribute to better performance in power-oriented actions (Coelho-e-Silva et al., 2022; Fuchs et al., 2018; Zhang et al., 2018). However, this interpretation should be made cautiously. The present study did not directly assess strength, maturation status, or biomechanical characteristics; therefore, the observed difference in smash should not be attributed solely to physiological factors. It is equally possible that training history, stroke confidence, and opportunities for repeated offensive practice also contributed to the performance gap.

The difference observed in chop is somewhat more complex. Although chop is commonly understood as a defensive technique, effective chop execution still requires sufficient strength and acceleration control to generate stable backspin, as well as fine coordination to manage incoming force and spin. In addition, chop places substantial demands on anticipation and on the player's ability to read the opponent's ball trajectory. The higher scores among male athletes in this component may therefore reflect a combination of physical readiness, technical familiarity, and accumulated playing experience rather than a single underlying cause. Research on table tennis performance has shown that defensive technical actions involve a sophisticated interplay of perceptual, coordinative, and tactical elements, especially under match-like conditions (Guarnieri et al., 2025; Yongtawee et al., 2022). This suggests that the lower performance among female athletes in chop should be interpreted as a developmental training issue rather than as evidence of a fixed limitation.

Equally important is the finding that no significant differences were identified in serve and block. These results indicate that some technical skills may depend more on precision, timing, positioning, and quality of practice than on maximal physical output. Serve, for example, is strongly influenced by technical repetition, spin control, and movement consistency, while block relies heavily on anticipation, hand control, and the efficient use of the opponent's incoming force. Because these skills are less directly dependent on explosive power, female athletes may be able to perform at levels comparable to male athletes when coaching input and practice exposure are sufficient. This interpretation is consistent with previous work suggesting that not all table tennis skill components are equally sensitive to sex-related performance differences and that technical-tactical training quality remains a critical determinant of performance (Abenza Cano et al., 2017; Fuchs et al., 2018; Pradas de la Fuente et al., 2023).

The skill level distribution findings further support the need for a nuanced interpretation. Although a higher proportion of male athletes reached the advanced category, no female athletes were classified at this level. This pattern may suggest uneven progression between groups, but it should not be interpreted in a deterministic manner. Athlete development is influenced by multiple interacting factors, including training duration, coaching quality, competitive exposure, biological maturation, and social support for sport participation (Coelho-e-Silva et al., 2022). Therefore, the absence of female athletes in the advanced category may reflect broader contextual limitations rather than inherent differences in potential. In this sense, the results of the present study underscore the importance of providing equitable developmental opportunities and more responsive technical support for all athletes.

Practical Implications for Coaching Programs

From a practical standpoint, the findings of this study provide several useful implications for coaching programs in Kolaka Regency. First, the results suggest the need for a more balanced training emphasis across technical domains. While serve appears to have been developed relatively well, weaker performance in chop indicates that defensive skills may require greater attention. Coaches may therefore consider allocating more structured practice time to reactive defensive drills, spin-control exercises, and match-based scenarios that help athletes develop stability in block-to-chop transitions and defensive rally management.

Second, because significant differences were observed in smash and chop, coaches may benefit from identifying athletes who require additional support in these components and tailoring training accordingly. For athletes with lower smash performance, drills emphasizing timing, footwork adjustment, trunk coordination, and progressive power generation may be beneficial (Dong & Yan, 2024). For athletes with weaker chop performance, technical repetition should ideally be combined with perceptual training, ball-reading practice, and controlled defensive exchanges that simulate realistic match demands. Recent evidence also suggests that multidirectional movement training, balance training, and broader physical conditioning can support the development of movement efficiency and performance-related capacities in young table tennis players (Z. Chen et al., 2025; Y. Liu et al., 2026).

At the same time, coaching recommendations should remain proportional to the scope of the findings. The present study does not support rigid assumptions that male athletes are categorically superior or that female athletes should be trained according to fixed limitations. Rather, the data suggest that some technical components may currently be less developed in certain athletes and therefore require more targeted coaching attention. Accordingly, the most appropriate practical implication is not a strict sex-based training separation, but a more individualized and evidence-informed approach in which athletes are evaluated regularly and trained according to their actual technical needs.

Limitations and Future Research

Several limitations of this study should be acknowledged. First, the sample size was relatively small, which reduces statistical power and limits the precision of the estimated group differences. This is particularly relevant for the total score comparison, where the observed effect size suggested practical importance, yet the confidence interval remained wide and included zero. As a consequence, non-significant findings in this study should be interpreted as inconclusive rather than as strong evidence of no difference.

Second, the cross-sectional design provides only a snapshot of current performance and does not allow conclusions about developmental change or causality. The study identifies differences in technical skill profiles, but it cannot determine whether those differences are caused by physical development, training exposure, coaching practices, or other contextual variables. Third, potentially influential factors such as biological maturation, years of training, competitive experience, and detailed coaching history were not examined in depth, even though these variables may substantially shape youth sport performance. Fourth, although the adapted assessment instrument demonstrated strong content validity and high inter-rater reliability, further research is still needed to establish its criterion-related validity in relation to actual match performance and competitive outcomes in Indonesian settings.

Despite these limitations, the study contributes meaningful preliminary evidence to the literature on youth table tennis development in Indonesia. Most previous studies have focused on elite players or on non-Indonesian populations, whereas this research addresses a regional student-athlete context in which developmental pathways may differ considerably. Future studies should therefore include larger samples, longitudinal designs, and a broader range of explanatory variables in order to better understand how technical skills develop over time and

how training programs can be optimized for different athlete needs. Such research would not only strengthen the scientific basis of athlete evaluation, but also support the long-term improvement of evidence-based coaching practice in regional table tennis development.

Conclusions

This study examined the basic table tennis skill profiles of student athletes in Kolaka Regency and compared the performance of male and female athletes across four fundamental technical components. Overall, the findings showed that the athletes were generally at an intermediate level of basic technical proficiency. Among the assessed components, serve demonstrated the strongest performance, whereas chop emerged as the weakest skill, indicating that defensive technique development may still require greater attention in the local training context.

The comparative analysis revealed that significant differences between male and female athletes were found only in smash and chop, with male athletes achieving higher scores in both components. In contrast, no significant differences were observed in serve and block. These results suggest that differences between male and female student athletes were not uniform across all basic table tennis skills, but were more evident in specific components that may involve greater physical and coordinative demands.

Taken together, these findings provide an initial empirical basis for evaluating the current technical abilities of student athletes in Kolaka Regency and for supporting more targeted coaching practices. However, the results should be interpreted cautiously due to the relatively small sample size and the cross-sectional design of the study. Future research involving larger samples, longitudinal approaches, and additional training-related variables is needed to strengthen understanding of skill development patterns in youth table tennis and to support more evidence-based athlete development programs.

Acknowledgment

The authors sincerely acknowledge the support of the Education Office and the Youth and Sports Office of Kolaka Regency, Southeast Sulawesi, Indonesia, for permitting and facilitating the conduct of this study. The authors are also grateful to the certified table tennis coaches and assessors for their valuable assistance in the administration and evaluation of the skill tests. Special appreciation is extended to all student athletes who participated in this research, together with their parents, guardians, and school authorities for their cooperation and support throughout the study. The authors also thank all individuals and institutions who contributed, directly or indirectly, to the successful completion of this research.

Conflict of interest

There is no conflict of interest.

References

Abenza Cano, L., Olmedilla Zafra, A., & Martínez Fábrega, C. (2017). Propuesta de entrenamiento psicológico integrado al deportivo en el tenis de mesa: una experiencia en el CAR Sant Cugat de Barcelona. *INFORMACIO PSICOLOGICA*, *0*(112 SE-DOSSIER), 74–94. https://doi.org/10.14635/IPSIC.2016.112.6

Bańkosz, Z., Winiarski, S., & Malagoli Lanzoni, I. (2025). Kinematic Analysis of Short and Long Services in Table Tennis. In *Applied Sciences* (Vol. 15, Issue 1, p. 470). https://doi.org/10.3390/app15010470

Chen, Q., Li, Y., Heng, X., Zhao, L., & Wu, B. (2025). The effects of 8 weeks of multi-directional movement training combined with balance training on the change of direction of young table tennis players. *Frontiers in Physiology*, *16*.

https://doi.org/https://doi.org/10.3389/fphys.2025.1541639

Chen, Z., Li, M., & Yang, Q. (2025). Evaluation of elite table tennis players' comprehensive technical and tactical performance. *BMC Sports Science, Medicine and Rehabilitation*, *17*(1), 45. https://doi.org/10.1186/s13102-025-01092-8

Coelho-e-Silva, M. J., Konarski, J. M., Krzykała, M., Galas, S., Beata, P., Żurek, P., Faria, J., Tavares, O. M., Oliveira, T. G., Rodrigues, I., Martinho, D. V, Valente-Dos-Santos, J., & Malina, R. M. (2022). Growth and maturity status of young male table tennis players. *Research in Sports Medicine*, *30*(1), 61–79. https://doi.org/10.1080/15438627.2021.1888099

Cohen, J. (2013). *Statistical Power Analysis for the Behavioral Sciences* (5th ed.). Routledge. https://doi.org/https://doi.org/10.4324/9780203771587

Creswell, J. W., & Creswell, J. D. (2022). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (Sixth Edit). Sage College Publishing.

Dong, K., & Yan, W. Q. (2024). Player Performance Analysis in Table Tennis Through Human Action Recognition. In *Computers* (Vol. 13, Issue 12, p. 332). https://doi.org/10.3390/computers13120332

Faber, I. R., Koopmann, T., Büsch, D., & Schorer, J. (2021). Developing a tool to assess technical skills in talented youth table tennis players—a multi-method approach combining professional and scientific literature and coaches' perspectives. *Sports Medicine - Open*, *7*(1), 42. https://doi.org/10.1186/s40798-021-00327-5

Field, A. (2018). *Discovering Statistics Using IBM SPSS Statistics*. SAGE Publications.

Fuchs, M., Liu, R., Malagoli Lanzoni, I., Munivrana, G., Straub, G., Tamaki, S., Yoshida, K., Zhang, H., & Lames, M. (2018). Table tennis match analysis: a review. *Journal of Sports Sciences*, *36*(23), 2653–2662. https://doi.org/10.1080/02640414.2018.1450073

Guarnieri, A., Laurenti, F., Mazzei, S., Presta, V., & Condello, G. (2025). Assessing Cognitive–Motor Performance in Table Tennis: Validity and Reliability of the Reactive Table Tennis Test. In *Applied Sciences* (Vol. 15, Issue 18, p. 10163). https://doi.org/10.3390/app151810163

Hoenig, J. M., & Heisey, D. M. (2001). The Abuse of Power. *The American Statistician*, *55*(1), 19–24. https://doi.org/10.1198/000313001300339897

International Test Commission. (2018). ITC Guidelines for Translating and Adapting Tests (Second Edition). *International Journal of Testing*, *18*(2), 101–134. https://doi.org/10.1080/15305058.2017.1398166

Kondrič, M., Zagatto, A. M., & Sekulić, D. (2013). The physiological demands of table tennis: a review. *Journal of Sports Science & Medicine*, *12*(3), 362–370. https://pmc.ncbi.nlm.nih.gov/articles/PMC3772576/

Liu, R., Rothe, F., & Lames, M. (2025). Performance assessment in elite table tennis matches using the enhanced first offensive shot model. *BMC Sports Science, Medicine and Rehabilitation*, *17*(1), 140. https://doi.org/10.1186/s13102-025-01183-6

Liu, Y., Abdullah, B. Bin, Abu Saad, H. Bin, Li, K., & Fan, C. (2026). Effects of exercise training on physical fitness of youth table tennis players: a systematic review. *Frontiers in Physiology*, *17*. https://www.frontiersin.org/journals/physiology/articles/10.3389/fphys.2026.1782585

Maghfiroh, M., Swadesi, I. K. I., & Sudarmada, I. N. (2022). Evaluasi Program Pembinaan Prestasi Cabang Olahraga Taekwondo dengan Metode Contex , Input , Process , Product. *Jurnal Ilmu Keolahragaan Undiksha*, *10*(3), 284–291. https://doi.org/https://doi.org/10.23887/jiku.v10i3.52846

Malagoli Lanzoni, I., Di Michele, R., & Merni, F. (2014). A notational analysis of shot characteristics in top-level table tennis players. *European Journal of Sport Science*, *14*(4), 309–317. https://doi.org/https://doi.org/10.1080/17461391.2013.819382

Pradas de la Fuente, F., Ortega-Zayas, M. Á., Toro-Román, V., & Moreno-Azze, A. (2023). Analysis of Technical–Tactical Actions in High-Level Table Tennis Players: Differences between Sexes. In *Sports* (Vol. 11, Issue 11, p. 225). https://doi.org/10.3390/sports11110225

Suparno, S., Hidayanto, D. N., & Labulan, P. M. (2020). Manajemen Pembinaan Prestasi Olahraga di Sekolah Khusus Olahragawan Internasional (SKOI) Kalimantan Timur. *Pendas Mahakam : Jurnal Pendidikan Dan Pembelajaran Sekolah Dasar*, *4*(1), 22–31. https://doi.org/10.24903/pm.v4i1.393

Tian, J., Liu, Y., & Xiao, Y. (2025). The correlation between table tennis players' reaction agility and stroke effect. *Scientific Reports*, *16*(1), 1673. https://doi.org/10.1038/s41598-025-31222-8

Yongtawee, A., Park, J., Kim, Y., & Woo, M. (2022). Athletes have different dominant cognitive functions depending on type of sport. *International Journal of Sport and Exercise Psychology*, *20*(1), 1–15. https://doi.org/10.1080/1612197X.2021.1956570

Zagatto, A. M., Morel, E. A., & Gobatto, C. A. (2010). Physiological Responses and Characteristics of Table Tennis Matches Determined in Official Tournaments. *The Journal of Strength & Conditioning Research*, *24*(4). https://doi.org/https://doi.org/10.1519/JSC.0b013e3181cb7003

Zhang, H., Zhou, Z., & Yang, Q. (2018). Match analyses of table tennis in China: a systematic review. *Journal of Sports Sciences*, *36*(23), 2663–2674. https://doi.org/10.1080/02640414.2018.1460050

Information about the authors:

Rahedin Suwo, S.Pd., M.Pd.: rahedinsuwou76@gmail.com, https://orcid.org/0000-0001-8370-8810, Faculty of Teacher Training and Education, Universitas Sembilanbelas November Kolaka, Indonesia

Prof. Dr. Nofi Marlina Siregar, M.Pd.: nofims@unj.ac.id, https://orcid.org/0000-0002-5529-3803, Faculty of Sports Science, Universitas Negeri Jakarta, Indonesia

Dr. Novri Asri, M.Pd.: novri.asri@unj.ac.id, https://orcid.org/0000-0002-5338-7005, Faculty of Sports Science, Universitas Negeri Jakarta, Indonesia

Cite this article as:

Suwo, Rahedin. et all. (2026). Analysis of Differences in Serve, Smash, Block, and Chop Skills between Male and Female Student Table Tennis Athletes in Kolaka Regency. *Indonesian Journal of Physical Education and Sport Science. 6* (2). Xx-xx. doi