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The Effects of Power, Reaction Speed, and Coordination on Forehand Topspin Accuracy in Table Tennis

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ABSTRACT

This study is motivated by the suboptimal accuracy of the forehand topspin stroke in table tennis, which is assumed to be related to several physical condition components, arm muscle power, reaction speed, and coordination. The purpose of this study is to examine the effect of these three variables on the accuracy of the forehand topspin among table tennis athletes. The method used is a quantitative descriptive approach with a correlational design. The sample consisted of 14 athletes selected using total sampling technique. Data were collected through a series of tests and measurements, including push-up test to measure power, ruler drop test to assess reaction speed, ball throw-and-catch test for coordination, and forehand topspin accuracy tests. Data analysis included descriptive statistics, normality test, linearity test, multicollinearity test, and multiple linear regression. The results showed that arm muscle power was in the good category, while reaction speed, coordination, and forehand topspin accuracy were in the moderate category. The regression analysis indicates that the power variable has a significance value (p) of 0.716, the reaction variable has a p value of 0.217, and the coordination variable has a p value of 0.543. Partially, the three independent variables did not show a significant effect on forehand topspin accuracy ($p > 0.05$). These findings indicate that forehand topspin accuracy is not only determined by physical condition, but also influenced by technical skills, playing experience, and training consistency.
Keywords: Table Tennis, Topspin, Power, Speed Reaction, Coordination

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INTRODUCTION

Sports are physical activities that play an important role in maintaining physical fitness (Kosen et al., 2025). The habit of exercising regularly can help maintain health and improve physical endurance, so that a person is more prepared and optimal in carrying out various daily activities (Arlita et al., 2024). Sports and recreation have a close and complementary relationship. Both contribute positively to each other, thereby providing sustainable benefits in improving overall health and individual well-being (Rangkuti et al., 2023). Sports not only function as a means of entertainment and recreation, but also have a strategic role in achieving performance. Through a planned training process and continuous coaching, sports are able to develop the potential of individuals and teams to compete and achieve optimal results at various levels, ranging from regional, national, to international. (Munandar et al., 2025). In the context of achievement sports in the educational environment, table tennis is one of the sports that has a high level of popularity and is often used as learning material in physical education activities in schools (Hasmarita et al., 2025).

Table tennis is an inclusive sport because it can be played by various groups without age restrictions, ranging from children to adults (Letsoin et al., 2023). Every individual has an equal opportunity to participate in this game. In addition, table tennis does not require a large space, with equipment that is relatively lightweight, easy to obtain, and available at affordable prices for various segments of society. The flexibility of its implementation time also makes table tennis an activity that can be carried out at any time according to individual needs (Pranata et al., 2024). Nevertheless, to perform optimally, table tennis still requires mastery of various stroke techniques as well as the skill to control and maneuver the racket effectively during a match. These abilities become important factors in maintaining consistency in play while also building strategies to gain points (Riskawati & Suwo, 2025).

As a foundation for technical mastery, players need to understand two main types of strokes, namely the forehand and backhand. Mastery of these two techniques becomes an important basis for developing overall playing skills. In table tennis, there are five basic strokes performed through forehand and backhand techniques, namely the drive, push, chop, and service (Faris et al., 2022). Each type of stroke has its own specific characteristics as well as a different role in supporting the implementation of game strategies. (Herliana et al., 2025). Basic techniques in table tennis can be developed into various stroke variations according to tactical needs and game situations. One of the basic techniques that has been developed is the drive. The drive technique is then varied into more aggressive forms of strokes, such as topspin and smash, which require higher levels of speed, power, and control. Among the various technique variations, the forehand topspin is one of the most commonly used attacking strokes. This technique functions as an offensive strategy because it can produce strong ball spin, making it difficult for opponents to anticipate and return the ball (Am et al., 2025). The forehand topspin technique involves coordinated movement of the entire body, with primary emphasis on the upper body. Through proper movement synergy, players can generate strong ball spin while directing the ball in accordance with the planned game strategy (Mao et al., 2023).

Excellent physical condition is a crucial factor for athletes in achieving and maintaining optimal performance, especially when facing matches in table tennis championships (Tumaloto et al., 2024). In table tennis, mastery of general physical condition components including power, endurance, muscular strength, speed, coordination, flexibility, agility, balance, accuracy, and reaction time plays an important role in supporting athletes' ability to perform optimally during matches (Fahrudin & Hafidz, 2023). Physical condition is a fundamental component that must be possessed by every athlete. When physical condition is at an optimal level, athletes will be better prepared to handle training loads without experiencing excessive fatigue. Therefore, the maintenance and improvement of physical condition need to be carried out continuously through athletes' awareness and discipline, supported by supervision and systematically planned training programs designed by coaches (Lisa et al., 2025).

Reaction speed is an individual's ability to respond to a stimulus quickly and accurately (Akbar & Hasan, 2022). In table tennis, reaction speed is one of the physical condition components that plays a crucial role. This component holds a level of importance equal to other physical elements, such as endurance, strength, coordination, and flexibility. Good reaction speed enables athletes to respond to game stimuli quickly and accurately, thereby supporting performance and the effectiveness of technique execution during matches.

Hand–eye coordination plays a crucial role in observing the direction and speed of the incoming ball, estimating the point of contact between the ball and the racket, adjusting body and hand position, and executing the stroke accurately. Through this ability, players can produce strokes that are more directed, stable, and accurate, allowing their responses to be aligned with the dynamics and demands of the game situation (Fadli, 2026). If hand–eye coordination does not develop optimally, individuals tend to experience difficulty in reading and accurately predicting the direction of the incoming ball. This condition can lead to inaccuracies in executing strokes, resulting in suboptimal outcomes and even failure to produce effective and well-targeted shots (Ariandi et al., 2026).

Arm muscle power is one of the physical condition components that has a dominant contribution in table tennis, especially in match situations. This component plays a significant role in producing strokes that are fast, sharp, and powerful. Theoretically, arm muscle power is understood as a combination of strength and speed that work together in a single movement, resulting in optimal explosive power (Arrahmat et al., 2025). When physical condition is at an optimal level, individuals have the capacity to undergo technical training with higher intensity and complexity. Adequate physical readiness not only supports the optimal execution of training but also provides opportunities for players to develop tactical abilities in a more systematic, focused, and efficient manner (Arrahmat et al., 2025).

A number of studies have examined the relationship between arm muscle power, reaction, and coordination with the ability to perform forehand strokes. However, studies that simultaneously analyze the contribution of these variables to the accuracy level of forehand topspin strokes are still relatively limited, especially in the context of athlete development at the regional club level. In fact, the forehand topspin has different technical characteristics compared to the forehand drive, particularly in terms of generating ball spin, which requires greater control, precision, and more complex movement synchronization.

Based on the above description, this study aims to analyze the effect of arm muscle power, reaction, and coordination on the accuracy of forehand topspin in PTM BTTS table tennis players. However, previous studies have generally examined these variables in isolation, and research that simultaneously analyzes the combined contribution of arm muscle strength, reaction speed, and coordination to the accuracy of the forehand topspin particularly among club-level athletes remains limited. Therefore, this study offers a more integrative approach by investigating these variables within a single regression model. The findings obtained are expected to serve as a basis for developing more comprehensive training programs by integrating the development of physical condition components and technical skills proportionally, thereby supporting the optimal improvement of table tennis athletes' performance.

METHOD

This study employed a quantitative descriptive method with a correlational approach. Correlational research is an approach used to analyze the relationship between one or more independent variables and another variable as the dependent variable (Arlita et al., 2024). This approach was used to determine the effect of the variables Power (X1), Reaction (X2), and Coordination (X3) on forehand topspin accuracy. The measurements included a power test (push-up) with a validity coefficient of r = 0,91 and a reliability coefficient of r = 0,97. The reaction test (ruler drop) demonstrated validity based on face validity, with a reliability coefficient of 0,89. The coordination test (ball throw-and-catch) showed a validity value of r

= 0,922 and a reliability value of r = 0,835. Meanwhile, the forehand topspin accuracy test had a validity coefficient of r = 0,44 and a reliability coefficient of r = 0,643. The procedure for conducting the forehand topspin accuracy test in table tennis was carried out based on predetermined stages and criteria to objectively measure the level of stroke accuracy. The equipment used in this study included a table tennis table, balls, racket, measuring tape, adhesive tape, scoring sheets, stationery, and documentation devices to support the implementation and recording of test data.

The relatively small sample size was due to the limited number of active athletes at the Bonpolo Table Tennis School club. Therefore, a total sampling technique was employed to ensure that all members of the population were adequately represented in the study. The data analysis technique was carried out through several stages, starting with descriptive statistical analysis to determine the mean, standard deviation, minimum, and maximum values of each variable, followed by prerequisite tests including normality and linearity tests to ensure that the data met the assumptions required for correlational analysis.

RESULT AND DISCUSSION

Result

The descriptive analysis results indicate that the participants had an average arm muscle power of 39.07, a reaction speed of 0.1887, coordination ability of 16.07, and a forehand topspin accuracy score of 38.14. All collected data were confirmed to be valid, indicating that they are suitable for further analysis.

Table 1. Descriptive Statistics

	Sample	Minimum	Maximum	Mean	Std. Deviation
Power	14	19	51	39,07	9,177
Reaction	14	0,15	0,22	0,1887	0,01904
Coordination	14	3	37	16.07	10.321
Topspin	14	17	58	38,14	12,290

Based on the results, the “good” category shows the highest frequency, with 6 out of 14 samples. In addition, 3 respondents (21%) are classified in the “good” category and another 3 respondents (21%) fall into the “poor” category. Meanwhile, the “moderate” and “very poor” categories each consist of 1 respondent (7%). Therefore, it can be concluded that the majority of respondents are in the “good” category, indicating that the overall level of ability tends to fall within this classification.

Table 2. Arm Muscle Power Test Results

Category	Class Interval	Frequency	Percentage
Very Good	47-53	3	21%
Good	40-46	6	43%
Fair	33-39	1	7%
Poor	26-32	3	21%
Very Poor	19-25	1	7%

The results of the reaction speed test indicate that the “fair” category has the highest frequency, with 6 participants (43%). In addition, 3 participants (21%) fall into the “good” category, while 2 participants (14%) are classified as “poor” and another 2 participants (14%) as “very poor.” Only 1 participant (7%) is included in the “very good” category.

Therefore, it can be concluded that, overall, the respondents' reaction speed tends to fall within the fair category.

Table 3. Reaction Test Results

Category	Class Interval	Frequency	Percentage
Very Good	23-25	1	7%
Good	20-22	3	21%
Fair	17-19	6	43%
Poor	14-16	2	14%
Very Poor	11-13	2	14%

The results of the coordination test show that the "very poor" category has the highest frequency, with 5 respondents (36%), followed by the "poor" category with 4 respondents (29%). In addition, 3 respondents (21%) fall into the "good" category, while 1 respondent (7%) is classified as "very good" and another 1 respondent (7%) as "fair." Therefore, it can be concluded that the overall level of respondents' coordination tends to range between very poor and poor.

Table 4. Coordination Test Results

Category	Class Interval	Frequency	Percentage
Very Good	31-37	1	7%
Good	24-30	3	21%
Fair	17-23	1	7%
Poor	10-16	4	29%
Very Poor	3-9	5	36%

The results of the forehand topspin test indicate that the "fair" category has the highest frequency, with 7 respondents (50%) of the total sample. In addition, 3 respondents (21%) fall into the "very poor" category, while 2 respondents (14%) are classified as "very good" and another 2 respondents (14%) as "good." Therefore, it can be concluded that, overall, the respondents demonstrate a moderate level of forehand topspin ability.

Table 5. Hasil Tes Forehand Topspin

Category	Class Interval	Frequency	Percentage
Very Good	53-61	2	14%
Good	44-52	2	14%
Fair	35-43	7	50%
Poor	26-34	0	0%
Very Poor	17-25	3	21%

Normality Test

To determine whether the variables under study follow a normal distribution, a normality test was conducted. The test was performed using the Shapiro–Wilk method, considering that the sample size was less than 50. All data analyses were carried out using SPSS software, and the results of the normality test are presented as follows.

Table 6. Normality Test Results

Variable	Shapiro-wilk Statistic	df	Sig.
Power	0,938	14	0,388
Topspin	0,931	14	0,319
Coordinaton	0,931	14	0,318
Reaction	0,944	14	0,477

Based on the results of the normality test, all variables—power, topspin, coordination, and reaction—show significance values greater than 0.05 in the Shapiro–Wilk test. Therefore, the data can be considered normally distributed and suitable for further analysis.

Linearity Test

The results of the linearity test are presented as follows. This test was conducted to determine whether the relationship between the independent variables and the dependent variable in this study follows a linear pattern.

Table 7. Linearity Test Results

Variable	df	Sig.
Topspin Power	1	0,568
Topspin Reaction	1	0,051
Topspin Coordination	1	0,514

Based on the results of the linearity test, power (0.568), reaction (0.051), and coordination (0.514) each show significance values greater than 0.05 (Sig. > 0.05). Therefore, it can be concluded that the relationships among the variables are linear, indicating that regression analysis can be appropriately conducted.

Multicollinearity Test

The multicollinearity test is used to determine whether there is a strong correlation among the independent variables in the regression model and to ensure that each independent variable is not highly correlated with one another. In other words, this test helps confirm that each variable contributes distinctly to the dependent variable. A good regression model is indicated by a Tolerance value greater than 0.10 and a Variance Inflation Factor (VIF) value less than 10, suggesting no multicollinearity issue. Once these assumptions are met, the regression model can be used for further analysis.

Table 8. Multicollinearity Test Results

Model	Tolerance	VIF
Power	0,660	1,516
Reaction	0,829	1,206
Coordination	0,712	1,405

The results of the multicollinearity test indicate that the tolerance values for coordination (0.660), power (0.829), and reaction (0.712) are all above 0.10, while the corresponding VIF values of 1.516, 1.206, and 1.405 are below 10. Therefore, it can be concluded that the regression model does not exhibit symptoms of multicollinearity.

Multiple Linear Regression Test

In this study, multiple linear regression analysis was employed to examine the influence of several independent variables on the dependent variable, both simultaneously and partially. This analysis also determines the extent to which each independent variable contributes to explaining the variation in the dependent variable, as well as the direction and strength of the relationships. Therefore, it provides a more comprehensive understanding of the research model used.

Table 9. Simultaneous Regression Test Results

Model	F	R^2	Sig.
Regresi	1,457	0,304	0,716

Based on the regression analysis, the F value was 1.457 with a coefficient of determination (R^2) of 0.304. This indicates that strength, reaction, and coordination collectively account for 30.4% of the variation in topspin ability. However, the significance value of 0.716 ($p > 0.05$) shows that the regression model is not statistically significant, meaning that these three independent variables do not have a meaningful simultaneous effect on topspin performance. These findings suggest that the accuracy of the forehand topspin is the result of a complex interaction of physical condition, technical mastery, playing experience, and consistent training, rather than being influenced by a single factor alone. Therefore, although physical condition plays an important role, good technical skills and specific training remain crucial factors in improving forehand topspin accuracy.

Table 10. Multiple Linear Regression Test Results

Model	Koefisien	Sig.
Power	-0,145	0,716
Reaction	-266,044	0,217
Coordination	0,244	0,543

The results of the partial regression test show that the power variable has a coefficient of -0.145 with a significance value of 0.716 ($p > 0.05$), the reaction variable has a coefficient of -266.044 with a significance value of 0.217 ($p > 0.05$), and the coordination variable has a coefficient of 0.244 with a significance value of 0.543 ($p > 0.05$). These findings indicate that, partially, none of the three variables have a significant effect on topspin ability.

Discussion

Descriptively, as presented in Table 1, the results indicate that the average arm muscle power is 39.07, which falls into the "good" category. Meanwhile, the average reaction speed of 0.1887 and coordination of 16.07 are both classified in the "fair" category, and the average forehand topspin accuracy score of 38.14 is also categorized as "fair." These findings suggest that the athletes' overall forehand topspin technique has not yet reached an optimal level. This condition may be influenced by variations in the athletes' physical abilities, which in turn affect their technical performance.

To perform strokes quickly and effectively in table tennis, players need to possess adequate arm muscle power as a key supporting factor for movement performance. (Mahendra et al., 2014). However, the regression results ($p > 0.05$) indicate that power does not have a significant effect on forehand topspin accuracy. This suggests that power alone is insufficient without proper technical control. Research Results (Arrahmat et al., 2025) The results indicate that power contributes to generating strokes; however, movement coordination and the proper application of technique play a crucial role in determining the effectiveness of the stroke.

In addition, reaction speed does not have a significant effect on forehand topspin accuracy. However, the findings of this study differ from those reported by (Suparman & Hasbillah, 2021) which suggest that the ability to execute strokes in table tennis is highly influenced by the player's hand reaction speed.

The non-significant effect of this variable in the present study may be related to the characteristics of the forehand topspin stroke, which emphasize control, precise timing, and technical mastery rather than merely the speed of responding to stimuli. Therefore, stroke

outcomes tend to remain less accurate even when athletes possess good reaction speed, if they are not supported by optimal technical proficiency.

In addition, the coordination variable shows a similar pattern, as it does not have a significant effect on the accuracy of the forehand topspin stroke. This finding is noteworthy, considering that, theoretically, hand–eye coordination is regarded as a crucial factor in determining stroke accuracy. Study (Pranata et al., 2024) It has been explained that the coordination variable is closely related to the ability to execute strokes in table tennis. However, one possible reason for the absence of a significant effect in this study is that the majority of respondents have relatively low levels of coordination.

Overall, the results of the study indicate that, partially, the variables of power, reaction, and coordination do not have a significant effect on the accuracy of the forehand topspin stroke. This suggests that forehand topspin accuracy is the result of a complex interaction between physical condition, technical mastery, playing experience, and consistent training, rather than being influenced by a single factor alone. Therefore, although physical condition plays an important role, proper technical mastery and specific training remain crucial factors in improving the accuracy of the forehand topspin stroke.

This perspective offers a new viewpoint that no longer positions physical condition as the sole primary factor. Instead, it considers performance more holistically, emphasizing that physical condition will yield optimal results when supported by proper technique and adequate training experience. Therefore, in the process of athlete development, training programs should be designed in an integrated manner by combining physical conditioning and sport-specific technical training simultaneously and implemented consistently over time.

Overall, the findings of this study indicate that the accuracy of the forehand topspin stroke is influenced by multiple interrelated factors. Therefore, focusing on a single aspect alone is not sufficient to improve stroke accuracy. Instead, a comprehensive and integrated training approach is required to achieve optimal improvements in accuracy.

CONCLUSION

Based on the results of the data analysis and the discussion presented, the findings indicate that, descriptively, the athletes' arm muscle power is classified as relatively good, while reaction speed, coordination, and forehand topspin accuracy fall into the fair category. Thus, the overall forehand topspin ability has not yet reached an optimal level. Furthermore, inferential analysis reveals that, partially, the variables of arm muscle power, reaction speed, and hand–eye coordination do not have a significant effect on the accuracy of the forehand topspin stroke.

This indicates that the accuracy of the forehand topspin stroke is not solely influenced by physical condition, but also by technical mastery, the complexity of movement coordination, playing experience, and training consistency. Therefore, efforts to improve forehand topspin ability should be carried out through a training approach that integrates physical conditioning with the development of sport-specific technical skills.

REFERENCES

Akbar, A., & Hasan, M. S. (2022). KONTRIBUSI RASA PERCAYA DIRI, KECEPATAN REAKSI DAN PERSEPSI KINESTETIK DENGAN KETERAMPILAN BERMAIN TENIS MEJA PADA PEMAIN PUTERA KOTA MAKASSAR. *Jurnal Olahraga Kebugaran dan Rehabilitasi (JOKER)*, *2*(1), 30–42. https://doi.org/10.35706/joker.v2i1.6639

Am, L., Donie, D., Haryanto, J., & Edmizal, E. (2025). Pengaruh Latihan Wall Volley Terhadap Peningkatan Forehand Topspin Pemain Tenis Meja PTM Gujes Kab. Sijunjung. *Jurnal Gladiator*, *5*(9), 1735–1744. https://doi.org/10.24036/gltdor2215011

Ariandi, M. Y., Haryanto, J., Lesmana, H. S., & Putra, Y. A. (2026). Hubungan Koordinasi Mata Tangan Terhadap Pukulan Backhand Push Tenis Meja Pada Siswa Ekstrakurikuler SMA N 1 Kecamatan Guguak. *Jurnal Gladiator*, *6*(1), 220–232. https://doi.org/10.24036/gltdor2276011

Arlita, D., M.Pd, D. A., M.Pd, D. M. R., & Jeki Haryanto S. Si, M. P. (2024). Kontribusi Kontribusi Kelincahan dan Kekuakatan Otot Lengan Terhadap Ketepatan Topspin Tenis Meja Pada Mahasiswa FIK UNP. *Jurnal Gladiator*, *4*(4), 891–904. https://doi.org/10.24036/gltdor1222011

Arrahmat, M., Arwandi, J., Yendrizal, Y., & Haryanto, J. (2025). Pengaruh Latihan Power Otot Lengan terhadap Kemampuan Smash Forehand Atlet UK Tenis Meja Universitas Negeri Padang. *Jurnal Gladiator*, *5*(2), 305–315. https://doi.org/10.24036/gltdor1716011

Fadli, M. (2026). *PENGARUH LATIHAN TERHADAP KEMAMPUAN PUKULAN DRIVE PADA PERMAINAN TENIS MEJA*.

Fahrudin, A., & Hafidz, A. (2023). PROFIL KONDISI FISIK ATLET TENIS MEJA PADA PTM ARTA JAYA KOTA KEDIRI. *Jurnal Prestasi Olahraga*, *6*(1), 116–123. https://doi.org/10.1234/jpo.v6i1.53165

Faris, L. A., Kusmaedi, N., Ugelta, S., & Ronald, H. (2022). *THE EFFECT OF LIFE KINETIC TRAINING ON TABLE TENNIS FOREHAND STRIKE ACCURACY*.

Hasmarita, S., Sobarna, A., Hambali, S., & Melani, R. (2025). Efektivitas Pendekatan Bermain dalam Meningkatkan Keterampilan Forehand Drive Tenis Meja pada Anak Usia 12-13 Tahun. *Jurnal Master Penjas & Olahraga*, *6*(1), 597–604. https://doi.org/10.37742/jmpo.v6i1.130

Herliana, M. N., Indrawan, B., Rubiana, I., & Yajid, F. A. (2025). Pengaruh Latihan Multiball Terhadap Ketepatan Forehand Drive dalam Tenis Meja. *Journal of SPORT (Sport, Physical Education, Organization, Recreation, and Training)*, *9*(2), 460–470. https://doi.org/10.37058/sport.v9i2.16291

Kosen, Y. D., Apriadi, A., Jannah, S. M., Adiwijaya, W., & Hasanah, A. N. (2025). OLAHRAGA SEBAGAI SOLUSI KESEHATAN: MANFAAT DAN RISIKO BERDASARKAN TINJAUAN SISTEMATIS. *Jurnal Kesehatan Bakti Tunas Husada: Jurnal Ilmu-ilmu Keperawatan, Analis Kesehatan dan Farmasi*, *25*(2), 60–71. https://doi.org/10.36465/jkbth.v25i2.1707

Letsoin, H. S. N., Hukubun, M. D., & Solissa, J. (2023). Survei Ketrampilan Dasar Bermain Tenis Meja pada Mahasiswa Penjaskesrek Angkatan 2021. *Journal on Education*, *5*(4), 16687–16694. https://doi.org/10.31004/joe.v5i4.2853

Lisa, Juita, A., Rahmatullah, M. I., & Zainur. (2025). Analisis Kondisi Fisik Atlet Tenis Meja Sekolah Keberbakatan Olahraga. *Journal Sport Science Indonesia*, *4*(4), 43–50. https://doi.org/10.31258/jassi.4.4.43-50

Mahendra, I. R., Sugiyarto, S., & Kiyatno, K. (2014). Faktor Kondisi Fisik Dominan Penentu Prestasi Bermain Tenis Meja (Analisis Faktor Fleksibilitas Pergelangan Tangan, Fleksibilitas Pinggul, Waktu Reaksi, Koordinasi Mata Tangan, Kelincahan , dan Power Otot Lengan pada Mahasiswa Pembinaan Prestasi Tenis Mej. *Indonesian Journal of Sports Science*, *1*(1), 218371.

Mao, C., Liu, T., Li, X., Lu, Z., Li, Z., Xing, K., Chen, L., & Sun, Y. (2023, July 12). *A Comparative Biomechanical Analysis of Topspin Forehand against Topspin and Backspin in Table Tennis*. https://doi.org/https://doi.org/10.3390/app13148119

Munandar, R. A., Hidayat, T., Zen, M. Z., & Faisal, F. (2025). Pengembangan Buku Ajar Tenis Meja dengan Metode Multiball Mpa'a Kacaru. *Jurnal Olahraga Dan Kesehatan Indonesia (JOKI)*, *6*(2), 136–145. https://doi.org/10.55081/joki.v6i2.4631

Pranata, P., Aziz, I., Fardi, A., & Sari, S. N. (2024). Hubungan Kordinasi Mata Tangan Terhadap Kemampuan Pukulan Forehand Drive Dalam Olahraga Tenis Meja. *Jurnal Gladiator*, *4*(2), 359–370. https://doi.org/10.24036/gltdor1013011

Rangkuti, Y. A., Kurniawan, R., Syaleh, M., & Pujiati, A. (2023). Kontribusi Olahraga Rekreasi Terhadap Pertumbuhan Ekonomi Masyarakat Lokal. *Jurnal Olahraga Dan Kesehatan Indonesia (JOKI)*, *3*(2), 139–145. https://doi.org/10.55081/joki.v3i2.875

Riskawati, & Suwo, R. (2025). Pengaruh Latihan Multiball terhadap Kemampuan Smash Forehand Tenis Meja. *Journal Olympic (Physical Education, Health and Sport)*, *5*(1), 8–15. https://doi.org/10.36709/jolympic.v5i1.124

Suparman, S., & Hasbillah, M. (2021). Kontribusi Kekuatan Otot Tungkai, Kecepatan Reaksi Tangan dan Kelentukan Pergelangan Tangan terhadap Kemampuan Ketepatan Pukulan Forehand Drive Permainan Tenis Meja PTM YPUP Makassar. *Jendela Olahraga*, *6*(1), 165–174. https://doi.org/10.26877/jo.v6i1.6999

Tumaloto, E. H., Kadir, S. S., Ilham, A., & Syaputra, R. (2024). EVALUASI PROGRAM LATIHAN FISIK ATLET TENIS MEJA. *Jambura Health and Sport Journal*, *6*(2), 155–164. https://doi.org/10.37311/jhsj.v6i2.26978