KRONOLOGI KORESPONDENSI PUBLIKASI ARTIKEL

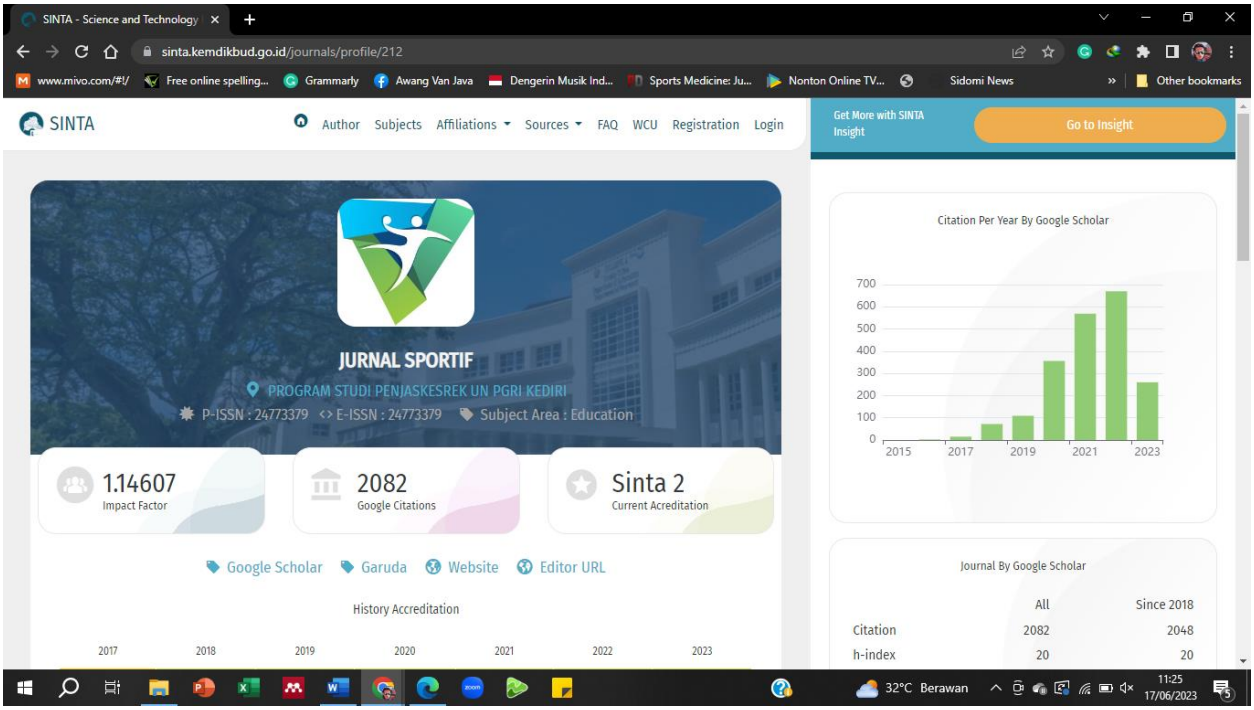
PADA JURNAL NASIONAL TERAKREDITASI SINTA 2

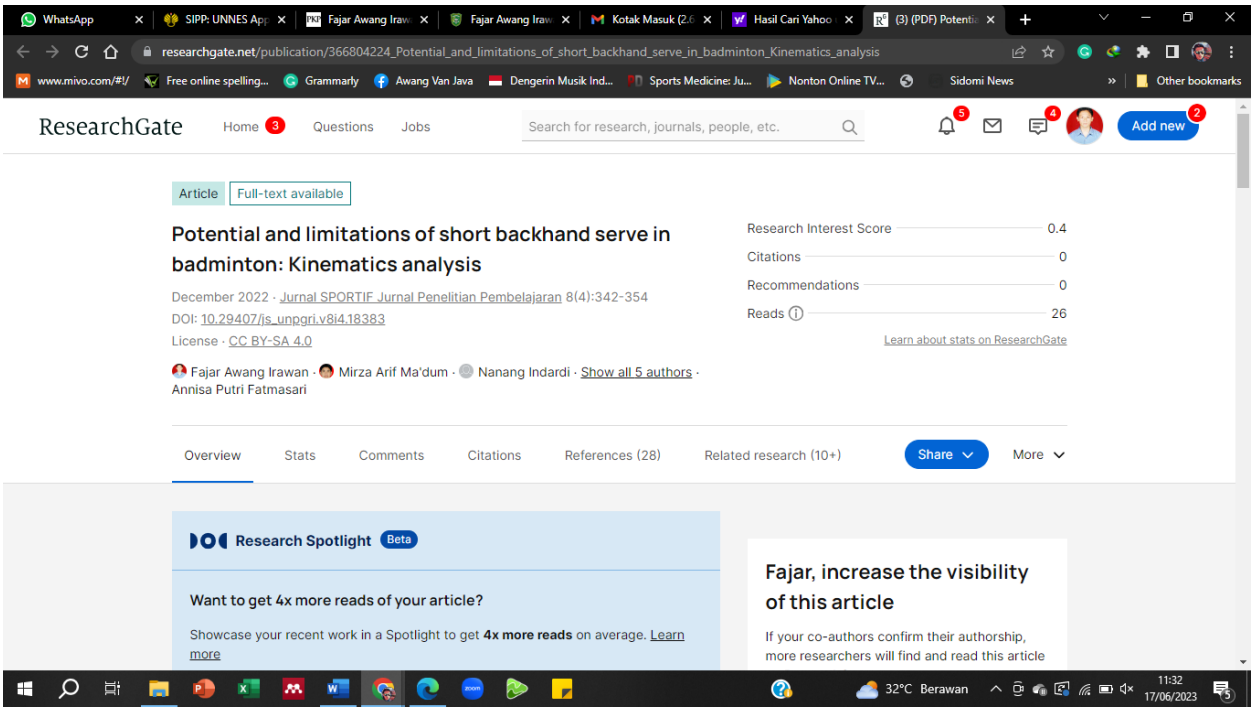
Judul	Potential and limitations of short backhand serve inKro badminton: Kinematics analysis
Jurnal	Jurnal SPORTIF: Jurnal Penelitian Pembelajaran
Volume	8
No	4
Halaman	342-354
Tahun	2022
Penerbit	Universitas Nusantara PGRI Kediri
ISSN	2477-3379
DOI	10.29407/js_unpgri.v8i4.18383
Akreditasi	Sinta 2
Impact Factor	1.14607
Google Citations	2.080
Penulis	Fajar Awang Irawan, Mirza Arif Ma'dum, Nanang Indardi, Minh Nghia Le Trans, Annisa Putri Fatmasari

Bukti Indeks Jurnal

Akreditasi : Sinta 2

Link akses : https://sinta.kemdikbud.go.id/journals/profile/212



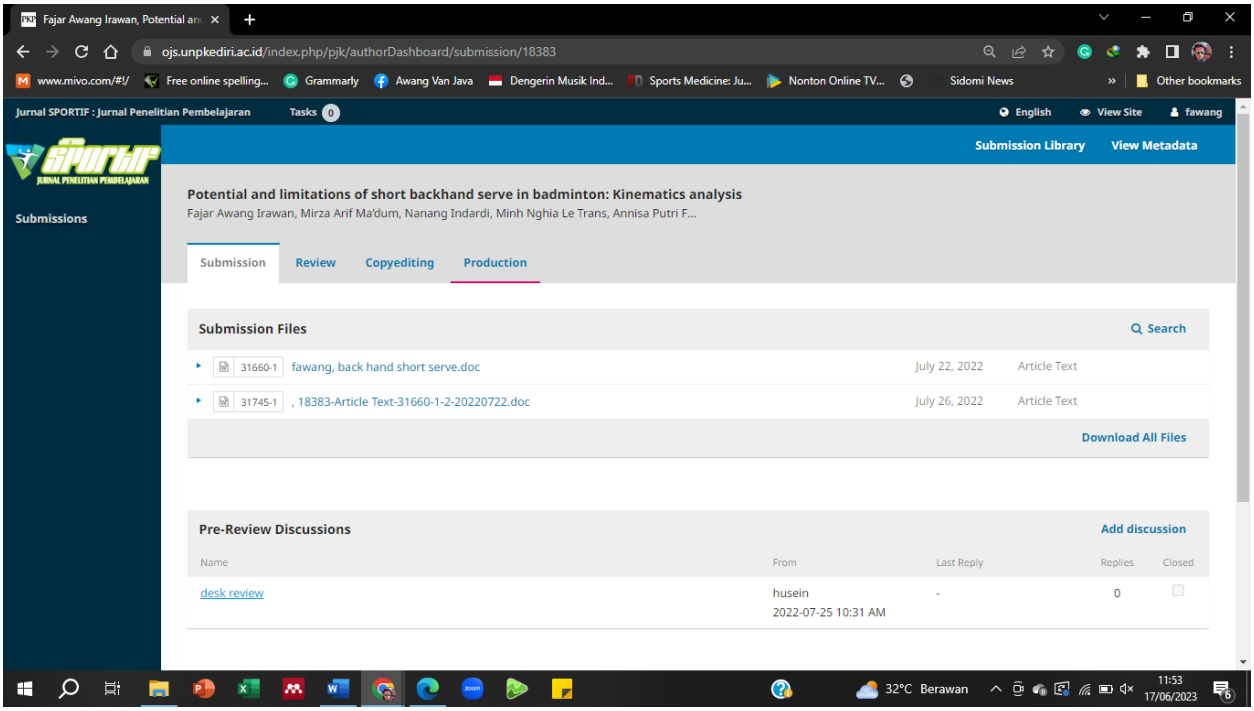


Kronologi Korespondensi

No	Tanggal	Aktivitas
1	22 July 2022	Submit artikel
2	21 Agustus 2022	Review artikel
3	9 Oktober 2022	Resubmit for Review
4	20 Oktober 2022	Accept Submission
5	25 Oktober 2022	sending it to production
6	1 Desember 2022	Publikasi

22 July 2022

Submit artikel



Potential and Limitations of Backhand Short Serve in Badminton: kinematics analysis

Abstract

The aim of this study to determine the potential and weaknesses of backhand short serve in badminton through a kinematic analysis approach, with a sample of children aged 12-16 years PB Pendowo Semarang City. The method used quantitative with a descriptive analysis approach and the analysis is assisted by using the Kinovea 0.9.4 series software. The sampling technique used is purposive sampling with 2 criteria; range age 12-16 years old, and having participated in a Semarang city-level tournament at least in the top 3 level. The results showed that the athletes of PB Pendowo Semarang City in the implementation phase are in the "Appropriate" category, with a percentage of 66.6%. Several factors that influence the level of conformity are muscle mass, arm length and height, and training intensity. This limitation in this study is in the extension active wrist analysis. Future research hopefully focuses on the wrist activation and more specifically explain about flick movement in the wrist motion. Additional supporting literacy in the back hand short serve analysis could help the athletes and coaches to reach effective movement to get point using back hand short serve as first attacked.

Keywords: motion analysis, backhand short serve, potential, limitations

Commented [A1]: Provide a background in research matters!

Commented [A2]: What instruments do you use?

Commented [A3]: Don't mention the limitations in the script, replace it with "this research can still be developed on future researches with....."

INTRODUCTION

Several types of sports that are popular and growing rapidly in Indonesian society, including badminton, have very complex basic techniques, defined very complex because each athlete is required to have speed, strength, and good strategy in dealing with opponents (Sumanjaya, 2015). An athlete is also required to be able to master all the basic techniques in this sport such as backhand, smash, lob, and drive to serve. In the research of Wardana & Dra. Ika Jayadi, (2017) explains that the basic movements in badminton have the same body posture in hitting movements, the difference is the power and accuracy used in making punches, for example when lob, smash, and drop shot or cop in the same taking attitude. his position. With the correct movement in basic techniques, it is expected to improve performance and prevent injury (Irawan et al., 2020; Irawan, Jannah, et al., 2021; Irawan, Nomi, et al., 2021).

There are several basic techniques that must be mastered by badminton athletes, technique is a skill that must be mastered by someone

to be able to play the sport (Nandika et al., 2017). According to Taufan et al., (2016) for someone to be able to play badminton, one must master various basic techniques of the game correctly, which include racket grip, footwork, and various basic hitting techniques. Some of the most popular basic techniques to learn are the smash, backhand, drop shot, forehand, and serve. Serve is a basic technique that is mandatory and very important to master, the serve is an early technique in badminton that serves as a sign that the game has started (Hussain, Ahmed, Mohammad, et al., 2011) the serve is also referred to as the first attack in badminton because it is very important to master the technique. This type of serve is the most widely used, especially in men's competitions (Gawin et al., 2013). Male athletes tend to use backhand short serve in a ratio of 91% points (Carboch & Smocek, 2020).

Based on the distance of the serve, the type of badminton serve is divided into 2 part. At first namely long serve, one of which is flick serve and the second is short serve. Short serve or short serve must be done "softly" or as thin as possible over the net and land as close as possible to the opponent's serve field (Singh & Mishra, 2020), so that it will be difficult for the opponent to make a return. Researchers are interested in discussing the analysis of what factors affect the suitability of the backhand short serve motion of badminton athletes when they are in the field. This is reinforced by the results of researchers' observations of the sample, namely athletes from PB Pendowo, Semarang city, with an age range of 12-16 years. This observation is carried out before data collection, or you could say this observation is used as a benchmark for the condition and performance of athletes in the field without any engineering and manipulation of athletes' movements when training or competing.

Commented [A4]: add also the reasons why this research is interesting to study, bai from the point of view of researchers, and readers especially badminton athletes.

Based on research from Wijaya, (2017), it is stated that the analysis of the service motion in badminton viewed anatomically, physiologically, and biomechanically affects the right and wrong of the action. Therefore, researchers are interested in discussing what factors affect the suitability

of the backhand short serve. The aim of this study to determine the potential and weaknesses of backhand short serve in badminton through a kinematic analysis approach.

METHOD

The type of this study using a single case study, which allows researchers to carry out in-depth and specific exploration of certain events of a phenomenon (Wahyuningsih, 2013), Mariotto et al., (2014) also added that this method allows for better dialogue and between researchers and their research both in terms of management, usefulness, and overall. The approach used in this method is analysis and evaluation. The population in this study was the PB Pendowo club, Semarang City. While total sample were 9 people who were selected using a purposive sampling technique with the provision that they were 12-16 years old and had at least been in the top 3 championships at the Semarang city level. Quantitative data in this study were obtained through photo and video recordings of backhand service movements which were then analyzed using the Kinovea application series 0.9.4 (Arjunnaja et al., 2022). This study has passed the Ethical Clearance (EC) with number 366/KEPK/EC/2021 as part of the legalicy protocol of human research procedures.

The research procedures in the data collection in PB Pendowo Semarang City are preparation, which is the stage to prepare tools and materials before the implementation of data collection such as the preparation of DSLR cameras, tripods, questionnaires, and inform consent. Then the implementation of data collection in this procedure includes of how to collect data in the field such as camera angle positions, briefings, and athlete direction when taking videos and photos (giving cues and so on). At last the data processing, the data that has been collected is then recapitulated and processed using the Kinovea 0.9.4 series software (motion analyzer).

RESULT

Commented [A5]: here you can add in detail the taking of the research subject!

Commented [A6]: add a new subtitle "kinematic parameters of motion"

in this subtitle discusses how the stages of kinematic analysis of movements on the subject of study!

Several variables or indicators measured in this study were right wrist extension angle (°), right wrist hyperextension (°), left elbow extension (°), and left knee extension (°), in the implementation phase. There are 3 phases of movement in the implementation of the backhand service including the preparation phase, the implementation phase (impact), and the follow-through phase. The basis for determining the 3 phases of the movement is based on the research of Sumardi et al., (2015) which states that there are 3 phases of movement, namely the preparation, implementation, and continuation phases.

The focus of the researchers in this article is to discuss the stages in the implementation phase only. Because in the movement phase, researchers and readers will better understand how the criteria for time, distance, speed, and angle of the backhand short serve are good and correct. In addition to measuring kinematic data as shown in Table 1. above, the researchers also measured anthropometric data such as weight, height, and BMI (Body Mass Index) of each athlete as supporting data. The number of samples consisted of 9 people with specifications 8 men and 1 woman.

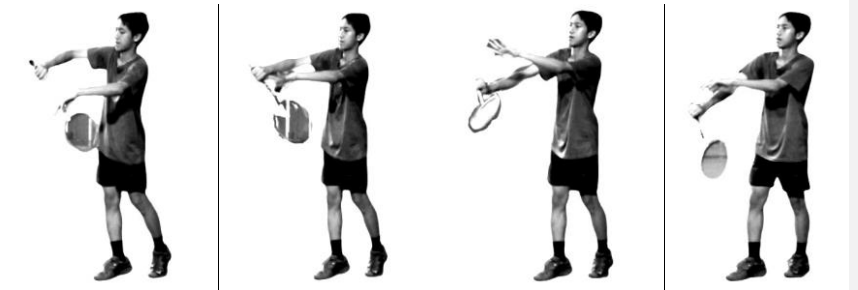
Table 1. Anthropometric Data.

n = 9	**Mean**	**Std. Deviation**	**Min**	**Max**
Age *(year)*	13,44	1,236	12	15
Height *(cm)*	156,5	11,649	134	175
Weight *(kg)*	46,97	11,482	27	63
BMI *(kg/m^2)*	18,91	2,784	15,08	22,63

Analysis in the implementation phase of the backhand short serve conducted by PB Pendowo athletes in Semarang City stated that as many as 2 athletes were in the "Very Appropriate" category with a percentage of 22.2%, as many as 6 athletes were included in the "Agree" category with a percentage of 66.6%, and 1 athlete was in the "Not Appropriate" category with a percentage of 11.1%, and 0 athletes were in the "Not Appropriate" category. It can be concluded that the average backhand short serve

movement of PB Pendowo athletes in Semarang City in the implementation phase has the "Appropriate" Criteria.

Commented [A7]: The results of the analysis of the categorization of motions are not at all explained by you, where can I read it? and how do researchers do categorization?



Preparation Phase ***Impact*** ***Release*** ***Advanced Phase***

Figure 1. Back Hand Short Serve Movement Phase

In the implementation phase there are 2 movements, namely impact and release, impact occurs on objects that move in one straight line or two straight lines (Afrizal, 2013). Release is defined as the momentum when the ball leaves the hand (Kharim & Nurkholis, 2018). Texier et al., (2012) added that the direction of the shuttlecock is basically a parabola, but the direction and magnitude of the angle is influenced by power, direction and the wind on the field.

DISCUSSION

Analysis in the implementation phase of the backhand short serve conducted by PB Pendowo athletes in Semarang City stated that as many as 2 athletes were in the "Very Appropriate" category with a percentage of 22.2%, and as many as 6 athletes were included in the "Agree" category with a percentage of 66.6%, and 1 athlete was in the "Not Appropriate" category with a percentage of 11.1%, and 0 athletes were in the "Not Appropriate" category. So it can be concluded that the average backhand short serve movement of PB Pendowo athletes in Semarang City in the implementation phase has the "Appropriate" Criteria. The determination of this value is based on research (Arikunto, 2006) related to the Likert scale, research (Grice, 2016) and (Dermawan, 2019) related to the determination of instruments and motion variables. Then it was specified again with the

Commented [A8]: is not at all talking about the likert scale on the method!

help of 2 expert validators and references from (Irawan & Permana, 2020) and (Irawan et al., 2019) by ticking the checklist " √ " in the available column when data collection in the field.

The value of each variable per movement phase is as follows, the serve time has an average of 0.11 seconds with a standard deviation of ± 0.02 seconds, the distance between legs has an average of 0.22 meters with a standard deviation of ± 0.13 meters, for right wrist extension data in the implementation phase or active phase has an average of 157.65º with a standard deviation of ± 14.73º, right wrist hyperextension has an average value of 218.45º with a standard deviation of ± 12.79º, elbow extension left with a mean value of 131.68º with a standard deviation of ± 24.18º, for left knee extension data has a mean of 165.17º and a standard deviation of ± 5.57º.

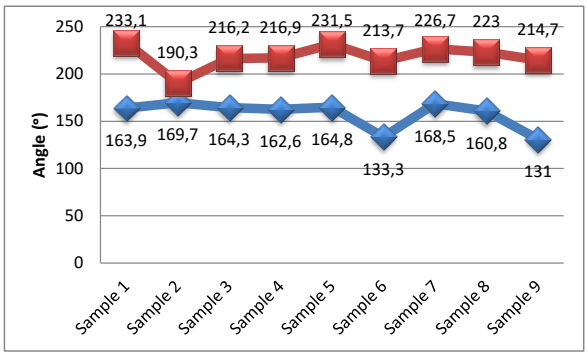
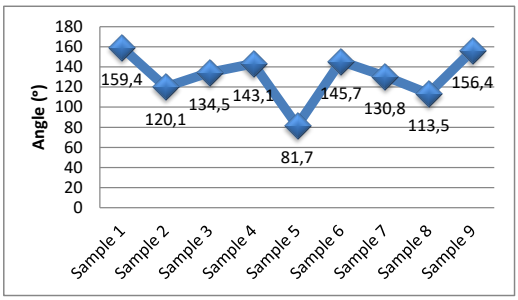


Figure 2. Extension and Hyperextension of the Right Wrist

The results of the analysis of the extension angle of the right wrist backhand short serve are presented in Figure 2, with the lower results of the extension angle in sample no.6 has an angle of 133.3º and sample no.9 has an angle of 131º. The average extension angle of 9 athletes from PB Pendowo Semarang City is 157.65º with a minimum value of 131º and a maximum value of 169.7º.

Meanwhile, the backhand short serve right wrist hyperextension data presented in Figure 4.2 states that the higher result of the hyperextension angle of sample no.1 has an angle of 233.1º; and the lower is in the

sample no.2 has an angle of 190.3º. The average hyperextension angle of 9 PB Pendowo athletes in Semarang City is 218.45º with a minimum value of 190.3º and a maximum value of 233.1º.



.

Figure 3. Left Elbow Extension Angle

The results of the researcher's analysis related to the left elbow extension angle variable in the implementation of the backhand short serve in the implementation phase are presented in Figure 3, with the results of the extension angle in the all sample with a lower was of 81.7º and the higher was 159.4º. Next in Figure 4.5 will present data on left knee extension in the implementation phase of each PB Pendowo athlete in Semarang City.

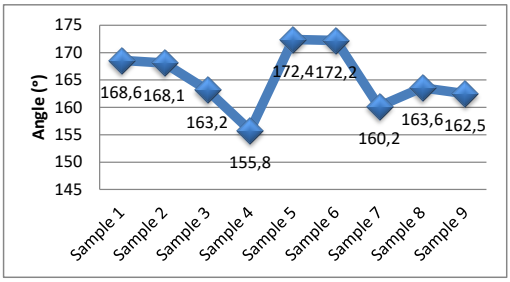


Figure 4. Left Knee Extension Angle

The results of the researcher's analysis related to the left knee extension angle variable in the implementation of the backhand short serve in the implementation phase are presented in Figure 4, with the

average results of the extension angle was 165.18º with lower value of 155.8º and higer value of 172.4º.

Several factors that can affect the level of suitability of the athlete's backhand short serve in the field include muscle mass, especially if the athlete is still too young or a child of course there are still difficulties in maximizing a movement, especially a serve, therefore more intense training is needed. In addition to power or muscle mass, according to Listanto, (2021) when athletes serve, they do not only rely on 100% leg power but also other more complex components such as coordination, speed, flexibility, and balance. Badminton athletes must also pay attention to mental and physical conditions to support performance on the field (Hinda Zhannisa & Sugiyanto, 2015).

The factor of arm length and athlete's height also affects the success and suitability of every movement in badminton, including serve. Based on the analysis of researchers in the field, if an athlete has a height and arm length above the average it will make it easier for them to reach and hit (cross) the shuttlecock to the opponent's area. Musofan, (2007) in the development of his research stated that to be a good badminton player, it is necessary to have a body posture with height such as slenderness. In terms of serve, especially backhand short serve, they will greatly benefit because when compared to the height of the net with their posture, it will be easier to cross the shuttlecock into the opponent's territory.

In addition to these factors, athletes also need continuous and well-programmed regular training. Because basically all talents, potential, and supporting physical conditions will not be maximized without serious training. Based on research by Hussain, Ahmed, Bari, et al., (2011) to improve service skills by practicing hand, elbow and shoulder auctions. Intense exercise can be done using assistive devices to facilitate and strengthen wrist rotation, both in serving movements and other movements, Irawan et al., (2016) human motion is significantly influenced

by several biomechanical factors such as ideal angle or body segmentation and body torque.

CONCLUSION

The potential for success and suitability of the backhand short serve of PB Pendowo athletes is classified as "Appropriate" in the implementation phase of the backhand short serve with a percentage of 66.6%, with an average right wrist extension angle of 157.65º, an average right wrist hyperextension angle of 218, 45º. The analysis of kinematic data in this study found the relation between the success and weakness of athletes influenced by muscle mass or power, arm length and height, as well as intense training. This study limitation also found that the result of speed and time in the backhand short serve technique need more efficiency at the center of movement and power is in the active wrist. Hopefully, future research is able to discuss certain parts or angles, such as the active wrist, to be more specifically described with other supporting literacy to make it more complex, so that this article can become one of the standard references for research on the theme of analysis and motion kinematics.

Commented [A9]: adjust to the method, and the results in the research you do!

ACKNOWLEDGMENT

The researcher want to Thank to all relevant parties who have contribution in the study and in particular to PB Pendowo Semarang City who has given permission and opportunities to researchers so that they can conduct research properly there.

REFERENCES

Afrizal, J. (2013). *Biomekanika dan Olahraga*.

Arikunto, S. (2006). *Prosedur Penelitian Suatu pendekatan Praktik*.

Arjunnaja, Irawan, F. A., & Purnomo, P. S. (2022). Journal of Sport Coaching and Physical Education Analisis Gerak Tendangan Shooting Menggunakan Punggung Kaki pada Atlet Popda Kabupaten Temanggung. *Journal of Sport Coaching and Physical Education*, *7*(1), 27–36.

Carboch, J., & Smocek, P. (2020). Serve and Return in Badminton: Gender Differences of Elite Badminton Players. *International Journal of Physical Education, Fitness and Sports*, *9*, 44–48. https://doi.org/10.34256/ijpefs2014

Dermawan, M. R. (2019). *Upaya Meningkatkan Keterampilan Servis*

Backhand Pendek Bulutangkis Melalui Media Audio Visual Pada Siswa SMAN 8 Pekanbaru. Universitas Islam Riau, Pekanbaru.

Gawin, W., C, B., H, H., & D, B. (2013). How to attack the service: an empirical contribution to rally opening in world-class badminton doubles,. *International Journal of Performance Analysis in Sport*, *13*, 860–871.

Grice, T. (2016). *Bulu Tangkis : petunjuk praktis untuk pemula dan lanjut* (Ed 1, Ceta). PT RajaGrafindo Persada.

Hinda Zhannisa, U., & Sugiyanto, F. (2015). *Model Tes Fisik Pencarian Bakat Olahraga Bulutangkis Usia Di Bawah 11 Tahun Di Diy a Model of Physical Test for Talent Scouting in Badminton Skill Under 11 Years Old in Diy*. *3*(1), 117–126.

Hussain, I., Ahmed, S., Bari, M. A., Ahmad, A., Mohammad, A., & Khan, A. (2011). *Analysis of Arm Movement in Badminton of ForehandLong and Short Service Analysis of Arm Movement in Badminton of ForehandLong and Short Service*. *2 (03)*(June).

Hussain, I., Ahmed, S., Mohammad, A., Khan, A., & Arshad Bari, M. (2011). Videographical Analysis of Short Service in Badminton. *Journal of Education and Practise*, *2*(2), 1–6.

Irawan, F. A., Chuang, L.-R., Peng, H., & Huang, S. (2016). A Biomechanical Baseball Pitching : Is the curveball generating higher risk of injuries than fastball on young pitchers ? *CJSB*, *2004*, 55–63.

Irawan, F. A., Jannah, S. P., Permana, D. F. W., Nurrachmad, L., & Anam, K. (2021). Mawashi Geri in Karate Junior Cadet Class : Kinematic Analysis. *Journal of Hunan University*, *Vol.48*(No.9), pp.437-443.

Irawan, F. A., Nomi, M. T., & Peng, H. (2021). Pencak Silat Side Kick in Persinas ASAD : Biomechanics Analysis. *International Journal of Human Movement and Sports Sciences*, *Vol.9*(No.6), pp.1230-1235. https://doi.org/10.13189/saj.2021.090617

Irawan, F. A., Nurrahmad, L., & Permana, D. F. W. (2020). The Association of Arch Height Index and Arcus Pedis on Agility : An Overview of Sport Science College Students. *International Journal of Innovation, Creativity and Change*, *14*(11), 669–676. https://doi.org/DOI: 10.53333/IJICC2013/141108

Irawan, F. A., & Permana, D. F. W. (2020). Parent-Child Fun Games sebagai Upaya Meminimalisasi Smartphone Addiction pada Anak di Madrasah Ibtidaiyah. *Jurnal Pemberdayaan Masyarakat Mandiri Indonesia*, *1*(1), 1–8. https://doi.org/https://doi.org/10.35473/jpmmi.v1i1.40

Irawan, F. A., Setiowati, A., Permana, D. F. W., & Sandiyudha, T. B. (2019). *Augment Reality Human Anatomy (ARMY) as Learning Media in Sport Science*. *362*(Acpes), 46–49. https://doi.org/10.2991/acpes-19.2019.10

Kharim, M. A., & Nurkholis. (2018). Analisis Backswing dan Release Ketepatan Pointing Half Lob Jongkok Pada Jarak 7 meter Olahraga Petanque. *Jurnal Prestasi Olahraga*, *1*(3).

Listanto, B. (2021). *Kontribusi Kekuatan Otot Lengan Terhadap Kemampuan Servis Panjang Bulutangkis Pada Club PB. Bank Riau*

Kepri Pekanbaru.
Mariotto, F. L., Zanni, P. P., & de Moraes, G. H. S. M. (2014). What is the use of a single-case study in management research? *RAE Revista de Administracao de Empresas*, *54*(4), 358–369. https://doi.org/10.1590/S0034-759020140402
Musofan. (2007). *Hubungan power otot lengan, panjang lengan, dan tinggi badan terhadap hasil forehand smash bulutangkis pada anggota PB. RSL Purbalingga*. Universitas Negeri Semarang.
Nandika, R., Hadi, D. T., & Ridho, Z. A. (2017). PENGEMBANGAN MODEL LATIHAN STROKES BULUTANGKISBERBASISFOOTWORKUNTUKANAKUSIA PEMULA (U-15). *Gladi Jurnal Ilmu Keolahragaan*, *08*(02), 103–111. https://doi.org/https://doi.org/10.21009/GJIK.082.03
Singh, A. P., & Mishra, V. B. (2020). A BIOMECHANICAL ANALYSIS OF BADMINTON FOREHAND SERVICE. *Vidyabharati International Interdisciplinary Research Journal*, 71–73.
Sumanjaya, S. A. (2015). *Hubungan Tingkat Pengetahuan Teknik Dasar Terhadap Penguasaan Ketrampilan Bulutangkis* (Vol. 2015). Universitas Pendidikan Indonesia.
Sumardi, Simanjuntak, V. G., & Atiq, A. (2015). *Pengaruh Model Pembelajaran Mandiri Terhadap Hasil Belajar Servis Pendek Backhand Bulutangkis SMPN 8 Pontianak*. 1–7.
Taufan, A., Dewantara, B., & Alsaudi. (2016). Pengaruh Strategi Pembelajaran Dan Konsep Diri Terhadap Keterampilan Smash Bulutangkis. *Jurnal Sport Area*, *15*(1), 10–22. https://doi.org/10.20527/multilateral.v15i1.2480
Texier, B. D., Cohen, C., Quéré, D., & Claneta, C. (2012). Shuttlecock dynamics. *Procedia Engineering*, *34*(July 2012), 176–181. https://doi.org/10.1016/j.proeng.2012.04.031
Wahyuningsih, S. (2013). Metode Penelitian Studi Kasus: Konsep, Teori Pendekatan Psikologi Komunikasi, dan Contoh Penelitiannya. *UTM PRESS Bangkalan - Madura*, 119.
Wardana, Z. S., & Dra. Ika Jayadi, M. (2017). ANALISIS KETEPATAN SERVIS PANJANG FOREHAND PADA ATLET PB. SURYANAGA SURABAYA KATEGORI REMAJA PUTRA (Ditinjau Dari Sport Video Analysis Kinovea). *Jurnal P Endidikan Kepelatihan Olahraga (JPKO)*, 1–23.
Wijaya, A. (2017). ANALISIS GERAK KETERAMPILAN SERVIS DALAM PERMAINAN BULUTANGKIS (Suatu Tinjauan Anatomi, Fisiologi, dan Biomekanika) Kata. *Indonesia Performance Journal*, *1*(2), 106–111.

Notifications

[JS_UNPGRI] Editor Decision

2022-08-21 07:40 PM

Fajar Awang Irawan; Mirza Arif Ma'dum, Nanang Indardi, Minh Nghia Le Trans, Annisa Putri Fatmasari (Author):

We have reached a decision regarding your submission to Jurnal SPORTIF : Jurnal Penelitian Pembelajaran, "Potential and Limitations of Backhand Short Serve in Badminton: kinematics analysis: Potential and Limitations of Backhand Short Serve in Badminton: kinematics analysis".

Our decision is to: Resubmit for Review

Iago Portela-Pino
Isabel I University
iagojuniorportelapinoi@gmail.com

Reviewer B:
Recommendation: Revisions Required

Relevance = The suitability of the topic of the article for publication in the journal "SPORTIF"

3

Contribution = The quality of the paper is reviewed from ideas and authenticity (originality), novelty, and innovation (innovation)

3

Notifications

[JS_UNPGRI] Editor Decision

2022-08-21 07:40 PM

Fajar Awang Irawan; Mirza Arif Ma'dum, Nanang Indardi, Minh Nghia Le Trans, Annisa Putri Fatmasari (Author):

We have reached a decision regarding your submission to Jurnal SPORTIF : Jurnal Penelitian Pembelajaran, "Potential and Limitations of Backhand Short Serve in Badminton: kinematics analysis: Potential and Limitations of Backhand Short Serve in Badminton: kinematics analysis".

Our decision is to: Resubmit for Review

Iago Portela-Pino
Isabel I University
iagojuniorportelapinoi@gmail.com

Reviewer B:
Recommendation: Revisions Required

Relevance = The suitability of the topic of the article for publication in the journal "SPORTIF"

3

Contribution = The quality of the paper is reviewed from ideas and authenticity (originality), novelty, and innovation (innovation)

3

Potential and Limitations of Backhand Short Serve in Badminton: kinematics analysis

Abstract

The aim of this study to determine the potential and weaknesses of backhand short serve in badminton through a kinematic analysis approach, with a sample of children aged 12-16 years PB Pendowo Semarang City. Moreover backhand short serve is an important element or main character. in badminton, where not many people can maximize the potential and limits of each athlete such as power, speed, accuracy, and motion efficiency. The method used quantitative with a descriptive analysis approach and the analysis is assisted by using the Kinovea 0.9.4 series software. The sampling technique used is purposive sampling with 2 criteria; age (12-16 years old), and having participated in a Semarang city-level tournament. The results showed that the athletes of PB Pendowo Semarang City in the implementation phase are in the "Appropriate" category, with a percentage of 66.6%. The instruments used in this data collection are observation and documentation. Several factors that influence the level of conformity are muscle mass, arm length and height, and training intensity. This research can still be developed in future research by discussing more specific things such as focusing on active wrists, and more specifically explain about flick movement in the wrist motion. Additional supporting literacy in the back hand short serve analysis could help the athletes and coaches to reach effective movement to get point using back hand short serve as first attacked.

Keywords: motion analysis, backhand short serve, potential, limitations

Commented [A1]: Provide a background in research matters!

The background of the issue has been added in the abstract and clarified in the introduction

Commented [A2]: What instruments do you use?

instrument has been added

Commented [A3]: Don't mention the limitations in the script, replace it with "this research can still be developed on future researches with....."

suggestions/recommendations have been added. Thank you,

INTRODUCTION

Several types of sports that are popular and growing rapidly in Indonesian society, including badminton, have very complex basic techniques, defined very complex because each athlete is required to have speed, strength, and good strategy in dealing with opponents (Sumanjaya, 2015). An athlete is also required to be able to master all the basic techniques in this sport such as backhand, smash, lob, and drive to serve. In the research of Wardana & Dra. Ika Jayadi, (2017) explains that the basic movements in badminton have the same body posture in hitting movements, the difference is the power and accuracy used in making punches, for example when lob, smash, and drop shot or cop in the same taking attitude. his position. With the correct movement in basic techniques, it is expected to improve performance and prevent injury (Irawan et al., 2020; Irawan, Jannah, et al., 2021; Irawan, Nomi, et al., 2021).

There are several basic techniques that must be mastered by badminton athletes, technique is a skill that must be mastered by someone to be able to play the sport (Nandika et al., 2017). According to Taufan et al., (2016) for someone to be able to play badminton, one must master various basic techniques of the game correctly, which include racket grip, footwork, and various basic hitting techniques. Some of the most popular basic techniques to learn are the smash, backhand, drop shot, forehand, and serve. Serve is a basic technique that is mandatory and very important to master, the serve is an early technique in badminton that serves as a sign that the game has started (Hussain, Ahmed, Mohammad, et al., 2011) the serve is also referred to as the first attack in badminton because it is very important to master the technique. This type of serve is the most widely used, especially in men's competitions (Gawin et al., 2013). Male athletes tend to use backhand short serve in a ratio of 91% points (Carboch & Smocek, 2020).

Based on the distance of the serve, the type of badminton serve is divided into 2 part. At first namely long serve, one of which is flick serve and the second is short serve. Short serve or short serve must be done "softly" or as thin as possible over the net and land as close as possible to the opponent's serve field (Singh & Mishra, 2020), so that it will be difficult for the opponent to make a return. Researchers are interested in discussing the analysis of what factors affect the suitability of the backhand short serve motion of badminton athletes when they are in the field. This is reinforced by the results of researchers' observations of the sample, namely athletes from PB Pendowo, Semarang city, with an age range of 12-16 years. This observation is carried out before data collection, or you could say this observation is used as a benchmark for the condition and performance of athletes in the field without any engineering and manipulation of athletes' movements when training or competing.

This research becomes more interesting to discuss because there is no clear and specific discussion or review related to the analysis of

Commented [A4]: add also the reasons why this research is interesting to study, bai from the point of view of researchers, and readers especially badminton athletes.

researcher interest and research urgency of this topic have been added

motion potential based on appropriate biomechanics (both in Indonesia and specifically at the research location), moreover backhand short serve is an important element or main character. in badminton, where not many people can maximize the potential and limits of each athlete such as power, speed, accuracy, and motion efficiency.

Based on research from Wijaya, (2017), it is stated that the analysis of the service motion in badminton viewed anatomically, physiologically, and biomechanically affects the right and wrong of the action. Therefore, researchers are interested in discussing what factors affect the suitability of the backhand short serve. The aim of this study to determine the potential and weaknesses of backhand short serve in badminton through a kinematic analysis approach.

METHOD

The type of this study using a single case study, which allows researchers to carry out in-depth and specific exploration of certain events of a phenomenon (Wahyuningsih, 2013), Mariotto et al., (2014) also added that this method allows for better dialogue and between researchers and their research both in terms of management, usefulness, and overall. The approach used in this method is analysis and evaluation. The population in this study was the PB Pendowo club, Semarang City. The number of samples studied was 9 people who were selected using purposive sampling technique with the provision that they were 12-16 years old and had at least won the top 3 at the Semarang city level. Quantitative data in this study were obtained through photo and video recordings of backhand service movements which were then analyzed using the Kinovea application series 0.9.4 (Arjunnaja et al., 2022). This study has passed the Ethical Clearance (EC) with number 366/KEPK/EC/2021 as part of the legalicy protocol of human research procedures.

Commented [A5]: here you can add in detail the taking of the research subject!

subject or sampling details have been added to the paraphrase clearly

The research procedures in the data collection in PB Pendowo Semarang City are preparation, which is the stage to prepare tools and materials before the implementation of data collection such as the preparation of DSLR cameras, tripods, questionnaires, and inform

consent. Then the implementation of data collection in this procedure includes of how to collect data in the field such as camera angle positions, briefings, and athlete direction when taking videos and photos (giving cues and so on). At last, the data processing, the data that has been collected is then recapitulated and processed using the Kinovea 0.9.4 series software (motion analyzer).

Kinematic parameters of motion. In this case, in detail, the backhand short serve motion is divided into 3 main motion phases, namely the preparation phase, the implementation phase, and the follow-through phase, this opinion is based on research (Sumardi et al., 2015). Details of the 3 phases of the backhand short serve motion have their respective descriptions, for the preparation phase starting from the beginning of the movement where the athlete holds the shuttlecock until the wrist is actively flexed, the implementation phase starts after the active wrist is flexed which is then followed by impact (the racket hits the shuttlecock) until Active wrist strikes with the lever position and the cubits straight parallel to the carpal or metacarpal, the last is the follow-through phase starting after the impact phase until the shuttlecock is completely released from the hand and leads to the opponent's court and is followed by an active wrist hyperextension position (as form part of the “continuation” of the backhand short serve). There is an important role of the arm muscles as a machine or motor that performs the movement when hitting and the muscles of the legs or feet. Apart from being a pedestal when doing stances, the leg muscles are also used as a movement stabilizer

RESULT

Several variables or indicators measured in this study were right wrist extension angle (°), right wrist hyperextension (°), left elbow extension (°), and left knee extension (°), in the implementation phase. There are 3 phases of movement in the implementation of the backhand service including the preparation phase, the implementation phase (impact), and the follow-through phase. The basis for determining the 3 phases of the movement is based on the research of Sumardi et al.,

Commented [A6]: add a new subtitle ″kinematic parameters of motion″

in this subtitle discusses how the stages of kinematic analysis of movements on the subject of study!

suggestions and recommendations have been added

(2015) which states that there are 3 phases of movement, namely the preparation, implementation, and continuation phases.

The focus of the researchers in this article is to discuss the stages in the implementation phase only. Because in the movement phase, researchers and readers will better understand how the criteria for time, distance, speed, and angle of the backhand short serve are good and correct. In addition to measuring kinematic data as shown in Table 1. above, the researchers also measured anthropometric data such as weight, height, and BMI (Body Mass Index) of each athlete as supporting data. The number of samples consisted of 9 people with specifications 8 men and 1 woman.

Table 1. Anthropometric Data.

n = 9	Mean	Std. Deviation	Min	Max
Age *(year)*	13,44	1,236	12	15
Height *(cm)*	156,5	11,649	134	175
Weight *(kg)*	46,97	11,482	27	63
BMI *(kg/m^2)*	18,91	2,784	15,08	22,63

Analysis in the implementation phase of the backhand short serve conducted by PB Pendowo athletes in Semarang City stated that as many as 2 athletes were in the "Very Appropriate" category with a percentage of 22.2%, as many as 6 athletes were included in the "Agree" category with a percentage of 66.6%, and 1 athlete was in the "Not Appropriate" category with a percentage of 11.1%, and 0 athletes were in the "Not Appropriate" category. It can be concluded that the average backhand short serve movement of PB Pendowo athletes in Semarang City in the implementation phase has the "Appropriate" Criteria. Determination of the level of conformity data above is based on the validator's assessment with the following calculation results.

Commented [A7]: The results of the analysis of the categorization of motions are not at all explained by you, where can I read it? and how do researchers do categorization?

Explanation and discussion of backhand short serve suitability data, calculation formulas, and additional data have been added.

No	Motion Analyst Indicator	Sample								
		1 Favi	2 Engg	3 Zidn	4 Ilhm	5 Tang	6 Nauf	7 Daff	8 Rizq	9 Marc
Phase 1										
1	Standing stance with both feet open at an ideal distance (ideal in terms of being sturdy or flexible to serve). Right foot in front and left foot behind slightly tipped.	4	3	2	2	1	1	3	4	4
2	The right-hand holds the racket and the left-hand holds the shuttlecock at waist level	3	3	4	4	4	2	3	2	3
3	The wrist is slightly bent, the angle is still above 90º (still in extension)	4	4	3	3	3	3	4	4	3
4	The left elbow and right elbow are bent following the flow of the movement	4	4	4	3	3	3	4	3	4
5	A view toward the future or the desired target	3	4	4	3	3	4	4	2	4
Phase 2										
1	Transfer your weight to the front of your feet or the tips of your toes	2	3	3	1	3	2	3	4	4
2	Straighten the body in a position ready to make a serve strike, with the chest or stake slightly opened	4	3	3	3	2	3	4	4	4
3	Do a strike with the dominant wrist (which holds the racket) until there is an impact with the shuttlecock	3	4	3	4	4	3	3	3	4
4	The wrist experiences peak extension in the impact phase (angle is still below 180º)	3	3	4	4	4	1	4	4	3
5	Make contact or impact with the provisions of the racket and shuttlecock hitting a maximum height of the chest (if it exceeds the chest it is considered foul)	4	3	4	3	3	2	1	4	4
Phase 3										
1	Do the release movement, with the racket in an open position and pointing forward following the flow of the backhand short serve	4	2	3	3	2	3	3	4	4
2	The wrist is hyperextended (flexed with a negative value) in the direction opposite to the impact phase	3	3	4	3	3	3	3	3	4
3	Open the right elbow angle parallel to the shoulder, with the gaze focused forward widely to pay attention to the opponent's field and follow the direction of the drop of the shuttlecock.	4	3	4	3	2	3	4	3	4
4	Rotate hips, and shoulders to end the movement with both hands above (follow through)	3	3	3	4	1	2	3	4	3
5	Lower your hands following the flow of the movement at waist level, to then be in a position ready to receive an attack or receive the opponent's shuttlecock	4	3	4	4	2	3	4	4	3

Figure 1. Backhand Short Serve Motion Suitability Data

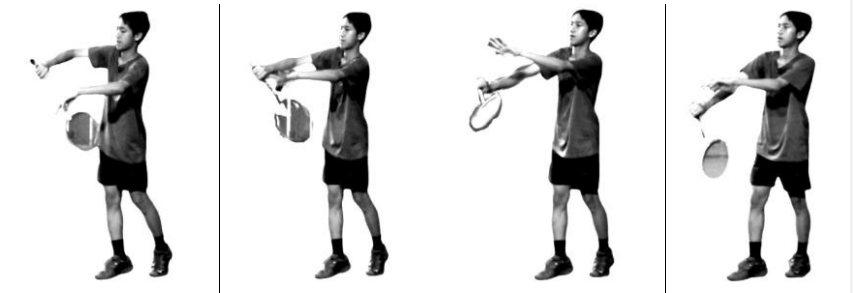
Then the data is collectively calculated using the formula. The formula for the suitability criteria for each athlete and each stage or phase of movement:

$$Average = \frac{Total\ Score}{Number\ of\ Indicators}$$

Overall criteria percentage formula:

$$Overall\ Criteria = \frac{Total\ Criteria}{Number\ of\ Athletes}\ x\ 100\%$$

The results obtained are entered in the table of suitability criteria and the percentage of movement in each phase.



Preparation Phase | *Impact* | *Release* | *Advanced Phase*

Figure 2. Back Hand Short Serve Movement Phase

In the implementation phase there are 2 movements, namely impact and release, impact occurs on objects that move in one straight line or two straight lines (Afrizal, 2013). Release is defined as the momentum when the ball leaves the hand (Kharim & Nurkholis, 2018). Texier et al., (2012) added that the direction of the shuttlecock is basically a parabola, but the direction and magnitude of the angle is influenced by power, direction, and the wind on the field.

DISCUSSION

Analysis in the implementation phase of the backhand short serve conducted by PB Pendowo athletes in Semarang City stated that as many as 2 athletes were in the "Very Appropriate" category with a percentage of 22.2%, and as many as 6 athletes were included in the "Agree" category with a percentage of 66.6%, and 1 athlete was in the "Not Appropriate" category with a percentage of 11.1%, and 0 athletes were in the "Not Appropriate" category. So it can be concluded that the average backhand short serve movement of PB Pendowo athletes in Semarang City in the implementation phase has the "Appropriate" Criteria. The determination of this value is based on research (Arikunto, 2009) related to the Likert scale, research (Grice, 2016) and (Dermawan, 2019) related to the determination of instruments and motion variables. Then it was specified again with the help of 2 expert validators and references from (Irawan & Permana, 2020)

Commented [A8]: is not at all talking about the likert scale on the method!

Arikunto is only one of the reinforcing studies that is used as a reference or reference for the author in determining the Likert scale, but basically several sources such as Tony Grice, and Dermawan are the main sources related to the discussion on the topic of badminton.

and (Irawan et al., 2019) by ticking the checklist " √ " in the available column when data collection in the field.

The value of each variable per movement phase is as follows, the serve time has an average of 0.11 seconds with a standard deviation of ± 0.02 seconds, the distance between legs has an average of 0.22 meters with a standard deviation of ± 0.13 meters, for right wrist extension data in the implementation phase or active phase has an average of 157.65º with a standard deviation of ± 14.73º, right wrist hyperextension has an average value of 218.45º with a standard deviation of ± 12.79º, elbow extension left with a mean value of 131.68º with a standard deviation of ± 24.18º, for left knee extension data has a mean of 165.17º and a standard deviation of ± 5.57º.

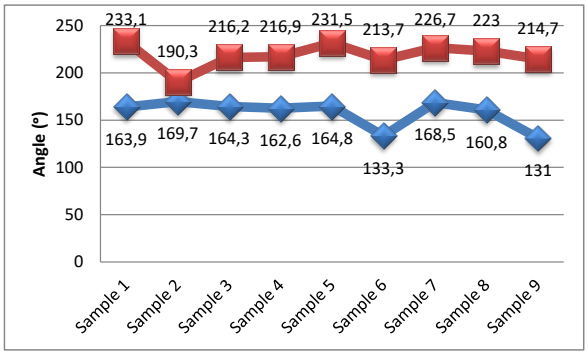
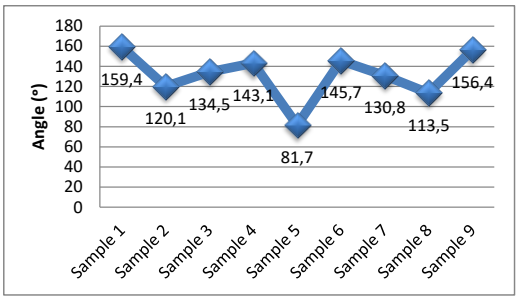


Figure 3. Extension and Hyperextension of the Right Wrist

The results of the analysis of the extension angle of the right wrist backhand short serve are presented in Figure 3, with the lower results of the extension angle in sample no.6 has an angle of 133.3º and sample no.9 has an angle of 131º. The average extension angle of 9 athletes from PB Pendowo Semarang City is 157.65º with a minimum value of 131º and a maximum value of 169.7º.

Meanwhile, the backhand short serve right wrist hyperextension data presented that the higher result of the hyperextension angle of sample no.1 has an angle of 233.1º; and the lower is in the sample no.2 has an angle of 190.3º. The average hyperextension angle of 9 PB Pendowo

athletes in Semarang City is 218.45º with a minimum value of 190.3º and a maximum value of 233.1º.



.

Figure 4. Left Elbow Extension Angle

The results of the researcher's analysis related to the left elbow extension angle variable in the implementation of the backhand short serve in the implementation phase are presented in Figure 4, with the results of the extension angle in the all sample with a lower was of 81.7º and the higher was 159.4º. Next in Figure 5 will present data on left knee extension in the implementation phase of each PB Pendowo athlete in Semarang City.

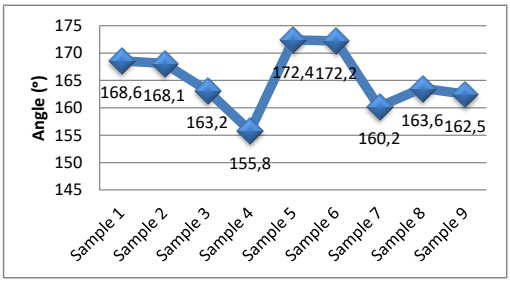


Figure 5. Left Knee Extension Angle

The results of the researcher's analysis related to the left knee extension angle variable in the implementation of the backhand short serve in the implementation phase are presented in Figure 5, with the average results of the extension angle was 165.18º with lower value of 155.8º and higer value of 172.4º.

Several factors that can affect the level of suitability of the athlete's backhand short serve in the field include muscle mass, especially if the athlete is still too young or a child of course there are still difficulties in maximizing a movement, especially a serve, therefore more intense training is needed. In addition to power or muscle mass, according to Listanto, (2021) when athletes serve, they do not only rely on 100% leg power but also other more complex components such as coordination, speed, flexibility, and balance. Badminton athletes must also pay attention to mental and physical conditions to support performance on the field (Hinda Zhannisa & Sugiyanto, 2015).

The factor of arm length and athlete's height also affects the success and suitability of every movement in badminton, including serve. Based on the analysis of researchers in the field, if an athlete has a height and arm length above the average it will make it easier for them to reach and hit (cross) the shuttlecock to the opponent's area. Musofan, (2007) in the development of his research stated that to be a good badminton player, it is necessary to have a body posture with height such as slenderness. In terms of serve, especially backhand short serve, they will greatly benefit because when compared to the height of the net with their posture, it will be easier to cross the shuttlecock into the opponent's territory.

In addition to these factors, athletes also need continuous and well-programmed regular training. Because basically all talents, potential, and supporting physical conditions will not be maximized without serious training. Based on research by Hussain, Ahmed, Bari, et al., (2011) to improve service skills by practicing hand, elbow and shoulder auctions. Intense exercise can be done using assistive devices to facilitate and strengthen wrist rotation, both in serving movements and other movements, Irawan et al., (2016) human motion is significantly influenced by several biomechanical factors such as ideal angle or body segmentation and body torque.

CONCLUSION

The potential for success and suitability of the backhand short serve of PB Pendowo athletes is classified as "Appropriate" in the implementation phase of the backhand short serve with a percentage of 66.6%, with an average right wrist extension angle of 157.65º, an average right wrist hyperextension angle of 218, 45º. The analysis of kinematic data in this study found the relation between the success and weakness of athletes influenced by muscle mass or power, arm length and height, as well as intense training. This study limitation also found that the result of speed and time in the backhand short serve technique need more efficiency at the center of movement and power is in the active wrist. Hopefully, future research can discuss certain parts or angles, such as the active wrist, to be more specifically described with other supporting literacy to make it more complex, so that this article can become one of the standard references for research on the theme of analysis and motion kinematics.

Commented [A9]: adjust to the method, and the results in the research you do!

the method has been adapted to the discussion as a quantitative method with a single case study model

ACKNOWLEDGMENT

The researcher wants to Thank to all relevant parties who have contribution in the study and to PB Pendowo Semarang City who has given permission and opportunities to researchers so that they can conduct research properly there.

REFERENCES

Afrizal, J. (2013). *Biomekanika dan Olahraga*. http://joeniafrizal.blogspot.com/2013/10/biomekanika-dan-olahraga.html

Arikunto, S. (2009). *Prosedur Penelitian Suatu Pendekatan Praktik* (E. 6 (ed.)). Rineka Cipta.

Arjunnaja, Irawan, F. A., & Purnomo, P. S. (2022). Journal of Sport Coaching and Physical Education Analisis Gerak Tendangan Shooting Menggunakan Punggung Kaki pada Atlet Popda Kabupaten Temanggung. *Journal of Sport Coaching and Physical Education*, *7*(1), 27–36.

Carboch, J., & Smocek, P. (2020). Serve and Return in Badminton: Gender Differences of Elite Badminton Players. *International Journal of Physical Education, Fitness and Sports*, *9*, 44–48. https://doi.org/10.34256/ijpefs2014

Dermawan, M. R. (2019). *Upaya Meningkatkan Keterampilan Servis Backhand Pendek Bulutangkis Melalui Media Audio Visual Pada Siswa SMAN 8 Pekanbaru*. Universitas Islam Riau, Pekanbaru.

Gawin, W., C, B., H, H., & D, B. (2013). How to attack the service: an empirical contribution to rally opening in world-class badminton doubles,. *International Journal of Performance Analysis in Sport*, *13*, 860–871.

Grice, T. (2016). *Bulu Tangkis : petunjuk praktis untuk pemula dan lanjut* (Ed 1, Ceta). PT RajaGrafindo Persada.

Hinda Zhannisa, U., & Sugiyanto, F. (2015). *Model Tes Fisik Pencarian Bakat Olahraga Bulutangkis Usia Di Bawah 11 Tahun Di Diy a Model of Physical Test for Talent Scouting in Badminton Skill Under 11 Years Old in Diy*. *3*(1), 117–126. http://journal.uny.ac.id/index.php/jolahraga

Hussain, I., Ahmed, S., Bari, M. A., Ahmad, A., Mohammad, A., & Khan, A. (2011). *Analysis of Arm Movement in Badminton of ForehandLong and Short Service Analysis of Arm Movement in Badminton of ForehandLong and Short Service*. *2 (03)*(June).

Hussain, I., Ahmed, S., Mohammad, A., Khan, A., & Arshad Bari, M. (2011). Videographical Analysis of Short Service in Badminton. *Journal of Education and Practise*, *2*(2), 1–6.

Irawan, F. A., Chuang, L.-R., Peng, H., & Huang, S. (2016). A Biomechanical Baseball Pitching : Is the curveball generating higher risk of injuries than fastball on young pitchers ? *CJSB*, *2004*, 55–63.

Irawan, F. A., Jannah, S. P., Permana, D. F. W., Nurrachmad, L., & Anam, K. (2021). Mawashi Geri in Karate Junior Cadet Class : Kinematic Analysis. *Journal of Hunan University*, *Vol.48*(No.9), pp.437–443.

Irawan, F. A., Nomi, M. T., & Peng, H. (2021). Pencak Silat Side Kick in Persinas ASAD : Biomechanics Analysis. *International Journal of Human Movement and Sports Sciences*, *Vol.9*(No.6), pp.1230–1235. https://doi.org/10.13189/saj.2021.090617

Irawan, F. A., Nurrahmad, L., & Permana, D. F. W. (2020). The Association of Arch Height Index and Arcus Pedis on Agility : An Overview of Sport Science College Students. *International Journal of Innovation, Creativity and Change*, *14*(11), 669–676. https://doi.org/DOI: 10.53333/IJICC2013/141108

Irawan, F. A., & Permana, D. F. W. (2020). Parent-Child Fun Games sebagai Upaya Meminimalisasi Smartphone Addiction pada Anak di Madrasah Ibtidaiyah. *Jurnal Pemberdayaan Masyarakat Mandiri Indonesia*, *1*(1), 1–8.

Irawan, F. A., Setiowati, A., Permana, D. F. W., & Sandiyudha, T. B. (2019). *Augment Reality Human Anatomy (ARMY) as Learning Media in Sport Science*. *362*(Acpes), 46–49. https://doi.org/10.2991/acpes-19.2019.10

Kharim, M. A., & Nurkholis. (2018). *Analisis Backswing Dan Release Ketepatan Pointing Half Lob Jongkok Pada Jarak 7 Meter Olahraga Petanque*. 1–6.

Listanto, B. (2021). *Kontribusi Kekuatan Otot Lengan Terhadap Kemampuan Servis Panjang Bulutangkis Pada Club PB. Bank Riau Kepri Pekanbaru*.

Mariotto, F. L., Zanni, P. P., & de Moraes, G. H. S. M. (2014). What is the

use of a single-case study in management research? *RAE Revista de Administracao de Empresas*, *54*(4), 358–369. https://doi.org/10.1590/S0034-759020140402

Musofan. (2007). *Hubungan power otot lengan, panjang lengan, dan tinggi badan terhadap hasil forehand smash bulutangkis pada anggota PB. RSL Purbalingga*. Universitas Negeri Semarang.

Nandika, R., Hadi, D. T., & Ridho, Z. A. (2017). PENGEMBANGAN MODEL LATIHAN STROKES BULUTANGKISBERBASISFOOTWORKUNTUKANAKUSIA PEMULA (U-15). *Gladi Jurnal Ilmu Keolahragaan*, *08*(02), 103–111. https://doi.org/https://doi.org/10.21009/GJIK.082.03

Singh, A. P., & Mishra, V. B. (2020). A BIOMECHANICAL ANALYSIS OF BADMINTON FOREHAND SERVICE. *Vidyabharati International Interdisciplinary Research Journal*, 71–73.

Sumanjaya, S. A. (2015). *Hubungan Tingkat Pengetahuan Teknik Dasar Terhadap Penguasaan Ketrampilan Bulutangkis* (Vol. 2015) [Universitas Pendidikan Indonesia]. http://eprints.ums.ac.id/14213/2/BAB_I.pdf

Sumardi, Simanjuntak, V. G., & Atiq, A. (2015). *Pengaruh Model Pembelajaran Mandiri Terhadap Hasil Belajar Servis Pendek Backhand Bulutangkis SMPN 8 Pontianak*. 1–7.

Taufan, A., Dewantara, B., & Alsaudi. (2016). Pengaruh Strategi Pembelajaran Dan Konsep Diri Terhadap Keterampilan Smash Bulutangkis. *Jurnal Sport Area*, *15*(1), 10–22. https://doi.org/10.20527/multilateral.v15i1.2480

Texier, B. D., Cohen, C., Quéré, D., & Claneta, C. (2012). Shuttlecock dynamics. *Procedia Engineering*, *34*(July 2012), 176–181. https://doi.org/10.1016/j.proeng.2012.04.031

Wahyuningsih, S. (2013). Metode Penelitian Studi Kasus: Konsep, Teori Pendekatan Psikologi Komunikasi, dan Contoh Penelitiannya. *UTM PRESS Bangkalan - Madura*, 119.

Wardana, Z. S., & Dra. Ika Jayadi, M. (2017). ANALISIS KETEPATAN SERVIS PANJANG FOREHAND PADA ATLET PB. SURYANAGA SURABAYA KATEGORI REMAJA PUTRA (Ditinjau Dari Sport Video Analysis Kinovea). *Jurnal P Endidikan Kepelatihan Olahraga (JPKO)*, 1–23.

Wijaya, A. (2017). ANALISIS GERAK KETERAMPILAN SERVIS DALAM PERMAINAN BULUTANGKIS (Suatu Tinjauan Anatomi, Fisiologi, dan Biomekanika) Kata. *Indonesia Performance Journal*, *1*(2), 106–111.

Notifications

[JS_UNPGRI] Editor Decision

2022-10-09 06:42 PM

Fajar Awang Irawan; Mirza Arif Ma'dum, Nanang Indardi, Minh Nghia Le Trans, Annisa Putri Fatmasari (Author):

We have reached a decision regarding your submission to Jurnal SPORTIF : Jurnal Penelitian Pembelajaran, "Potential and Limitations of Backhand Short Serve in Badminton: kinematics analysis: Potential and Limitations of Backhand Short Serve in Badminton: kinematics analysis".

Our decision is to: Resubmit for Review

Iago Portela-Pino
Isabel I University
iagojuniorportelapinoi@gmail.com

Reviewer A:
Recommendation: Revisions Required

Relevance = The suitability of the topic of the article for publication in the journal "SPORTIF"

3

Contribution = The quality of the paper is reviewed from ideas and authenticity (originality), novelty, and innovation (innovation)

3

Notifications

[JS_UNPGRI] Editor Decision

2022-10-09 06:42 PM

Fajar Awang Irawan; Mirza Arif Ma'dum, Nanang Indardi, Minh Nghia Le Trans, Annisa Putri Fatmasari (Author):

We have reached a decision regarding your submission to Jurnal SPORTIF : Jurnal Penelitian Pembelajaran, "Potential and Limitations of Backhand Short Serve in Badminton: kinematics analysis: Potential and Limitations of Backhand Short Serve in Badminton: kinematics analysis".

Our decision is to: Resubmit for Review

Iago Portela-Pino
Isabel I University
iagojuniorportelapinoi@gmail.com

Reviewer A:
Recommendation: Revisions Required

Relevance = The suitability of the topic of the article for publication in the journal "SPORTIF"

3

Contribution = The quality of the paper is reviewed from ideas and authenticity (originality), novelty, and innovation (innovation)

3

Potential and Limitations of Backhand Short Serve in Badminton: kinematics analysis

Abstract

The aim of this study to determine the potential and weaknesses of backhand short serve in badminton through a kinematic analysis approach, with a sample of children aged 12-16 years PB Pendowo Semarang City. The method used is quantitative with a single case study model and the analysis is assisted by using the Kinovea 0.9.4 software series, the total sample studied is 9 people using purposive sampling technique with 2 main criteria; range age 12-16 years old, and having participated in a Semarang city-level tournament at least in the top 3 level. The results showed that the athletes of PB Pendowo Semarang City in the implementation phase are in the "Appropriate" category, with a percentage of 66.6%. Several factors that influence the level of conformity are muscle mass, arm length and height, and training intensity. This limitation in this study is in the extension active wrist analysis. Future research hopefully focuses on the wrist activation and more specifically explain about flick movement in the wrist motion. Additional supporting literacy in the back hand short serve analysis could help the athletes and coaches to reach effective movement to get point using back hand short serve as first attacked.

Keywords: motion analysis, backhand short serve, potential, limitations

Commented [W81]: after explaining the sampling method, how many research samples were used?

if it will explain in more detail regarding the taking of research subjects, then explain it to the research method!

the number of samples, sampling techniques, and research methods has been added to the abstract

Commented [W82]: the results of the study did not correspond to the method written on the manuscript.

a quantitative method with a single case study model aims to review phenomena or events in an "activity" at one time, this is following the results of research which discusses the biomechanics of motion significantly with in-depth discussions related to general data (BMI), to details of the angle of motion for each athlete

INTRODUCTION

Several types of sports that are popular and growing rapidly in Indonesian society, including badminton, have very complex basic techniques, defined very complex because each athlete is required to have speed, strength, and good strategy in dealing with opponents (Sumanjaya, 2015). An athlete is also required to be able to master all the basic techniques in this sport such as backhand, smash, lob, and drive to serve. In the research of Wardana & Dra. Ika Jayadi, (2017) explains that the basic movements in badminton have the same body posture in hitting movements, the difference is the power and accuracy used in making punches, for example when lob, smash, and drop shot or cop in the same taking attitude. his position. With the correct movement in basic techniques, it is expected to improve performance and prevent injury (Irawan et al., 2020; Irawan, Jannah, et al., 2021; Irawan, Nomi, et al., 2021).

There are several basic techniques that must be mastered by badminton athletes, technique is a skill that must be mastered by someone

to be able to play the sport (Nandika et al., 2017). According to Taufan et al., (2016) for someone to be able to play badminton, one must master various basic techniques of the game correctly, which include racket grip, footwork, and various basic hitting techniques. Some of the most popular basic techniques to learn are the smash, backhand, drop shot, forehand, and serve. Serve is a basic technique that is mandatory and very important to master, the serve is an early technique in badminton that serves as a sign that the game has started (Hussain, Ahmed, Mohammad, et al., 2011) the serve is also referred to as the first attack in badminton because it is very important to master the technique. This type of serve is the most widely used, especially in men's competitions (Gawin et al., 2013). Male athletes tend to use backhand short serve in a ratio of 91% points (Carboch & Smocek, 2020).

Based on the distance of the serve, the type of badminton serve is divided into 2 part. At first namely long serve, one of which is flick serve and the second is short serve. Short serve or short serve must be done "softly" or as thin as possible over the net and land as close as possible to the opponent's serve field (Singh & Mishra, 2020), so that it will be difficult for the opponent to make a return. In this research interested in discussing the analysis of what factors affect the suitability of the backhand short serve motion of badminton athletes when they are in the field. This is reinforced by the results of researchers' observations of the sample, namely athletes from PB Pendowo, Semarang city, with an age range of 12-16 years. This observation is carried out before data collection, or you could say this observation is used as a benchmark for the condition and performance of athletes in the field without any engineering and manipulation of athletes' movements when training or competing.

Commented [W83]: Change "in this research……..."

suggestions/recommendations have been added. Thank you

Based on research from Wijaya, (2017), it is stated that the analysis of the service motion in badminton viewed anatomically, physiologically, and biomechanically affects the right and wrong of the action. Therefore, researchers are interested in discussing what factors affect the suitability of the backhand short serve. The aim of this study to determine the

potential and weaknesses of backhand short serve in badminton through a kinematic analysis approach.

METHOD

The type of this study using a single case study, which allows researchers to carry out in-depth and specific exploration of certain events of a phenomenon (Wahyuningsih, 2013), Mariotto et al., (2014) also added that this method allows for better dialogue and between researchers and their research both in terms of management, usefulness, and overall. The approach used in this method is analysis and evaluation. The population in this study was the PB Pendowo club, Semarang City. While total sample were 9 people who were selected using a purposive sampling technique with the provision that they were 12-16 years old and had at least been in the top 3 championships at the Semarang city level. The instruments in this study use digital camera, Canon 1300D type with Full HD 1080 x 1920P resolution with a speed of 30 FPS/ Frame Rate Per Second, camera tripod, blank or questionnaire containing the respondent's data as well as indicators of movement suitability analysis, badminton equipment, and a laptop with the Kinovea series application 0.9.4, quantitative data in this study were obtained through photo and video recordings of backhand service movements which were then analyzed using the Kinovea application series 0.9.4 (Arjunnaja et al., 2022). This study has passed the Ethical Clearance (EC) with number 366/KEPK/EC/2021 as part of the legalicy protocol of human research procedures.

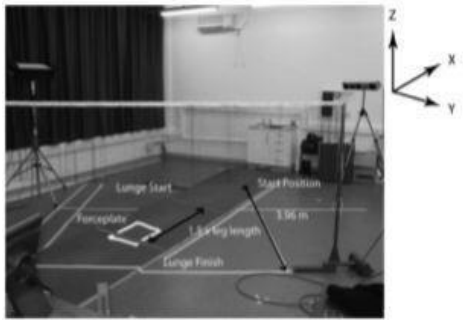
The research procedures in the data collection in PB Pendowo Semarang City are preparation, which is the stage to prepare tools and materials before the implementation of data collection such as the preparation of DSLR cameras, tripods, a questionnaire that discusses the observation data and quantitative data of athletes with the help of a validator, and inform consent. The placement of the camera in taking pictures and videos on the left side of the athlete's serve direction is based on research (Nasrullah, 2019), which has been adjusted by researchers, especially in placing the camera according to research needs.

Commented [W84]: replace this sentence with "The instruments in this study use ..... (camera/video/etc) (the brand of the fastener used) ."

recommendations have been added and adjusted to reviewers' suggestions

Commented [W85]: what the wuestioners?

an explanation regarding what and how the questionnaire has been added



Camera Laying Based on Research (Nasrullah, 2019)

Then the implementation of data collection in this procedure includes of how to collect data in the field such as camera angle positions, briefings, and athlete direction when taking videos and photos (giving cues and so on). At last the data processing, the data that has been collected is then recapitulated and processed using the Kinovea 0.9.4 series software (motion analyzer).

RESULT

Several variables or indicators measured in this study were right wrist extension angle (°), right wrist hyperextension (°), left elbow extension (°), and left knee extension (°), in the implementation phase. There are 3 phases of movement in the implementation of the backhand service including the preparation phase, the implementation phase (impact), and the follow-through phase. The basis for determining the 3 phases of the movement is based on the research of Sumardi et al., (2015) which states that there are 3 phases of movement, namely the preparation, implementation, and continuation phases

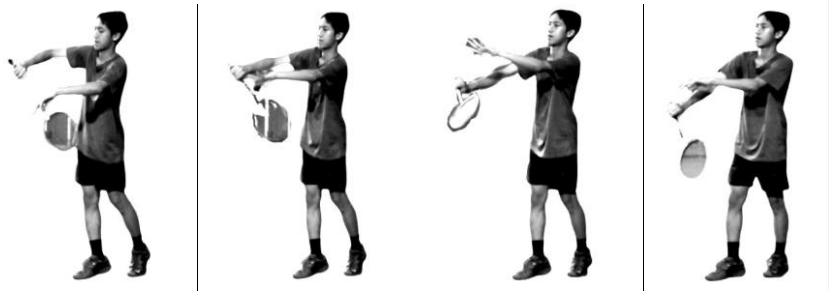
The focus of the researchers in this article is to discuss the stages in the implementation phase only. Because in the movement phase, researchers and readers will better understand how the criteria for time, distance, speed, and angle of the backhand short serve are good and correct. In addition to measuring kinematic data as shown in Table 1. above, the researchers also measured anthropometric data such as weight, height, and BMI (Body Mass Index) of each athlete as supporting

data. The number of samples consisted of 9 people with specifications 8 men and 1 woman.

Table 1. Anthropometric Data.

n = 9	Mean	Std. Deviation	Min	Max
Age *(year)*	13,44	1,236	12	15
Height *(cm)*	156,5	11,649	134	175
Weight *(kg)*	46,97	11,482	27	63
BMI *(kg/m^2)*	18,91	2,784	15,08	22,63

Analysis in the implementation phase of the backhand short serve conducted by PB Pendowo athletes in Semarang City stated that as many as 2 athletes were in the "Very Appropriate" category with a percentage of 22.2%, as many as 6 athletes were included in the "Agree" category with a percentage of 66.6%, and 1 athlete was in the "Not Appropriate" category with a percentage of 11.1%, and 0 athletes were in the "Not Appropriate" category. It can be concluded that the average backhand short serve movement of PB Pendowo athletes in Semarang City in the implementation phase has the "Appropriate" Criteria.



Preparation Phase ***Impact*** ***Release*** ***Advanced Phase***

Figure 1. Back Hand Short Serve Movement Phase

In the implementation phase there are 2 movements, namely impact and release, impact occurs on objects that move in one straight line or two straight lines (Afrizal, 2013). Release is defined as the momentum

when the ball leaves the hand (Kharim & Nurkholis, 2018). Texier et al., (2012) added that the direction of the shuttlecock is basically a parabola, but the direction and magnitude of the angle is influenced by power, direction and the wind on the field.

DISCUSSION

No	Motion Analyst Indicator	Sample								
		1 Favi	2 Engg	3 Zidn	4 Ilhm	5 Tang	6 Nauf	7 Daff	8 Rizq	9 Marc
Phase 1										
1	Standing stance with both feet open at an ideal distance (ideal in terms of being sturdy or flexible to serve). Right foot in front and left foot behind slightly tipped.	4	3	2	2	1	1	3	4	4
2	The right-hand holds the racket and the left-hand holds the shuttlecock at waist level	3	3	4	4	4	2	3	2	3
3	The wrist is slightly bent, the angle is still above 90º (still in extension)	4	4	3	3	3	3	4	4	3
4	The left elbow and right elbow are bent following the flow of the movement	4	4	4	3	3	3	4	3	4
5	A view toward the future or the desired target	3	4	4	3	3	4	4	2	4
Phase 2										
1	Transfer your weight to the front of your feet or the tips of your toes	2	3	3	1	3	2	3	4	4
2	Straighten the body in a position ready to make a serve strike, with the chest or stake slightly opened	4	3	3	3	2	3	4	4	4
3	Do a strike with the dominant wrist (which holds the racket) until there is an impact with the shuttlecock	3	4	3	4	4	3	3	3	4
4	The wrist experiences peak extension in the impact phase (angle is still below 180º)	3	3	4	4	4	1	4	4	3
5	Make contact or impact with the provisions of the racket and shuttlecock hitting a maximum height of the chest (if it exceeds the chest it is considered foul)	4	3	4	3	3	2	1	4	4
Phase 3										
1	Do the release movement, with the racket in an open position and pointing forward following the flow of the backhand short serve	4	2	3	3	2	3	3	4	4
2	The wrist is hyperextended (flexed with a negative value) in the direction opposite to the impact phase	3	3	4	3	3	3	3	3	4
3	Open the right elbow angle parallel to the shoulder, with the gaze focused forward widely to pay attention to the opponent's field and follow the direction of the drop of the shuttlecock.	4	3	4	3	2	3	4	3	4
4	Rotate hips, and shoulders to end the movement with both hands above (follow through)	3	3	3	4	1	2	3	4	3
5	Lower your hands following the flow of the movement at waist level, to then be in a position ready to receive an attack or receive the opponent's shuttlecock	4	3	4	4	2	3	4	4	3

Figure 2. Kinematic Data and Motion Suitability of PB Pendowo Athletes

The picture above describes how the level of suitability and serve potential of each athlete at PB Pendowo Semarang City, which resulted in a statement that, the analysis at the stage of implementing the backhand short serve carried out by PB Pendowo athletes Semarang City stated that as many as 2 athletes were in the "Very Appropriate" category. with a percentage of 22.2%, and as many as 6 athletes are included in the "Agree" category with a percentage of 66.6%, and 1 athlete is in the "Incompatible" category with a percentage of 11.1%, and 0 athletes are in the category "Very Inappropriate". So it can be concluded that the average backhand short serve movement of PB Pendowo athletes in Semarang

Commented [W86]: On the results of the study, it does not discuss this kind of result at all, how to do this analysis!

basic data and data calculation sources have been added

City in the implementation phase has the "Appropriate" Criteria. The determination of this value is based on research (Arikunto, 2009) related to the Likert scale, research (Grice, 2016) and (Dermawan, 2019) related to the determination of instruments and motion variables. Then it was specified again with the help of 2 expert validators and references from (Irawan & Permana, 2020) and (Irawan et al., 2019) by ticking the checklist " √ " in the available column when data collection in the field.

The value of each variable per movement phase is as follows, the serve time has an average of 0.11 seconds with a standard deviation of ± 0.02 seconds, the distance between legs has an average of 0.22 meters with a standard deviation of ± 0.13 meters, for right wrist extension data in the implementation phase or active phase has an average of 157.65º with a standard deviation of ± 14.73º, right wrist hyperextension has an average value of 218.45º with a standard deviation of ± 12.79º, elbow extension left with a mean value of 131.68º with a standard deviation of ± 24.18º, for left knee extension data has a mean of 165.17º and a standard deviation of ± 5.57º.

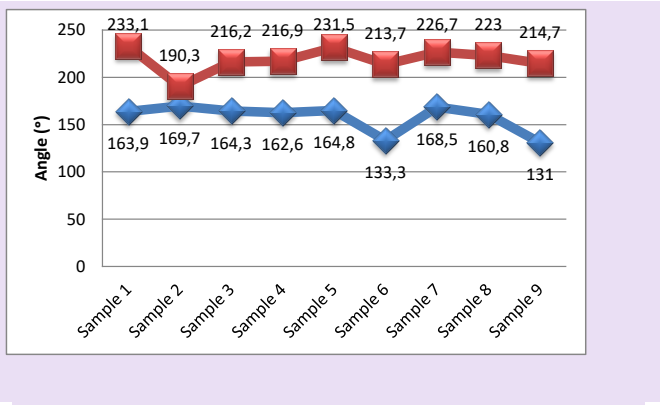


Figure 3. Extension and Hyperextension of the Right Wrist

The results of the analysis of the extension angle of the right wrist backhand short serve are presented in Figure 3, with the lower results of the extension angle in sample no.6 has an angle of 133.3º and sample no.9 has an angle of 131º. The average extension angle of 9 athletes from

PB Pendowo Semarang City is 157.65º with a minimum value of 131º and a maximum value of 169.7º.

Meanwhile, the backhand short serve right wrist hyperextension data presented that the higher result of the hyperextension angle of sample no.1 has an angle of 233.1º; and the lower is in the sample no.2 has an angle of 190.3º. The average hyperextension angle of 9 PB Pendowo athletes in Semarang City is 218.45º with a minimum value of 190.3º and a maximum value of 233.1º.

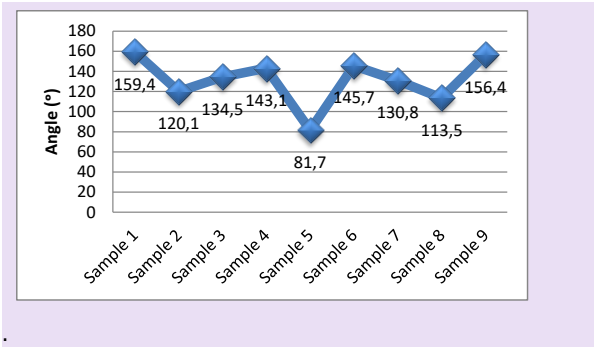


Figure 4. Left Elbow Extension Angle

The results of the researcher's analysis related to the left elbow extension angle variable in the implementation of the backhand short serve in the implementation phase are presented in Figure 4, with the results of the extension angle in the all sample with a lower was of 81.7º and the higher was 159.4º. Next in Figure 5 will present data on left knee extension in the implementation phase of each PB Pendowo athlete in Semarang City.

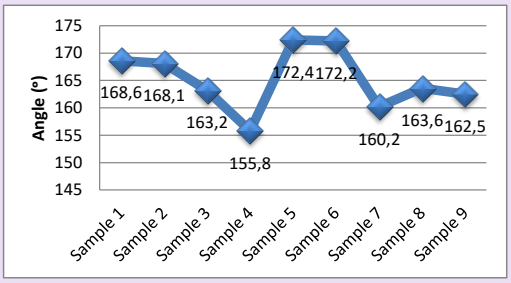


Figure 5. Left Knee Extension Angle

The results of the researcher's analysis related to the left knee extension angle variable in the implementation of the backhand short serve in the implementation phase are presented in Figure 5, with the average results of the extension angle was 165.18º with lower value of 155.8º and higer value of 172.4º.

Commented [W87]: where does the result of this explanation of the data come from?

This data is an elaboration of the results of the measurement of the left knee angle of each athlete with the classification of the average athlete's left leg angle data, the highest angle, to the lowest angle.

Several factors that can affect the level of suitability of the athlete's backhand short serve in the field include muscle mass, especially if the athlete is still too young or a child of course there are still difficulties in maximizing a movement, especially a serve, therefore more intense training is needed. In addition to power or muscle mass, according to Listanto, (2021) when athletes serve, they do not only rely on 100% leg power but also other more complex components such as coordination, speed, flexibility, and balance. Badminton athletes must also pay attention to mental and physical conditions to support performance on the field (Hinda Zhannisa & Sugiyanto, 2015).

The factor of arm length and athlete's height also affects the success and suitability of every movement in badminton, including serve. Based on the analysis of researchers in the field, if an athlete has a height and arm length above the average it will make it easier for them to reach and hit (cross) the shuttlecock to the opponent's area. Musofan, (2007) in the development of his research stated that to be a good badminton player, it is necessary to have a body posture with height such as slenderness. In terms of serve, especially backhand short serve, they will greatly benefit because when compared to the height of the net with their posture, it will be easier to cross the shuttlecock into the opponent's territory.

In addition to these factors, athletes also need continuous and well-programmed regular training. Because basically all talents, potential, and supporting physical conditions will not be maximized without serious training. Based on research by Hussain, Ahmed, Bari, et al., (2011) to improve service skills by practicing hand, elbow and shoulder auctions.

Intense exercise can be done using assistive devices to facilitate and strengthen wrist rotation, both in serving movements and other movements, Irawan et al., (2016) human motion is significantly influenced by several biomechanical factors such as ideal angle or body segmentation and body torque.

CONCLUSION

The potential for success and suitability of the backhand short serve of PB Pendowo athletes is classified as "Appropriate" in the implementation phase of the backhand short serve with a percentage of 66.6%, with an average right wrist extension angle of 157.65^{o}, an average right wrist hyperextension angle of 218, 45^{o}. The analysis of kinematic data in this study found the relation between the success and weakness of athletes influenced by muscle mass or power, arm length and height, as well as intense training. This study limitation also found that the result of speed and time in the backhand short serve technique need more efficiency at the center of movement and power is in the active wrist. Hopefully, future research is able to discuss certain parts or angles, such as the active wrist, to be more specifically described with other supporting literacy to make it more complex, so that this article can become one of the standard references for research on the theme of analysis and motion kinematics.

ACKNOWLEDGMENT

The researcher wants to Thank to all relevant parties who have contribution in the study and in particular to PB Pendowo Semarang City who has given permission and opportunities to researchers so that they can conduct research properly there.

REFERENCES

Afrizal, J. (2013). *Biomekanika dan Olahraga*. http://joeniafrizal.blogspot.com/2013/10/biomekanika-dan-olahraga.html

Arikunto, S. (2009). *Prosedur Penelitian Suatu Pendekatan Praktik* (E. 6 (ed.)). Rineka Cipta.

Arjunnaja, Irawan, F. A., & Purnomo, P. S. (2022). Journal of Sport Coaching and Physical Education Analisis Gerak Tendangan Shooting Menggunakan Punggung Kaki pada Atlet Popda Kabupaten

Temanggung. *Journal of Sport Coaching and Physical Education*, *7*(1), 27–36.
Carboch, J., & Smocek, P. (2020). Serve and Return in Badminton: Gender Differences of Elite Badminton Players. *International Journal of Physical Education, Fitness and Sports*, *9*, 44–48. https://doi.org/10.34256/ijpefs2014
Dermawan, M. R. (2019). *Upaya Meningkatkan Keterampilan Servis Backhand Pendek Bulutangkis Melalui Media Audio Visual Pada Siswa SMAN 8 Pekanbaru*. Universitas Islam Riau, Pekanbaru.
Gawin, W., C, B., H, H., & D, B. (2013). How to attack the service: an empirical contribution to rally opening in world-class badminton doubles,. *International Journal of Performance Analysis in Sport*, *13*, 860–871.
Grice, T. (2016). *Bulu Tangkis : petunjuk praktis untuk pemula dan lanjut* (Ed 1, Ceta). PT RajaGrafindo Persada.
Hinda Zhannisa, U., & Sugiyanto, F. (2015). *Model Tes Fisik Pencarian Bakat Olahraga Bulutangkis Usia Di Bawah 11 Tahun Di Diy a Model of Physical Test for Talent Scouting in Badminton Skill Under 11 Years Old in Diy*. *3*(1), 117–126. http://journal.uny.ac.id/index.php/jolahraga
Hussain, I., Ahmed, S., Bari, M. A., Ahmad, A., Mohammad, A., & Khan, A. (2011). *Analysis of Arm Movement in Badminton of ForehandLong and Short Service Analysis of Arm Movement in Badminton of ForehandLong and Short Service*. *2 (03)*(June).
Hussain, I., Ahmed, S., Mohammad, A., Khan, A., & Arshad Bari, M. (2011). Videographical Analysis of Short Service in Badminton. *Journal of Education and Practise*, *2*(2), 1–6.
Irawan, F. A., Chuang, L.-R., Peng, H., & Huang, S. (2016). A Biomechanical Baseball Pitching : Is the curveball generating higher risk of injuries than fastball on young pitchers ? *CJSB*, *2004*, 55–63.
Irawan, F. A., Jannah, S. P., Permana, D. F. W., Nurrachmad, L., & Anam, K. (2021). Mawashi Geri in Karate Junior Cadet Class : Kinematic Analysis. *Journal of Hunan University*, *Vol.48*(No.9), pp.437–443.
Irawan, F. A., Nomi, M. T., & Peng, H. (2021). Pencak Silat Side Kick in Persinas ASAD : Biomechanics Analysis. *International Journal of Human Movement and Sports Sciences*, *Vol.9*(No.6), pp.1230–1235. https://doi.org/10.13189/saj.2021.090617
Irawan, F. A., Nurrahmad, L., & Permana, D. F. W. (2020). The Association of Arch Height Index and Arcus Pedis on Agility : An Overview of Sport Science College Students. *International Journal of Innovation, Creativity and Change*, *14*(11), 669–676. https://doi.org/DOI: 10.53333/IJICC2013/141108
Irawan, F. A., & Permana, D. F. W. (2020). Parent-Child Fun Games sebagai Upaya Meminimalisasi Smartphone Addiction pada Anak di Madrasah Ibtidaiyah. *Jurnal Pemberdayaan Masyarakat Mandiri Indonesia*, *1*(1), 1–8.
Irawan, F. A., Setiowati, A., Permana, D. F. W., & Sandiyudha, T. B. (2019). *Augment Reality Human Anatomy (ARMY) as Learning Media*

in Sport Science. *362*(Acpes), 46–49. https://doi.org/10.2991/acpes-19.2019.10

Kharim, M. A., & Nurkholis. (2018). *Analisis Backswing Dan Release Ketepatan Pointing Half Lob Jongkok Pada Jarak 7 Meter Olahraga Petanque*. 1–6.

Listanto, B. (2021). *Kontribusi Kekuatan Otot Lengan Terhadap Kemampuan Servis Panjang Bulutangkis Pada Club PB. Bank Riau Kepri Pekanbaru*.

Mariotto, F. L., Zanni, P. P., & de Moraes, G. H. S. M. (2014). What is the use of a single-case study in management research? *RAE Revista de Administracao de Empresas*, *54*(4), 358–369. https://doi.org/10.1590/S0034-759020140402

Musofan. (2007). *Hubungan power otot lengan, panjang lengan, dan tinggi badan terhadap hasil forehand smash bulutangkis pada anggota PB. RSL Purbalingga*. Universitas Negeri Semarang.

Nandika, R., Hadi, D. T., & Ridho, Z. A. (2017). PENGEMBANGAN MODEL LATIHAN STROKES BULUTANGKISBERBASISFOOTWORKUNTUKANAKUSIA PEMULA (U-15). *Gladi Jurnal Ilmu Keolahragaan*, *08*(02), 103–111. https://doi.org/https://doi.org/10.21009/GJIK.082.03

Nasrullah, M. (2019). *Analisis Biomekanik Servis Pendek Backhand Atlet Bulutangkis Kendal*.

Singh, A. P., & Mishra, V. B. (2020). A BIOMECHANICAL ANALYSIS OF BADMINTON FOREHAND SERVICE. *Vidyabharati International Interdisciplinary Research Journal*, 71–73.

Sumanjaya, S. A. (2015). *Hubungan Tingkat Pengetahuan Teknik Dasar Terhadap Penguasaan Ketrampilan Bulutangkis* (Vol. 2015) [Universitas Pendidikan Indonesia]. http://eprints.ums.ac.id/14213/2/BAB_I.pdf

Sumardi, Simanjuntak, V. G., & Atiq, A. (2015). *Pengaruh Model Pembelajaran Mandiri Terhadap Hasil Belajar Servis Pendek Backhand Bulutangkis SMPN 8 Pontianak*. 1–7.

Taufan, A., Dewantara, B., & Alsaudi. (2016). Pengaruh Strategi Pembelajaran Dan Konsep Diri Terhadap Keterampilan Smash Bulutangkis. *Jurnal Sport Area*, *15*(1), 10–22. https://doi.org/10.20527/multilateral.v15i1.2480

Texier, B. D., Cohen, C., Quéré, D., & Claneta, C. (2012). Shuttlecock dynamics. *Procedia Engineering*, *34*(July 2012), 176–181. https://doi.org/10.1016/j.proeng.2012.04.031

Wahyuningsih, S. (2013). Metode Penelitian Studi Kasus: Konsep, Teori Pendekatan Psikologi Komunikasi, dan Contoh Penelitiannya. *UTM PRESS Bangkalan - Madura*, 119.

Wardana, Z. S., & Dra. Ika Jayadi, M. (2017). ANALISIS KETEPATAN SERVIS PANJANG FOREHAND PADA ATLET PB. SURYANAGA SURABAYA KATEGORI REMAJA PUTRA (Ditinjau Dari Sport Video Analysis Kinovea). *Jurnal P Endidikan Kepelatihan Olahraga (JPKO)*, 1–23.

Wijaya, A. (2017). ANALISIS GERAK KETERAMPILAN SERVIS DALAM

PERMAINAN BULUTANGKIS (Suatu Tinjauan Anatomi, Fisiologi, dan Biomekanika) Kata. *Indonesia Performance Journal*, *1*(2), 106–111.

Potential and Limitations of Backhand Short Serve in Badminton: kinematics analysis

Abstract

The aim of this study to determine the potential and weaknesses of backhand short serve in badminton through a kinematic analysis approach, with a sample of children aged 12-16 years PB Pendowo Semarang City. Moreover backhand short serve is an important element or main character. in badminton, where not many people can maximize the potential and limits of each athlete such as power, speed, accuracy, and motion efficiency. The method used quantitative with a descriptive analysis approach and the analysis is assisted by using the Kinovea 0.9.4 series software. The sampling technique used is purposive sampling with 2 criteria; age (12-16 years old), and having participated in a Semarang city-level tournament. The results showed that the athletes of PB Pendowo Semarang City in the implementation phase are in the "Appropriate" category, with a percentage of 66.6%. The instruments used in this data collection are observation and documentation. Several factors that influence the level of conformity are muscle mass, arm length and height, and training intensity. This research can still be developed in future research by discussing more specific things such as focusing on active wrists, and more specifically explain about flick movement in the wrist motion. Additional supporting literacy in the back hand short serve analysis could help the athletes and coaches to reach effective movement to get point using back hand short serve as first attacked.

Keywords: motion analysis, backhand short serve, potential, limitations

INTRODUCTION

Several types of sports that are popular and growing rapidly in Indonesian society, including badminton, have very complex basic techniques, defined very complex because each athlete is required to have speed, strength, and good strategy in dealing with opponents (Sumanjaya, 2015). An athlete is also required to be able to master all the basic techniques in this sport such as backhand, smash, lob, and drive to serve. In the research of Wardana & Dra. Ika Jayadi, (2017) explains that the basic movements in badminton have the same body posture in hitting movements, the difference is the power and accuracy used in making punches, for example when lob, smash, and drop shot or cop in the same taking attitude. his position. With the correct movement in basic techniques, it is expected to improve performance and prevent injury (Irawan et al., 2020; Irawan, Jannah, et al., 2021; Irawan, Nomi, et al., 2021).

There are several basic techniques that must be mastered by badminton athletes, technique is a skill that must be mastered by someone to be able to play the sport (Nandika et al., 2017). According to Taufan et al., (2016) for someone to be able to play badminton, one must master various basic techniques of the game correctly, which include racket grip, footwork, and various basic hitting techniques. Some of the most popular basic techniques to learn are the smash, backhand, drop shot, forehand, and serve. Serve is a basic technique that is mandatory and very important to master, the serve is an early technique in badminton that serves as a sign that the game has started (Hussain, Ahmed, Mohammad, et al., 2011) the serve is also referred to as the first attack in badminton because it is very important to master the technique. This type of serve is the most widely used, especially in men's competitions (Gawin et al., 2013). Male athletes tend to use backhand short serve in a ratio of 91% points (Carboch & Smocek, 2020).

Based on the distance of the serve, the type of badminton serve is divided into 2 part. At first namely long serve, one of which is flick serve and the second is short serve. Short serve or short serve must be done "softly" or as thin as possible over the net and land as close as possible to the opponent's serve field (Singh & Mishra, 2020), so that it will be difficult for the opponent to make a return. Researchers are interested in discussing the analysis of what factors affect the suitability of the backhand short serve motion of badminton athletes when they are in the field. This is reinforced by the results of researchers' observations of the sample, namely athletes from PB Pendowo, Semarang city, with an age range of 12-16 years. This observation is carried out before data collection, or you could say this observation is used as a benchmark for the condition and performance of athletes in the field without any engineering and manipulation of athletes' movements when training or competing.

This research becomes more interesting to discuss because there is no clear and specific discussion or review related to the analysis of motion potential based on appropriate biomechanics (both in Indonesia and

specifically at the research location), moreover backhand short serve is an important element or main character. in badminton, where not many people can maximize the potential and limits of each athlete such as power, speed, accuracy, and motion efficiency.

Based on research from Wijaya, (2017), it is stated that the analysis of the service motion in badminton viewed anatomically, physiologically, and biomechanically affects the right and wrong of the action. Therefore, researchers are interested in discussing what factors affect the suitability of the backhand short serve. The aim of this study to determine the potential and weaknesses of backhand short serve in badminton through a kinematic analysis approach.

METHOD

The type of this study using a single case study, which allows researchers to carry out in-depth and specific exploration of certain events of a phenomenon (Wahyuningsih, 2013), Mariotto et al., (2014) also added that this method allows for better dialogue and between researchers and their research both in terms of management, usefulness, and overall. The approach used in this method is analysis and evaluation. The population in this study was the PB Pendowo club, Semarang City. The number of samples studied was 9 people who were selected using purposive sampling technique with the provision that they were 12-16 years old and had at least won the top 3 at the Semarang city level. Quantitative data in this study were obtained through photo and video recordings of backhand service movements which were then analyzed using the Kinovea application series 0.9.4 (Arjunnaja et al., 2022). This study has passed the Ethical Clearance (EC) with number 366/KEPK/EC/2021 as part of the legalicy protocol of human research procedures.

The research procedures in the data collection in PB Pendowo Semarang City are preparation, which is the stage to prepare tools and materials before the implementation of data collection such as the preparation of DSLR cameras, tripods, questionnaires, and inform consent. Then the implementation of data collection in this procedure includes of how

to collect data in the field such as camera angle positions, briefings, and athlete direction when taking videos and photos (giving cues and so on). At last, the data processing, the data that has been collected is then recapitulated and processed using the Kinovea 0.9.4 series software (motion analyzer).

Kinematic parameters of motion especially in the backhand short serve motion is divided into 3 main motion phases, namely the preparation phase, the implementation phase, and the follow-through phase, this opinion is based on research (Sumardi et al., 2015). Details of the 3 phases of the backhand short serve motion have their respective descriptions, for the preparation phase starting from the beginning of the movement where the athlete holds the shuttlecock until the wrist is actively flexed, the implementation phase starts after the active wrist is flexed which is then followed by impact (the racket hits the shuttlecock) until Active wrist strikes with the lever position and the cubits straight parallel to the carpal or metacarpal, the last is the follow-through phase starting after the impact phase until the shuttlecock is completely released from the hand and leads to the opponent's court and is followed by an active wrist hyperextension position (as form part of the “continuation” of the backhand short serve). There is an important role of the arm muscles as a machine or motor that performs the movement when hitting and the muscles of the legs or feet. Apart from being a pedestal when doing stances, the leg muscles are also used as a movement stabilizer

Commented [A1]: don’t (.) at the end of this sentence!

Commented [N2R1]: done

RESULT

Several variables or indicators measured in this study were right wrist extension angle (°), right wrist hyperextension (°), left elbow extension (°), and left knee extension (°), in the implementation phase. There are 3 phases of movement in the implementation of the backhand service including the preparation phase, the implementation phase (impact), and the follow-through phase. The basis for determining the 3 phases of the movement is based on the research of Sumardi et al., (2015) which states

that there are 3 phases of movement, namely the preparation, implementation, and continuation phases.

The focus of the researchers in this article is to discuss the stages in the implementation phase only. Because in the movement phase, researchers and readers will better understand how the criteria for time, distance, speed, and angle of the backhand short serve are good and correct. In addition to measuring kinematic data as shown in Table 1. above, the researchers also measured anthropometric data such as weight, height, and BMI (Body Mass Index) of each athlete as supporting data. The number of samples consisted of 9 people with specifications 8 men and 1 woman.

Table 1. Anthropometric Data.

n = 9	**Mean ± SD**	**Min**	**Max**
Age *(year)*	13,44 ± 1,236	12	15
Height *(cm)*	156,5 ± 11,649	134	175
Weight *(kg)*	46,97 ± 11,482	27	63
BMI *(kg/m^2)*	18,91 ± 2,784	15,08	22,63

Analysis in the implementation phase of the backhand short serve conducted by PB Pendowo athletes in Semarang City stated that as many as 2 athletes were in the "Very Appropriate" category with a percentage of 22.2%, as many as 6 athletes were included in the "Agree" category with a percentage of 66.6%, and 1 athlete was in the "Not Appropriate" category with a percentage of 11.1%, and 0 athletes were in the "Not Appropriate" category. It can be concluded that the average backhand short serve movement of PB Pendowo athletes in Semarang City in the implementation phase has the "Appropriate" Criteria. Determination of the level of conformity data above is based on the validator's assessment with the following calculation results.

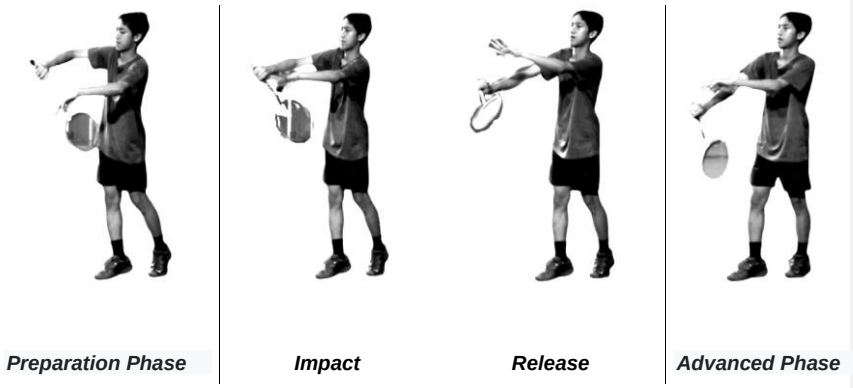


Figure 1. Back Hand Short Serve Movement Phase

In the implementation phase there are 2 movements, namely impact and release, impact occurs on objects that move in one straight line or two straight lines (Afrizal, 2013). Release is defined as the momentum when the ball leaves the hand (Kharim & Nurkholis, 2018). Texier et al., (2012) added that the direction of the shuttlecock is basically a parabola, but the direction and magnitude of the angle is influenced by power, direction, and the wind on the field.

DISCUSSION

Analysis in the implementation phase of the backhand short serve conducted by PB Pendowo athletes in Semarang City stated that as many as 2 athletes were in the "Very Appropriate" category with a percentage of 22.2%, and as many as 6 athletes were included in the "Agree" category with a percentage of 66.6%, and 1 athlete was in the "Not Appropriate" category with a percentage of 11.1%, and 0 athletes were in the "Not Appropriate" category. So it can be concluded that the average backhand short serve movement of PB Pendowo athletes in Semarang City in the implementation phase has the "Appropriate" Criteria. The determination of this value is based on research (Arikunto, 2009) related to the Likert scale, research (Grice, 2016) and (Dermawan, 2019) related to the determination of instruments and motion variables. Then it was specified again with the help of 2 expert validators and references from (Irawan & Permana, 2020)

and (Irawan et al., 2019) by ticking the checklist " √ " in the available column when data collection in the field.

The value of each variable per movement phase is as follows, the serve time has an average of 0.11 seconds with a standard deviation of ± 0.02 seconds, the distance between legs has an average of 0.22 meters with a standard deviation of ± 0.13 meters, for right wrist extension data in the implementation phase or active phase has an average of 157.65º with a standard deviation of ± 14.73º, right wrist hyperextension has an average value of 218.45º with a standard deviation of ± 12.79º, elbow extension left with a mean value of 131.68º with a standard deviation of ± 24.18º, for left knee extension data has a mean of 165.17º and a standard deviation of ± 5.57º.

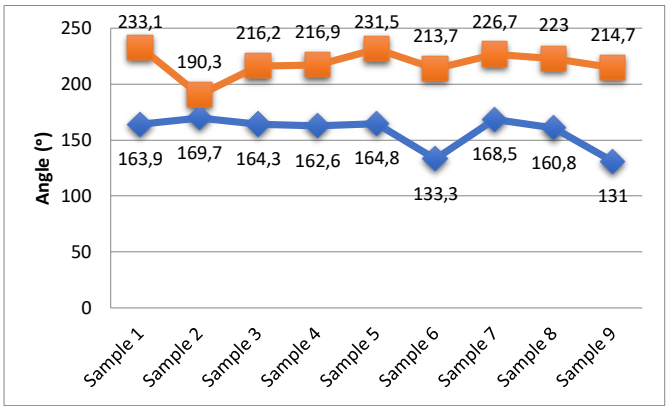


Figure 2. Extension and Hyperextension of the Right Wrist

The results of the analysis of the extension angle of the right wrist backhand short serve are presented in Figure 2, with the lower results of the extension angle in sample no.6 has an angle of 133.3º and sample no.9 has an angle of 131º. The average extension angle of 9 athletes from PB Pendowo Semarang City is 157.65º with a minimum value of 131º and a maximum value of 169.7º.

Meanwhile, the backhand short serve right wrist hyperextension data presented that the higher result of the hyperextension angle of sample no.1 has an angle of 233.1º; and the lower is in the sample no.2 has an angle of 190.3º. The average hyperextension angle of 9 PB Pendowo athletes in

Semarang City is 218.45º with a minimum value of 190.3º and a maximum value of 233.1º.

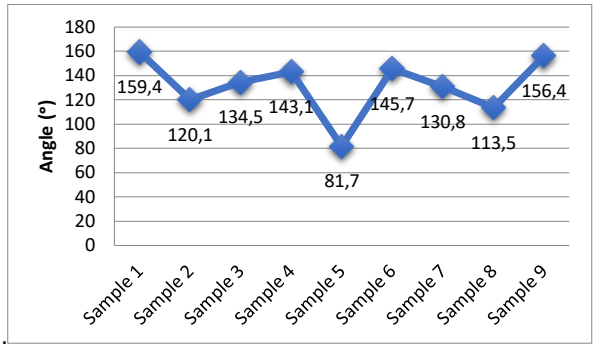


Figure 3. Left Elbow Extension Angle

The results of the researcher's analysis related to the left elbow extension angle variable in the implementation of the backhand short serve in the implementation phase are presented in Figure 3, with the results of the extension angle in the all sample with a lower was of 81.7º and the higher was 159.4º. Next in Figure 5 will present data on left knee extension in the implementation phase of each PB Pendowo athlete in Semarang City.

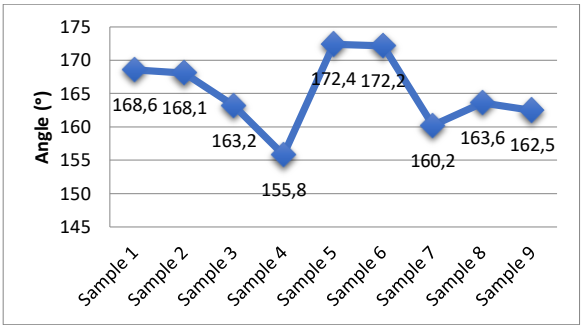


Figure 4. Left Knee Extension Angle

The results of the researcher's analysis related to the left knee extension angle variable in the implementation of the backhand short serve in the implementation phase are presented in Figure 4, with the average results of the extension angle was 165.18º with lower value of 155.8º and higer value of 172.4º.

Several factors that can affect the level of suitability of the athlete's backhand short serve in the field include muscle mass, especially if the athlete is still too young or a child of course there are still difficulties in maximizing a movement, especially a serve, therefore more intense training is needed. In addition to power or muscle mass, according to Listanto, (2021) when athletes serve, they do not only rely on 100% leg power but also other more complex components such as coordination, speed, flexibility, and balance. Badminton athletes must also pay attention to mental and physical conditions to support performance on the field (Hinda Zhannisa & Sugiyanto, 2015).

The factor of arm length and athlete's height also affects the success and suitability of every movement in badminton, including serve. Based on the analysis of researchers in the field, if an athlete has a height and arm length above the average it will make it easier for them to reach and hit (cross) the shuttlecock to the opponent's area. Musofan, (2007) in the development of his research stated that to be a good badminton player, it is necessary to have a body posture with height such as slenderness. In terms of serve, especially backhand short serve, they will greatly benefit because when compared to the height of the net with their posture, it will be easier to cross the shuttlecock into the opponent's territory.

In addition to these factors, athletes also need continuous and well-programmed regular training. Because basically all talents, potential, and supporting physical conditions will not be maximized without serious training. Based on research by Hussain, Ahmed, Bari, et al., (2011) to improve service skills by practicing hand, elbow and shoulder auctions. Intense exercise can be done using assistive devices to facilitate and strengthen wrist rotation, both in serving movements and other movements, Irawan et al., (2016) human motion is significantly influenced by several biomechanical factors such as ideal angle or body segmentation and body torque.

CONCLUSION

The potential for success and suitability of the backhand short serve of PB Pendowo athletes is classified as "Appropriate" in the implementation phase of the backhand short serve with a percentage of 66.6%, with an average right wrist extension angle of 157.65º, an average right wrist hyperextension angle of 218, 45º. The analysis of kinematic data in this study found the relation between the success and weakness of athletes influenced by muscle mass or power, arm length and height, as well as intense training. This study limitation also found that the result of speed and time in the backhand short serve technique need more efficiency at the center of movement and power is in the active wrist. Hopefully, future research can discuss certain parts or angles, such as the active wrist, to be more specifically described with other supporting literacy to make it more complex, so that this article can become one of the standard references for research on the theme of analysis and motion kinematics.

ACKNOWLEDGMENT

The researcher wants to Thank to all relevant parties who have contribution in the study and to PB Pendowo Semarang City who has given permission and opportunities to researchers so that they can conduct research properly there.

REFERENCES

Afrizal, J. (2013). *Biomekanika dan Olahraga*. http://joeniafrizal.blogspot.com/2013/10/biomekanika-dan-olahraga.html

Arikunto, S. (2009). *Prosedur Penelitian Suatu Pendekatan Praktik* (E. 6 (ed.)). Rineka Cipta.

Arjunnaja, Irawan, F. A., & Purnomo, P. S. (2022). Journal of Sport Coaching and Physical Education Analisis Gerak Tendangan Shooting Menggunakan Punggung Kaki pada Atlet Popda Kabupaten Temanggung. *Journal of Sport Coaching and Physical Education*, *7*(1), 27–36.

Carboch, J., & Smocek, P. (2020). Serve and Return in Badminton: Gender Differences of Elite Badminton Players. *International Journal of Physical Education, Fitness and Sports*, *9*, 44–48. https://doi.org/10.34256/ijpefs2014

Dermawan, M. R. (2019). *Upaya Meningkatkan Keterampilan Servis Backhand Pendek Bulutangkis Melalui Media Audio Visual Pada Siswa SMAN 8 Pekanbaru*. Universitas Islam Riau, Pekanbaru.

Gawin, W., C, B., H, H., & D, B. (2013). How to attack the service: an empirical contribution to rally opening in world-class badminton doubles,. *International Journal of Performance Analysis in Sport*, *13*, 860–871.

Grice, T. (2016). *Bulu Tangkis : petunjuk praktis untuk pemula dan lanjut* (Ed 1, Ceta). PT RajaGrafindo Persada.

Hinda Zhannisa, U., & Sugiyanto, F. (2015). *Model Tes Fisik Pencarian Bakat Olahraga Bulutangkis Usia Di Bawah 11 Tahun Di Diy a Model of Physical Test for Talent Scouting in Badminton Skill Under 11 Years Old in Diy*. *3*(1), 117–126. http://journal.uny.ac.id/index.php/jolahraga

Hussain, I., Ahmed, S., Bari, M. A., Ahmad, A., Mohammad, A., & Khan, A. (2011). *Analysis of Arm Movement in Badminton of ForehandLong and Short Service Analysis of Arm Movement in Badminton of ForehandLong and Short Service*. *2 (03)*(June).

Hussain, I., Ahmed, S., Mohammad, A., Khan, A., & Arshad Bari, M. (2011). Videographical Analysis of Short Service in Badminton. *Journal of Education and Practise*, *2*(2), 1–6.

Irawan, F. A., Chuang, L.-R., Peng, H., & Huang, S. (2016). A Biomechanical Baseball Pitching : Is the curveball generating higher risk of injuries than fastball on young pitchers ? *CJSB*, *2004*, 55–63.

Irawan, F. A., Jannah, S. P., Permana, D. F. W., Nurrachmad, L., & Anam, K. (2021). Mawashi Geri in Karate Junior Cadet Class : Kinematic Analysis. *Journal of Hunan University*, *Vol.48*(No.9), pp.437–443.

Irawan, F. A., Nomi, M. T., & Peng, H. (2021). Pencak Silat Side Kick in Persinas ASAD : Biomechanics Analysis. *International Journal of Human Movement and Sports Sciences*, *Vol.9*(No.6), pp.1230–1235. https://doi.org/10.13189/saj.2021.090617

Irawan, F. A., Nurrahmad, L., & Permana, D. F. W. (2020). The Association of Arch Height Index and Arcus Pedis on Agility : An Overview of Sport Science College Students. *International Journal of Innovation, Creativity and Change*, *14*(11), 669–676. https://doi.org/DOI: 10.53333/IJICC2013/141108

Irawan, F. A., & Permana, D. F. W. (2020). Parent-Child Fun Games sebagai Upaya Meminimalisasi Smartphone Addiction pada Anak di Madrasah Ibtidaiyah. *Jurnal Pemberdayaan Masyarakat Mandiri Indonesia*, *1*(1), 1–8.

Irawan, F. A., Setiowati, A., Permana, D. F. W., & Sandiyudha, T. B. (2019). *Augment Reality Human Anatomy (ARMY) as Learning Media in Sport Science*. *362*(Acpes), 46–49. https://doi.org/10.2991/acpes-19.2019.10

Kharim, M. A., & Nurkholis. (2018). *Analisis Backswing Dan Release Ketepatan Pointing Half Lob Jongkok Pada Jarak 7 Meter Olahraga Petanque*. 1–6.

Listanto, B. (2021). *Kontribusi Kekuatan Otot Lengan Terhadap Kemampuan Servis Panjang Bulutangkis Pada Club PB. Bank Riau Kepri Pekanbaru*.

Mariotto, F. L., Zanni, P. P., & de Moraes, G. H. S. M. (2014). What is the use of a single-case study in management research? *RAE Revista de*

Administracao de Empresas, *54*(4), 358–369. https://doi.org/10.1590/S0034-759020140402

Musofan. (2007). *Hubungan power otot lengan, panjang lengan, dan tinggi badan terhadap hasil forehand smash bulutangkis pada anggota PB. RSL Purbalingga*. Universitas Negeri Semarang.

Nandika, R., Hadi, D. T., & Ridho, Z. A. (2017). PENGEMBANGAN MODEL LATIHAN STROKES BULUTANGKISBERBASISFOOTWORKUNTUKANAKUSIA PEMULA (U-15). *Gladi Jurnal Ilmu Keolahragaan*, *08*(02), 103–111. https://doi.org/https://doi.org/10.21009/GJIK.082.03

Singh, A. P., & Mishra, V. B. (2020). A BIOMECHANICAL ANALYSIS OF BADMINTON FOREHAND SERVICE. *Vidyabharati International Interdisciplinary Research Journal*, 71–73.

Sumanjaya, S. A. (2015). *Hubungan Tingkat Pengetahuan Teknik Dasar Terhadap Penguasaan Ketrampilan Bulutangkis* (Vol. 2015) [Universitas Pendidikan Indonesia]. http://eprints.ums.ac.id/14213/2/BAB_I.pdf

Sumardi, Simanjuntak, V. G., & Atiq, A. (2015). *Pengaruh Model Pembelajaran Mandiri Terhadap Hasil Belajar Servis Pendek Backhand Bulutangkis SMPN 8 Pontianak*. 1–7.

Taufan, A., Dewantara, B., & Alsaudi. (2016). Pengaruh Strategi Pembelajaran Dan Konsep Diri Terhadap Keterampilan Smash Bulutangkis. *Jurnal Sport Area*, *15*(1), 10–22. https://doi.org/10.20527/multilateral.v15i1.2480

Texier, B. D., Cohen, C., Quéré, D., & Claneta, C. (2012). Shuttlecock dynamics. *Procedia Engineering*, *34*(July 2012), 176–181. https://doi.org/10.1016/j.proeng.2012.04.031

Wahyuningsih, S. (2013). Metode Penelitian Studi Kasus: Konsep, Teori Pendekatan Psikologi Komunikasi, dan Contoh Penelitiannya. *UTM PRESS Bangkalan - Madura*, 119.

Wardana, Z. S., & Dra. Ika Jayadi, M. (2017). ANALISIS KETEPATAN SERVIS PANJANG FOREHAND PADA ATLET PB. SURYANAGA SURABAYA KATEGORI REMAJA PUTRA (Ditinjau Dari Sport Video Analysis Kinovea). *Jurnal P Endidikan Kepelatihan Olahraga (JPKO)*, 1–23.

Wijaya, A. (2017). ANALISIS GERAK KETERAMPILAN SERVIS DALAM PERMAINAN BULUTANGKIS (Suatu Tinjauan Anatomi, Fisiologi, dan Biomekanika) Kata. *Indonesia Performance Journal*, *1*(2), 106–111.

Notifications

[JS_UNPGRI] Editor Decision

2022-10-20 09:55 PM

Fajar Awang Irawan; Mirza Arif Ma'dum, Nanang Indardi, Minh Nghia Le Trans, Annisa Putri Fatmasari (Author):

We have reached a decision regarding your submission to Jurnal SPORTIF : Jurnal Penelitian Pembelajaran, "Potential and Limitations of Backhand Short Serve in Badminton: kinematics analysis: Potential and Limitations of Backhand Short Serve in Badminton: kinematics analysis".

Our decision is to: Accept Submission

Iago Portela-Pino
Isabel I University
iagojuniorportelapinoi@gmail.com

Reviewer A:
Recommendation: Accept Submission

Relevance = The suitability of the topic of the article for publication in the journal "SPORTIF"

3

Contribution = The quality of the paper is reviewed from ideas and authenticity (originality), novelty, and innovation (innovation)

3

Notifications

[JS_UNPGRI] Editor Decision

2022-10-20 09:55 PM

Fajar Awang Irawan; Mirza Arif Ma'dum, Nanang Indardi, Minh Nghia Le Trans, Annisa Putri Fatmasari (Author):

We have reached a decision regarding your submission to Jurnal SPORTIF : Jurnal Penelitian Pembelajaran, "Potential and Limitations of Backhand Short Serve in Badminton: kinematics analysis: Potential and Limitations of Backhand Short Serve in Badminton: kinematics analysis".

Our decision is to: Accept Submission

Iago Portela-Pino
Isabel I University
iagojuniorportelapinoi@gmail.com

Reviewer A:
Recommendation: Accept Submission

Relevance = The suitability of the topic of the article for publication in the journal "SPORTIF"

3

Contribution = The quality of the paper is reviewed from ideas and authenticity (originality), novelty, and innovation (innovation)

3

Discussion

Participants

Fajar Awang (fawang)

Iago Portela-Pino (iagoj)

Messages

Note	From
Dear Author Thank you for the response given. We congratulate you on being part of our publication in Volume 8, Number 4 of 2022. Furthermore, please complete some of these requirements so that we can continue your manuscript process. iagoj, Manuscript Statement new December.pdf	iagoj 2022-10-25 11:16 AM
Dear Editor, I have attached this Manuscript Statement to complement the article to continue the publication process. Thank you fawang, MS 18383-Article Text-33866-1-18-20221025 (1).pdf	fawang 2022-11-10 08:58 PM

Add Message

Discussion

Participants

Fajar Awang (fawang)

Iago Portela-Pino (iagoj)

Messages

Note	From
Dear Author Thank you for the response given. We congratulate you on being part of our publication in Volume 8, Number 4 of 2022. Furthermore, please complete some of these requirements so that we can continue your manuscript process. iagoj, Manuscript Statement new December.pdf	iagoj 2022-10-25 11:16 AM
Dear Editor, I have attached this Manuscript Statement to complement the article to continue the publication process. Thank you fawang, MS 18383-Article Text-33866-1-18-20221025 (1).pdf	fawang 2022-11-10 08:58 PM

Add Message

Jurnal SPORTIF
Jurnal Penelitian Pembelajaran
e-ISSN : 2477-3379
p-ISSN : 2548-7833
Website: ojs.unpkediri.ac.id/index.php/pjk
jurnal.sportif@unpkediri.ac.id

Jurnal SPORTIF: Jurnal Penelitian Pembelajaran
Accredited SINTA 2
Decree of the Director General of Strengthening Research and Development of the Ministry of Research, Technology, and Higher Education, number 3./E/KPT/2019, dated January 14, 2019 and Number 10/E/KPT/2019, dated April 4, 2019

Manuscript Statement

With this article with the title:

"Potential and Limitations of Backhand Short Serve in Badminton: kinematics analysis"

With the authors : (please fill in completely)

Author 1 : Fajar Awang Irawan[ab] signature:
Email Author 1: fajarawang@mail.unnes.ac.id Institution Author 1:
OrciD : 0000-0002-0508-267X Universitas Negeri Semarang, Indonesia
Author 2 : Mirza Arif Ma'dum[c] signature:
Email Author 2: mirzaarif@students.unnes.ac.id Institution Author 2:
OrciD : 0000-0003-4592-1287 Universitas Negeri Semarang, Indonesia
Author 3 : Nanang Indardi[d] signature:
Email Author 3: nanangindardi@mail.unnes.ac.id Institution Author 3:
OrciD : Universitas Negeri Semarang, Indonesia
Author 4 : Minh Nghia Le Trans[e] signature:
Email Author 4: letranminhnghia@tdtu.vn Institution Author 4:
OrciD : Ton Duc Thang University, Vietnam
Author 5 : Annisa Putri Fatmasari[f] signature:
Email Author 5: annisaputri@students.unnes.ac.id Institution Author 5:
OrciD : Universitas Negeri Semarang, Indonesia

Contribution:

a – Preparing concepts; b – Formulating methods; c – Conducting research; d – Processing results; e – Interpretation and conclusions; f - Editing the final version
Give a letter code on the contribution in accordance with the role of the author in the manuscript. at the end of the author's name.
(Example: Author 1: Abizar Ibrahim[ab])

Has fulfilled the creteria of the publication of Jurnal Sportif: Journal of Learning Research and we can receive as manuscript material for the publication of Sportif Journal: Journal of Learning Research **Volume 8, Number 4 Year 2022** published in the month December 2022 in print and electronic versions.

Potential and limitations of short backhand serve in badminton: Kinematics analysis

by Fajar Awang Irawan

Submission date: 22-Dec-2022 04:23AM (UTC-0800)
Submission ID: 1985844090
File name: 18383-Article_Text-33864-1-11-20221024_1.docx (759.67K)
Word count: 2883
Character count: 14935

Potential and limitations of short backhand serve in badminton: Kinematics analysis

Abstract

Moreover backhand short serve is an important element of the main character in badminton, where not many people can maximize the potential and limits of each athlete, such as power, speed, accuracy, and motion efficiency. This study aims to determine the potential and weaknesses of short backhand serve in badminton through a kinematic analysis approach, with a sample of children aged 12-16 years PB Pendowo Semarang City. The method used quantitative with a descriptive analysis approach, and the analysis is assisted by using the Kinovea 0.9.4 series software. The sampling technique used is purposive sampling with two criteria; age (12-16 years old) and participation in a Semarang city-level tournament. The results showed that the PB Pendowo Semarang City athletes in the implementation phase are in the "Appropriate" category, with a percentage of 66.6%. The instruments used in this data collection are observation and documentation. Several factors that influence the level of conformity are muscle mass, arm length and height, and training intensity. This research can still be developed in future research by discussing more specific things, such as focusing on active wrists and, more specifically, explain about flick movement in the wrist motion. Additional supporting literacy in the backhand short serve analysis could help the athletes and coaches to reach effective movement to get points using the backhand short of serving as the first attack.

Keywords: motion analysis, backhand short serve, potential, limitations

INTRODUCTION

His position. Several types of sports that are popular and growing rapidly in Indonesian society, including badminton, have very complex basic techniques defined very complex because each athlete is required to have speed, strength, and good strategy in dealing with opponents (Sumanjaya, 2015). An athlete is also required to be able to master all the basic techniques in this sport, such as backhand, smash, lob, and drive to serve in the research of Wardana & Dra. Ika Jayadi, (2017) explains that the basic movements in badminton have the same body posture in hitting movements, the difference is the power and accuracy used in making punches, for example, when lob, smash, and drop shot or cop in the same taking attitude. The correct movement in basic techniques is expected to improve performance and prevent injury (Irawan et al., 2020; Irawan, Jannah, et al., 2021; Irawan, Nomi, et al., 2021).

There are several basic techniques that badminton athletes must master, technique is a skill that must be mastered by someone to be able to

play the sport (Nandika et al., 2017). According to Taufan et al., (2016), for someone to play badminton, one must master various basic game techniques correctly, including racket grip, footwork, and various basic hitting techniques. Some of the most popular basic techniques to learn are the smash, backhand, drop shot, forehand, and serve. Serve is a basic technique that is mandatory and very important to master, the serve is an early technique in badminton that serves as a sign that the game has started (Hussain, Ahmed, Mohammad, et al., 2011) the serve is also referred to as the first attack in badminton because it is very important to master the technique. This type of serve is the most widely used, especially in men's competitions (Gawin et al., 2013). Male athletes tend to use short backhand serve in a ratio of 91% points (Carboch & Smocek, 2020).

Based on the distance of the serve, the type of badminton serve is divided into two parts. At first, namely long serve, one of which is flick serve, and the second is short serve. Short serve or short serve must be done "softly" or as thin over the net and land as close as possible to the opponent's serve field (Singh & Mishra, 2020) so that it will be difficult for the opponent to make a return. Researchers are interested in discussing the analysis of what factors affect the suitability of the backhand short serve motion of badminton athletes when they are in the field. This is reinforced by the results of researchers' observations of the sample, namely athletes from PB Pendowo, Semarang city, with an age range of 12-16 years. This observation is carried out before data collection, or you could say this observation is used as a benchmark for the condition and performance of athletes in the field without any engineering and manipulation of athletes' movements when training or competing.

This research becomes more interesting to discuss because there is no clear and specific discussion or review related to the analysis of motion potential based on appropriate biomechanics (both in Indonesia and specifically at the research location), moreover backhand short serve is an important element or main character. In badminton, where not many people

can maximize the potential and limits of each athlete, such as power, speed, accuracy, and motion efficiency.

This study aims to determine the potential and weaknesses of short backhand serve in badminton through a kinematic analysis approach. Based on research from Wijaya, (2017), it is stated that the analysis of the service motion in badminton viewed anatomically, physiologically, and biomechanically affects the right and wrong of the action. Therefore, researchers are interested in discussing what factors affect the suitability of the backhand short serve.

METHOD

The type of this study uses a single case study, which allows researchers to carry out in-depth and specific exploration of certain events of a phenomenon (Wahyuningsih, 2013), Mariotto et al., (2014) also added that this method allows for better dialogue between researchers and their research both in terms of management, usefulness, and overall. The approach used in this method is analysis and evaluation. The population in this study was the PB Pendowo club, Semarang City. The number of samples studied was nine people selected using a purposive sampling technique with the provision that they were 12-16 years old and had at least won the top 3 at the Semarang city level. Quantitative data in this study were obtained through photo and video recordings of backhand service movements which were then analyzed using the Kinovea application series 0.9.4 (Arjunnaja et al., 2022). This study has passed the Ethical Clearance (EC) with number 366/KEPK/EC/2021 as part of the legality protocol of human research procedures.

The research procedures in the data collection in PB Pendowo Semarang City are preparation, which is the stage to prepare tools and materials before the implementation of data collection, such as the preparation of DSLR cameras, tripods, questionnaires, and informed consent. Then the implementation of data collection in this procedure includes how to collect data in the field, such as camera angle positions,

briefings, and athlete direction when taking videos and photos (giving cues and so on). At last, the data processing, the data that has been collected, is then recapitulated and processed using the Kinovea 0.9.4 series software (motion analyzer).

Kinematic parameters of motion, especially in the backhand short serve motion, are divided into three main motion phases, namely the preparation phase, the implementation phase, and the follow-through phase, this opinion is based on research (Sumardi et al., 2015). Details of the 3 phases of the backhand short serve motion have their respective descriptions, for the preparation phase starting from the beginning of the movement, where the athlete holds the shuttlecock until the wrist is actively flexed, the implementation phase starts after the active wrist is flexed which is then followed by impact (the racket hits the shuttlecock) until Active wrist strikes with the lever position and the cubits straight parallel to the carpal or metacarpal, the last is the follow-through phase starting after the impact phase until the shuttlecock is completely released from the hand and leads to the opponent's court and is followed by an active wrist hyperextension position (as form part of the "continuation" of the backhand short serve). There is an important role of the arm muscles as a machine or motor that performs the movement when hitting the muscles of the legs or feet. Apart from being a pedestal when doing stances, the leg muscles are also used as a movement stabilizer.

RESULT

There are 3 phases of movement in the implementation of the backhand service, including the preparation phase, the implementation phase (impact), and the follow-through phase. The basis for determining the 3 phases of the movement is based on the research of Sumardi et al., (2015), which states that there are 3 phases of movement, namely the preparation, implementation, and continuation phases. Several variables or indicators measured in this study were right wrist extension angle (°), right

wrist hyperextension (°), left elbow extension (°) and left knee extension (°) in the implementation phase.

The focus of the researchers in this article is only to discuss the stages in the implementation phase. Because in the movement phase, researchers and readers will better understand how the criteria for time, distance, speed, and angle of the short backhand serve are good and correct. In addition to measuring kinematic data, as shown in Table 1. above, the researchers also measured anthropometric data such as weight, height, and BMI (Body Mass Index) of each athlete as supporting data. The number samples consisted of 9 people, with eight men and one woman specifications.

Table 1. Anthropometric data.

n = 9	Mean ± SD	Min	Max
Age *(year)*	13,44 ± 1,236	12	15
Height *(cm)*	156,5 ± 11,649	134	175
Weight *(kg)*	46,97 ± 11,482	27	63
BMI *(kg/m^2)*	18,91 ± 2,784	15,08	22,63

Analysis in the implementation phase of the backhand short serve conducted by PB Pendowo athletes in Semarang City stated that as many as two athletes were in the "Very Appropriate" category with a percentage of 22.2%, as many as six athletes were included in the "Agree" category with a percentage of 66.6%. One athlete was in the "Not Appropriate" category with a percentage of 11.1%, and 0 athletes were in the "Not Appropriate" category. It can be concluded that the average backhand short serve movement of PB Pendowo athletes in Semarang City in the implementation phase has the "Appropriate" Criteria. The level of conformity data determined above is based on the validator's assessment with the following calculation results.

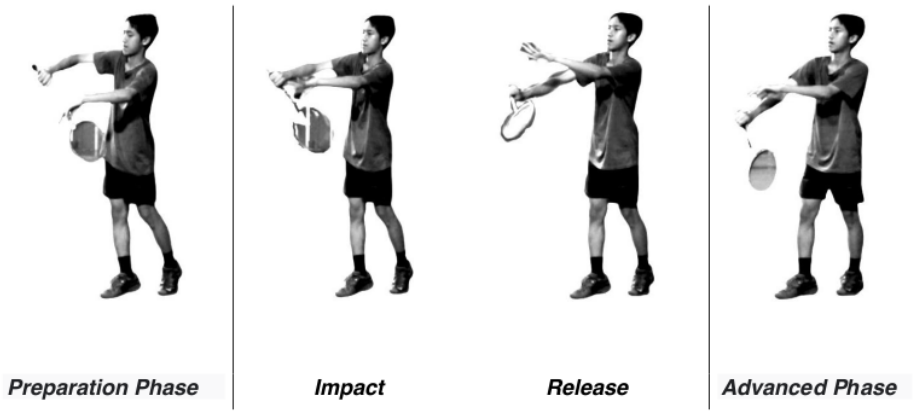


Figure 1. Backhand short serve movement phase

In the implementation phase, there are two movements: impact and release. Impact occurs on objects that move in one straight line or two straight lines (Afrizal, 2013). The release is the momentum when the ball leaves the hand (Kharim & Nurkholis, 2018). Texier et al., (2012) added that the direction of the shuttlecock is basically a parabola, but the direction and magnitude of the angle are influenced by power, direction, and the wind on the field.

DISCUSSION

Analysis in the implementation phase of the backhand short serve conducted by PB Pendowo athletes in Semarang City stated that as many as two athletes were in the "Very Appropriate" category with a percentage of 22.2%. As many as six athletes were included in the "Agree" category, with a percentage of 66.6%. One athlete was in the "Not Appropriate" category with a percentage of 11.1%, and 0 athletes were in the "Not Appropriate" category. So it can be concluded that the average backhand short serve movement of PB Pendowo athletes in Semarang City in the implementation phase has the "Appropriate" Criteria. The determination of this value is based on research (Arikunto, 2009) related to the Likert scale, research (Grice, 2016) and (Dermawan, 2019) related to the determination of instruments and motion variables. Then it was specified again with the help of 2 expert validators and references from (Irawan & Permana, 2020)

and (Irawan et al., 2019) by ticking the checklist " √ " in the available column when data collection in the field.

The value of each variable per movement phase is as follows, and the serve time has an average of 0.11 seconds with a standard deviation of ± 0.02 seconds, the distance between legs has an average of 0.22 meters with a standard deviation of ± 0.13 meters, for right wrist extension data in the implementation phase or active phase has an average of 157.65° with a standard deviation of ± 14.73°, right wrist hyperextension has an average value of 218.45° with a standard deviation of ± 12.79°, elbow extension left with a mean value of 131.68° with a standard deviation of ± 24.18°, for left knee extension data has a mean of 165.17° and a standard deviation of ± 5.57°.

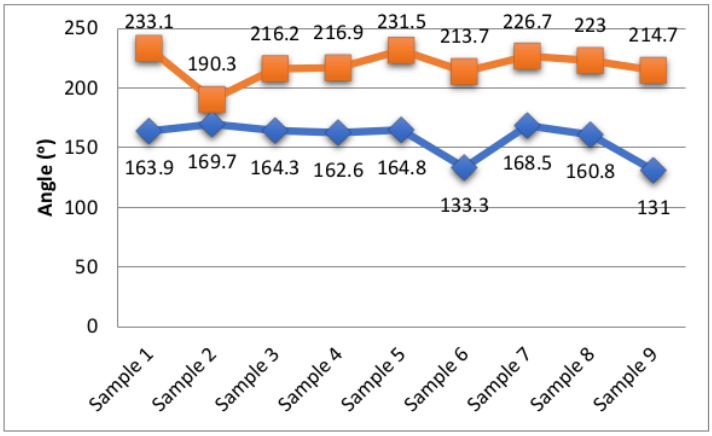


Figure 2. Extension and hyperextension of the right wrist

The results of the analysis of the extension angle of the right wrist backhand short serve are presented in Figure 2, with the lower results of the extension angle in sample no.6 having an angle of 133.3° and sample no.9 having an angle of 131°. The average extension angle of 9 athletes from PB Pendowo Semarang City is 157.65° with a minimum value of 131° and a maximum value of 169.7°.

Meanwhile, the backhand short serve right wrist hyperextension data presented that the higher result of the hyperextension angle of sample no.1 has an angle of 233.1°; and the lower is in sample no.2 has an angle of

190.3°. The average hyperextension angle of 9 PB Pendowo athletes in Semarang City is 218.45° with a minimum value of 190.3° and a maximum value of 233.1°.

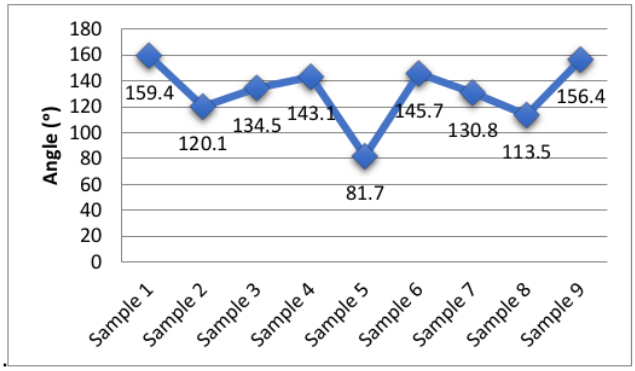


Figure 3. Left elbow extension angle

The results of the researcher's analysis related to the left elbow extension angle variable in the implementation of the short backhand serve in the implementation phase are presented in Figure 3, with the results of the extension angle in all samples with a lower was of 81.7° and the higher was 159.4°. Next, Figure 5 will present data on left knee extension in the implementation phase of each PB Pendowo athlete in Semarang City.

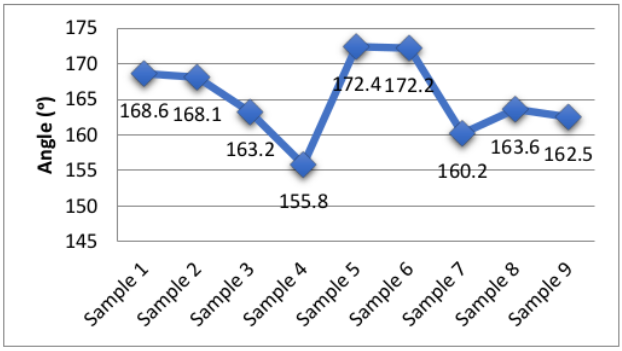


Figure 4. Left knee extension angle

The results of the researcher's analysis related to the left knee extension angle variable in the implementation of the short backhand serve in the implementation phase are presented in Figure 4, with the average

results of the extension angle was 165.18° with a lower value of 155.8° and higher value of 172.4°.

Several factors that can affect the level of suitability of the athlete's backhand short serve in the field include muscle mass, especially if the athlete is still too young or a child, of course, there are still difficulties in maximizing a movement, especially a serve, therefore more intense training is needed. In addition to power or muscle mass, according to Listanto, (2021), when athletes serve, they do not only rely on 100% leg power but also other more complex components such as coordination, speed, flexibility, and balance. Badminton athletes must also pay attention to mental and physical conditions to support performance on the field (Hinda Zhannisa & Sugiyanto, 2015).

The factor of arm's length and athlete's height also affects the success and suitability of every movement in badminton, including serve. Based on the field researchers' analysis, if an athlete has a height and arm length above the average, it will make it easier for them to reach and hit (cross) the shuttlecock to the opponent's area. Musofan, (2007), in the development of his research, stated that to be a good badminton player, it is necessary to have a body posture with height, such as slenderness. In terms of serve, especially short backhand serve, they will greatly benefit because compared to the net's height with their posture, it will be easier to cross the shuttlecock into the opponent's territory.

Because basically, all talents, potential, and supporting physical conditions will not be maximized without serious training. Based on research by Hussain, Ahmed, Bari, et al., (2011) to improve service skills by practising hand, elbow and shoulder auctions. Intense exercise can be done using assistive devices to facilitate and strengthen wrist rotation, both in serving movements and other movements, Irawan et al., (2016), human motion is significantly influenced by several biomechanical factors such as ideal angle or body segmentation and body torque. In addition to these factors, athletes also need continuous and well-programmed regular training.

CONCLUSION

The potential for success and suitability of the short backhand serve of PB Pendowo athletes is classified as "Appropriate" in the implementation phase of the backhand short serve with a percentage of 66.6%, with an average right wrist extension angle of 157.65^{o}, an average right wrist hyperextension angle of 218, 45^{o}. The analysis of kinematic data in this study found the relationship between the success and weakness of athletes influenced by muscle mass or power, arm length and height, as well as intense training. This study limitation also found that the result of speed and time in the backhand short serve technique needs more efficiency at the centre of the movement, and power is in the active wrist. Hopefully, future research can discuss certain parts or angles, such as the active wrist, to be more specifically described with other supporting literacy to make it more complex so that this article can become one of the standard references for research on the theme of analysis and motion kinematics.

ACKNOWLEDGMENT

The researcher wants to Thank all relevant parties who contribute to the study and to PB Pendowo Semarang City, which has given permission and opportunities to researchers so that they can conduct research properly there.

Potential and limitations of short backhand serve in badminton: Kinematics analysis

ORIGINALITY REPORT

2%	2%	0%	2%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	discovery.researcher.life Internet Source	2%
2	Submitted to Curtin University of Technology Student Paper	<1%
3	Swagata Das, Wataru Sakoda, Priyanka Ramasamy, Ramin Tadayon, Antonio Vega Ramirez, Yuichi Kurita. "Feature Selection and Validation of a Machine Learning-Based Lower Limb Risk Assessment Tool: A Feasibility Study", Sensors, 2021 Publication	<1%

Exclude quotes	On	Exclude matches	Off
Exclude bibliography	On		

ISSN: 2477 – 3379 (Online)
ISSN: 2548 – 7833 (Print)

VOLUME 8 NUMBER 4 PAGE 327-474 December 2022

Jurnal SPORTIF: Jurnal Penelitian Pembelajaran is published three times a year in April, August, and December containing research papers in the field of sports. The focus and scope are educational sports, coaching sports, recreational sports, traditional sports, physical activity, sports biomechanics, sports pedagogy, sports physiology, and sports psychology.

Editor in Chief

M. Akbar Husein Allsabah, M.Or. (Universitas Nusantara PGRI Kediri)

Peer Reviewer

Dr. Lim Boon Hooi	(University of Malaya)
David Hideyoshi Fukuda	(University of Central Florida)
Veronica Vleck, Ph. D	(University of Lisbon)
José Luis Ubago-Jiménez	(Universidad de Granada)
Tomasz Niznikowski	(Józef Piłsudski University)
Jem Cloyd M. Tanucan	(Cebu Normal University)
Prof. Dr. Agus Kristiyanto, M.Pd.	(Universitas Sebelas Maret Surakarta)
Prof. Dr. M. E. Winarno, M.Pd.	(Universitas Negeri Malang)
Prof. Dr. Yustinus Sukarmin, MS.	(Universitas Negeri Yogyakarta)
Dr. Muhammad Muhyi, M.Pd.	(Universitas Adi Buana Surabaya)
Dr. Fajar Junaedi, S.Sos, M.Si	(Universitas Muhammadiyah Yogyakarta)
Kunjung Ashadi, M.Pd., AIFO.	(Universitas Negeri Surabaya)
Agus Rusdiana, S.Pd., M.A., Ph.D.	(Universitas Pendidikan Indonesia)
Dr. Mirza Hapsari Sakti Titis P., S.Gz. MPH.	(Universitas Gadjah Mada Yogyakarta)
Jusuf Blegur, M.Pd.	(Universitas Kristen Artha Wacana)
Imam Safei, S.Pd., M.Or.	(Institut Teknologi Sumatera)
Mesa Rahmi Stephani, M.Pd.	(Universitas Pendidikan Indonesia)
Sri Sumartiningsih, S. Si., M. Kes., Ph.D.	(Universitas Negeri Semarang)
dr. Novita Intan Arovah, MPH., Ph.D.	(Universitas Negeri Yogyakarta)
Gustiana Mega Anggita, S. Pd. Jas., M.Or.	(Universitas Negeri Semarang)

Yulingga Nanda Hanief, S.Pd., M.Or. (Universitas Negeri Malang)
Muhammad Imam Rahmatullah (Universitas Riau)

Editorial Board

Gheorghe Balint (Vasile Alecsandri University)
Laura Dybal, Ph. D (University of Montana)
Iago Portela-Pino, Ph. D (Isabel I University)
Cristiana D'anna (University of Salermo)
Gheorghe Balint (Vasile Alecsandri University)
Novri Gazali (Universitas Islam Riau)
Suesthi Maharani, M.Pd. (IAIN Salatiga)
Dr. Setyo Harmono, M.Pd. (Universitas Nusantara PGRI Kediri)
Drs. Sugito, M.Pd. (Universitas Nusantara PGRI Kediri)
Dr. Setyo Harmono, M.Pd. (Universitas Nusantara PGRI Kediri)
Dr. Wasis Himawanto, S.Pd., M.Or. (Universitas Nusantara PGRI Kediri)
Ardhi Mardiyanto Indra P., M.Or. (Universitas Nusantara PGRI Kediri)
Dhedhy Yuliawan, M.Or. (Universitas Nusantara PGRI Kediri)
Dr. Budiman Agung Pratama, M.Pd. (Universitas Nusantara PGRI Kediri)
Dr. Nur Ahmad Muharram, S.Pd., M.Or. (Universitas Nusantara PGRI Kediri)
Reo Prasetiyo Herpandika, M.Pd. (Universitas Nusantara PGRI Kediri)
Rizki Burstiando, M.Pd. (Universitas Nusantara PGRI Kediri)
Wing Prasetya Kurniawan, M.Pd. (Universitas Nusantara PGRI Kediri)
Weda, M.Pd. (Universitas Nusantara PGRI Kediri)
M. Anis Zawawi, S.Pd., M.Or. (Universitas Nusantara PGRI Kediri)
Puspodari, M.Pd. (Universitas Nusantara PGRI Kediri)
Moh. Nurkholis, S.Pd., M.Or (Universitas Nusantara PGRI Kediri)
Rendhitya Prima Putra (Universitas Nusantara PGRI Kediri)
Muhammad Yanuar Rizky, M.Pd. (Universitas Nusantara PGRI Kediri)
Mokhammad Firdaus, M.Or (Universitas Nusantara PGRI Kediri)
Aulia Safrotun Nimah (Universitas Sebelas Maret Surakarta)

EDITOR'S ADDRESS

Departement Penjas Kampus I UNP Kediri Office
KH. Achmad Dahlan Street Number 76 Kediri
Telp. (0354) 771503, Fax. (0354) 771576
Website: ojs.unpkediri.ac.id/ index.php/pjk
Email: jurnal.sportif@unpkediri.ac.id

PREFACE

Our sincere gratitude is expressed to Almighty God. Without His will and strength, the editorial team may not be able to publish Jurnal SPORTIF: Journal penelitian dan pembelajaran Volume 8 Number 4 of the December 2022 edition online and in print. Starting in 2020, the editorial team has increased the frequency of publications that were originally published in May and November to be published in April, August, and December. In addition, the scope is also expanded, some of the scope of science added include physical activity, sports biomechanics, sports pedagogy, sports physiology, and sports psychology. Jurnal SPORTIF: Jurnal Penelitian Pembelajaran has been accredited by **SINTA 2** by **the Ministry of Research, Technology, and Higher Education of the Republic of Indonesia** as an achievement of peer-reviewed journals that have outstanding quality in management and publication. This recognition is published in Director Decree No. 10 / E / KPT / 2019 4 April 2019 which is valid until 2023.

Jurnal SPORTIF: Jurnal Penelitian Pembelajaran is a medium of information and dissemination for research results in the field of sports. Jurnal SPORTIF: Jurnal Penelitian Pembelajaran is expected to actively and continuously disseminate the results of research for the development of science and technology (IPTEK) in the field of sports in Indonesia. This edition features 10 articles. In the current edition, it is an honor to have the opportunity to publish 1 article by an author who comes from the Philippines. All articles have been reviewed through a rigorous review processby reviewers/interested partners.

We would like to express our appreciation and gratitude to the writers and reviewers. This edition comes with an index that loads after the preface page to help readers find the page. Hopefully JURNAL SPORTIF: Jurnal Penelitian Pembelajaran can be useful and able to improve the quality of research results for lecturers, teachers, researchers, students, and practitioners.

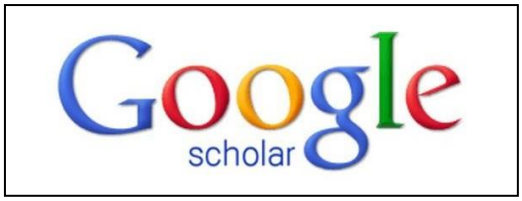
Kediri, 28 December 2022

Editor in Chief

M. Akbar Husein Allsabah M.Or.

Jurnal SPORTIF: Jurnal Penelitian Pembelajaran

HAS BEEN INDEXED BY:



ISSN: 2477 – 3379 (Online)

ISSN: 2548 – 7833 (Print)

VOLUME 8 NUMBER 4 PAGE 327-474 December 2022

TABLE OF CONTENTS

Kecepatan dan kekuatan atlet bela diri: Apakah plyometrics mempengaruhi pemulihan aktif-pasif? **327 – 341**
Candra Kurnaiawan, Hadi Hadi, Novriansyah Novriansyah

Potential and limitations of short backhand serve in badminton: Kinematics analysis **342 – 354**
Fajar Awang Irawan, Mirza Arif Ma'dum, Nanang Indardi, Minh Nghia Le Trans, Annisa Putri Fatmasari

Variations of the Angiotensin converting enzyme (ACE) gene on the explosion performance of badminton athletes **355 – 366**
Arimbi Arimbi, Hasmyati Hasmyati, Syahruddin Syahruddin, Poppy Elisano Arfanda, Wahyana Mujari Wahid

Leadership in physical education: Systematic review of the last five years **367 – 386**
Novri Gazali, Norazlinda Saad, Romi Cendra, Syed Kamaruzaman, Ripa'i Ripa'i

Motivation and challenges in a humble beginning: The case of potential young Filipino (Batang Pinoy) boxers **387 – 404**
Jordan Miranda Pocaan, Analiza Pasano

Tai chi exercise is better than low-intensity steady-state cardio for improving physical fitness and sleep quality in the elderly **405 – 425**
Laily Mita Andriana, Arif Rahman Nurdianto

The effect of learning methods and motivation on learning outcomes of long jump skills **426 – 439**
Syahruddin Syahruddin

The quality skill level of playing basketball young basketball player **440 – 450**
Lalu Moh Yudha isnaini, Sylvana Yaka Saputra, Yadi Imansyah, Muhammad Riyan Hidayatullah, Khaerul Anam

The correlation of leadership styles toward sports federation performance **451 – 459**
Priyo Puji Nugroho, Tri Rustiadi, Billy Castyana

Analisis faktor keberhasilan menunjuk pada atlet petanque **460 – 474**
Osa Maliki, Wawan Sundawan Suherman, Yudik Prasetyo, Galih Dwi Pradipta, Ainun Rahma Hartono

THANK YOU

WRITING GUIDELINES

Jurnal SPORTIF: Jurnal Penelitian Pembelajaran
Vol. 8 No. 4, December 2022, pp. 342 - 354
https://doi.org/10.29407/js_unpgri.v8i4.18383

Potential and limitations of short backhand serve in badminton: Kinematics analysis

Fajar Awang Irawan[1ab], Mirza Arif Ma'dum[1c], Nanang Indardi[1d], Minh Nghia Le Trans[2e], Annisa Putri Fatmasari[3f]

[1]Department of Sport Scince, Faculty of Sport Science, Universitas Negeri Semarang, Sekaran Village, Gunungpati District, Semarang Regency, Central of Java, 50229, Indonesia
[2]Ton Duc Thang University, District 7, Ho Chi Minh City, Vietnam
[3]Department of Public Health, Faculty of Sport Science, Universitas Negeri Semarang, Sekaran Village, Gunungpati District, Semarang Regency, Central of Java, 50229, Indonesia

Authors contribution: a – Preparing concepts; b – Formulating methods; c – Conducting research; d – Processing results; e – Interpretation and conclusions; f - Editing the final version

Received: 15 June 2022; Revised: 30 July 2022; Accepted: 6 September 2022

Abstract

Moreover backhand short serve is an important element of the main character in badminton, where not many people can maximize the potential and limits of each athlete, such as power, speed, accuracy, and motion efficiency. This study aims to determine the potential and weaknesses of short backhand serve in badminton through a kinematic analysis approach, with a sample of children aged 12-16 years PB Pendowo Semarang City. The method used quantitative with a descriptive analysis approach, and the analysis is assisted by using the Kinovea 0.9.4 series software. The sampling technique used is purposive sampling with two criteria; age (12-16 years old) and participation in a Semarang city-level tournament. The results showed that the PB Pendowo Semarang City athletes in the implementation phase are in the "Appropriate" category, with a percentage of 66.6%. The instruments used in this data collection are observation and documentation. Several factors that influence the level of conformity are muscle mass, arm length and height, and training intensity. This research can still be developed in future research by discussing more specific things, such as focusing on active wrists and, more specifically, explain about flick movement in the wrist motion. Additional supporting literacy in the backhand short serve analysis could help the athletes and coaches to reach effective movement to get points using the backhand short of serving as the first attack.

Keywords: motion analysis, backhand short serve, potential, limitations.

INTRODUCTION

His position. Several types of sports that are popular and growing rapidly in Indonesian society, including badminton, have very complex basic techniques defined very complex because each athlete is required to have speed, strength, and good strategy in dealing with opponents (Sumanjaya,

Correspondence author: Fajar Awang Irawan, Universitas Negeri Semarang, Indonesia.
Email: fajarawang@mail.unnes.ac.id

Jurnal SPORTIF: Jurnal Penelitian Pembelajaran is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

2015). An athlete is also required to be able to master all the basic techniques in this sport, such as backhand, smash, lob, and drive to serve in the research of Wardana & Dra. Ika Jayadi, (2017) explains that the basic movements in badminton have the same body posture in hitting movements, the difference is the power and accuracy used in making punches, for example, when lob, smash, and drop shot or cop in the same taking attitude. The correct movement in basic techniques is expected to improve performance and prevent injury (Irawan et al., 2020; Irawan, Jannah, et al., 2021; Irawan, Nomi, et al., 2021).

There are several basic techniques that badminton athletes must master, technique is a skill that must be mastered by someone to be able to play the sport (Nandika et al., 2017). According to Taufan et al., (2016), for someone to play badminton, one must master various basic game techniques correctly, including racket grip, footwork, and various basic hitting techniques. Some of the most popular basic techniques to learn are the smash, backhand, drop shot, forehand, and serve. Serve is a basic technique that is mandatory and very important to master, the serve is an early technique in badminton that serves as a sign that the game has started (Hussain, Ahmed, Mohammad, et al., 2011) the serve is also referred to as the first attack in badminton because it is very important to master the technique. This type of serve is the most widely used, especially in men's competitions (Gawin et al., 2013). Male athletes tend to use short backhand serve in a ratio of 91% points (Carboch & Smocek, 2020).

Based on the distance of the serve, the type of badminton serve is divided into two parts. At first, namely long serve, one of which is flick serve, and the second is short serve. Short serve or short serve must be done "softly" or as thin over the net and land as close as possible to the opponent's serve field (Singh & Mishra, 2020) so that it will be difficult for the opponent to make a return. Researchers are interested in discussing the analysis of what factors affect the suitability of the backhand short serve motion of badminton athletes when they are in the field. This is reinforced by the results of researchers' observations of the sample, namely athletes

https://doi.org/10.29407/js_unpgri.v8i4.18383
8 (4) 2022 | 342-354

from PB Pendowo, Semarang city, with an age range of 12-16 years. This observation is carried out before data collection, or you could say this observation is used as a benchmark for the condition and performance of athletes in the field without any engineering and manipulation of athletes' movements when training or competing.

This research becomes more interesting to discuss because there is no clear and specific discussion or review related to the analysis of motion potential based on appropriate biomechanics (both in Indonesia and specifically at the research location), moreover backhand short serve is an important element or main character. In badminton, where not many people can maximize the potential and limits of each athlete, such as power, speed, accuracy, and motion efficiency.

This study aims to determine the potential and weaknesses of short backhand serve in badminton through a kinematic analysis approach. Based on research from Wijaya, (2017), it is stated that the analysis of the service motion in badminton viewed anatomically, physiologically, and biomechanically affects the right and wrong of the action. Therefore, researchers are interested in discussing what factors affect the suitability of the backhand short serve.

METHOD

The type of this study uses a single case study, which allows researchers to carry out in-depth and specific exploration of certain events of a phenomenon (Wahyuningsih, 2013), Mariotto et al., (2014) also added that this method allows for better dialogue between researchers and their research both in terms of management, usefulness, and overall. The approach used in this method is analysis and evaluation. The population in this study was the PB Pendowo club, Semarang City. The number of samples studied was nine people selected using a purposive sampling technique with the provision that they were 12-16 years old and had at least won the top 3 at the Semarang city level. Quantitative data in this study were obtained through photo and video recordings of backhand service

https://doi.org/10.29407/js_unpgri.v8i4.18383
8 (4) 2022 | 342-354

movements which were then analyzed using the Kinovea application series 0.9.4 (Arjunnaja et al., 2022). This study has passed the Ethical Clearance (EC) with number 366/KEPK/EC/2021 as part of the legality protocol of human research procedures.

The research procedures in the data collection in PB Pendowo Semarang City are preparation, which is the stage to prepare tools and materials before the implementation of data collection, such as the preparation of DSLR cameras, tripods, questionnaires, and informed consent. Then the implementation of data collection in this procedure includes how to collect data in the field, such as camera angle positions, briefings, and athlete direction when taking videos and photos (giving cues and so on). At last, the data processing, the data that has been collected, is then recapitulated and processed using the Kinovea 0.9.4 series software (motion analyzer).

Kinematic parameters of motion, especially in the backhand short serve motion, are divided into three main motion phases, namely the preparation phase, the implementation phase, and the follow-through phase, this opinion is based on research (Sumardi et al., 2015). Details of the 3 phases of the backhand short serve motion have their respective descriptions, for the preparation phase starting from the beginning of the movement, where the athlete holds the shuttlecock until the wrist is actively flexed, the implementation phase starts after the active wrist is flexed which is then followed by impact (the racket hits the shuttlecock) until Active wrist strikes with the lever position and the cubits straight parallel to the carpal or metacarpal, the last is the follow-through phase starting after the impact phase until the shuttlecock is completely released from the hand and leads to the opponent's court and is followed by an active wrist hyperextension position (as form part of the "continuation" of the backhand short serve). There is an important role of the arm muscles as a machine or motor that performs the movement when hitting the muscles of the legs or feet. Apart from being a pedestal when doing stances, the leg muscles are also used as a movement stabilizer.

https://doi.org/10.29407/js_unpgri.v8i4.18383
8 (4) 2022 | 342-354

RESULT

There are 3 phases of movement in the implementation of the backhand service, including the preparation phase, the implementation phase (impact), and the follow-through phase. The basis for determining the 3 phases of the movement is based on the research of Sumardi et al., (2015), which states that there are 3 phases of movement, namely the preparation, implementation, and continuation phases. Several variables or indicators measured in this study were right wrist extension angle (°), right wrist hyperextension (°), left elbow extension (°) and left knee extension (°) in the implementation phase.

The focus of the researchers in this article is only to discuss the stages in the implementation phase. Because in the movement phase, researchers and readers will better understand how the criteria for time, distance, speed, and angle of the short backhand serve are good and correct. In addition to measuring kinematic data, as shown in Table 1. above, the researchers also measured anthropometric data such as weight, height, and BMI (Body Mass Index) of each athlete as supporting data. The number samples consisted of 9 people, with eight men and one woman specifications.

Table 1. Anthropometric data.

n = 9	Mean ± SD	Min	Max
Age *(year)*	13,44 ± 1,236	12	15
Height *(cm)*	156,5 ± 11,649	134	175
Weight *(kg)*	46,97 ± 11,482	27	63
BMI *(kg/m^2)*	18,91 ± 2,784	15,08	22,63

Analysis in the implementation phase of the backhand short serve conducted by PB Pendowo athletes in Semarang City stated that as many as two athletes were in the "Very Appropriate" category with a percentage of 22.2%, as many as six athletes were included in the "Agree" category with a percentage of 66.6%. One athlete was in the "Not Appropriate" category with a percentage of 11.1%, and 0 athletes were in the "Not Appropriate" category. It can be concluded that the average backhand short serve movement of PB Pendowo athletes in Semarang City in the

https://doi.org/10.29407/js_unpgri.v8i4.18383
8 (4) 2022 | 342-354

implementation phase has the "Appropriate" Criteria. The level of conformity data determined above is based on the validator's assessment with the following calculation results.

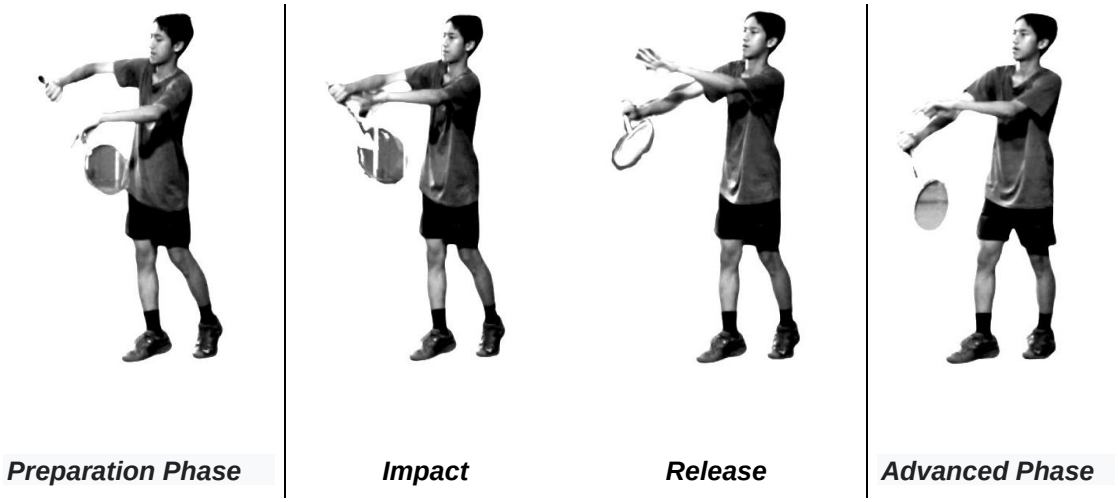


Figure 1. Backhand short serve movement phase

In the implementation phase, there are two movements: impact and release. Impact occurs on objects that move in one straight line or two straight lines (Afrizal, 2013). The release is the momentum when the ball leaves the hand (Kharim & Nurkholis, 2018). Texier et al., (2012) added that the direction of the shuttlecock is basically a parabola, but the direction and magnitude of the angle are influenced by power, direction, and the wind on the field.

DISCUSSION

Analysis in the implementation phase of the backhand short serve conducted by PB Pendowo athletes in Semarang City stated that as many as two athletes were in the "Very Appropriate" category with a percentage of 22.2%. As many as six athletes were included in the "Agree" category, with a percentage of 66.6%. One athlete was in the "Not Appropriate" category with a percentage of 11.1%, and 0 athletes were in the "Not Appropriate" category. So it can be concluded that the average backhand short serve movement of PB Pendowo athletes in Semarang City in the implementation phase has the "Appropriate" Criteria. The determination of this value is based on research (Arikunto, 2009) related to the Likert scale,

https://doi.org/10.29407/js_unpgri.v8i4.18383
8 (4) 2022 | 342-354

research (Grice, 2016) and (Dermawan, 2019) related to the determination of instruments and motion variables. Then it was specified again with the help of 2 expert validators and references from (Irawan & Permana, 2020) and (Irawan et al., 2019) by ticking the checklist " √ " in the available column when data collection in the field.

The value of each variable per movement phase is as follows, and the serve time has an average of 0.11 seconds with a standard deviation of ± 0.02 seconds, the distance between legs has an average of 0.22 meters with a standard deviation of ± 0.13 meters, for right wrist extension data in the implementation phase or active phase has an average of 157.65º with a standard deviation of ± 14.73º, right wrist hyperextension has an average value of 218.45º with a standard deviation of ± 12.79º, elbow extension left with a mean value of 131.68º with a standard deviation of ± 24.18º, for left knee extension data has a mean of 165.17º and a standard deviation of ± 5.57º.

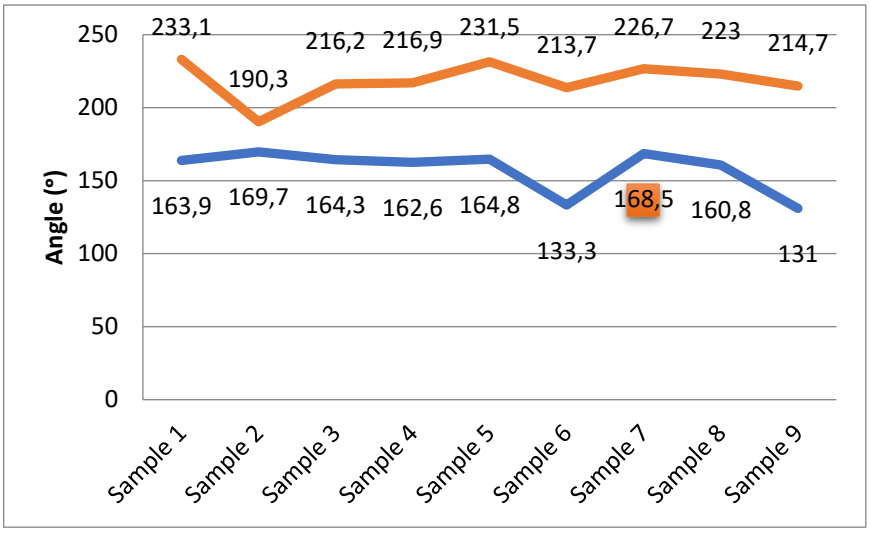


Figure 2. Extension and hyperextension of the right wrist

The results of the analysis of the extension angle of the right wrist backhand short serve are presented in Figure 2, with the lower results of the extension angle in sample no.6 having an angle of 133.3º and sample no.9 having an angle of 131º. The average extension angle of 9 athletes from PB Pendowo Semarang City is 157.65º with a minimum value of 131º and a maximum value of 169.7º.

https://doi.org/10.29407/js_unpgri.v8i4.18383
8 (4) 2022 | 342-354

Meanwhile, the backhand short serve right wrist hyperextension data presented that the higher result of the hyperextension angle of sample no.1 has an angle of 233.1º; and the lower is in sample no.2 has an angle of 190.3º. The average hyperextension angle of 9 PB Pendowo athletes in Semarang City is 218.45º with a minimum value of 190.3º and a maximum value of 233.1º.

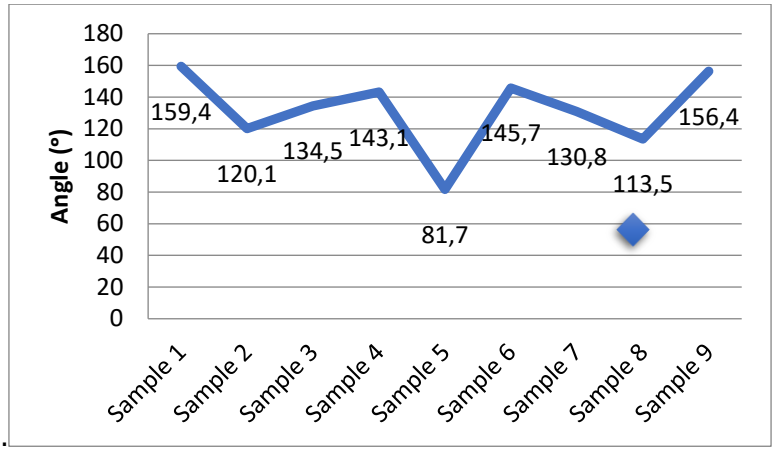


Figure 3. Left elbow extension angle

The results of the researcher's analysis related to the left elbow extension angle variable in the implementation of the short backhand serve in the implementation phase are presented in Figure 3, with the results of the extension angle in all samples with a lower was of 81.7º and the higher was 159.4º. Next, Figure 5 will present data on left knee extension in the implementation phase of each PB Pendowo athlete in Semarang City.

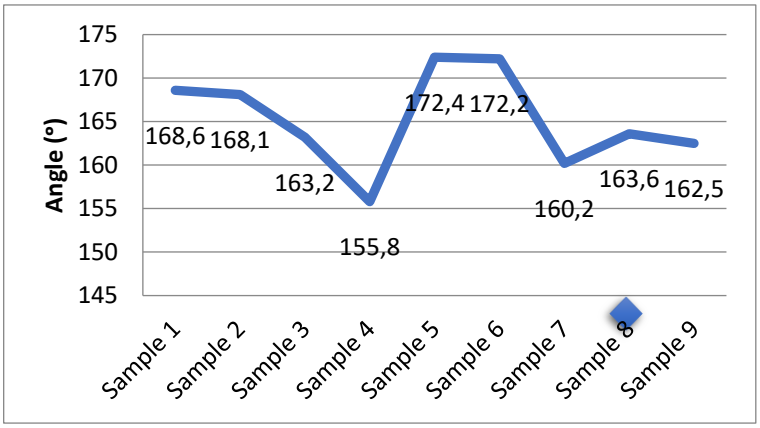


Figure 4. Left knee extension angle

The results of the researcher's analysis related to the left knee extension angle variable in the implementation of the short backhand serve

https://doi.org/10.29407/js_unpgri.v8i4.18383
8 (4) 2022 | 342-354

in the implementation phase are presented in Figure 4, with the average results of the extension angle was 165.18^{o} with a lower value of 155.8^{o} and higher value of 172.4^{o}.

Several factors that can affect the level of suitability of the athlete's backhand short serve in the field include muscle mass, especially if the athlete is still too young or a child, of course, there are still difficulties in maximizing a movement, especially a serve, therefore more intense training is needed. In addition to power or muscle mass, according to Listanto, (2021), when athletes serve, they do not only rely on 100% leg power but also other more complex components such as coordination, speed, flexibility, and balance. Badminton athletes must also pay attention to mental and physical conditions to support performance on the field (Hinda Zhannisa & Sugiyanto, 2015).

The factor of arm's length and athlete's height also affects the success and suitability of every movement in badminton, including serve. Based on the field researchers' analysis, if an athlete has a height and arm length above the average, it will make it easier for them to reach and hit (cross) the shuttlecock to the opponent's area. Musofan, (2007), in the development of his research, stated that to be a good badminton player, it is necessary to have a body posture with height, such as slenderness. In terms of serve, especially short backhand serve, they will greatly benefit because compared to the net's height with their posture, it will be easier to cross the shuttlecock into the opponent's territory.

Because basically, all talents, potential, and supporting physical conditions will not be maximized without serious training. Based on research by Hussain, Ahmed, Bari, et al., (2011) to improve service skills by practising hand, elbow and shoulder auctions. Intense exercise can be done using assistive devices to facilitate and strengthen wrist rotation, both in serving movements and other movements, Irawan et al., (2016), human motion is significantly influenced by several biomechanical factors such as ideal angle or body segmentation and body torque. In addition to these

https://doi.org/10.29407/js_unpgri.v8i4.18383
8 (4) 2022 | 342-354

factors, athletes also need continuous and well-programmed regular training.

CONCLUSION

The potential for success and suitability of the short backhand serve of PB Pendowo athletes is classified as "Appropriate" in the implementation phase of the backhand short serve with a percentage of 66.6%, with an average right wrist extension angle of 157.65^{o}, an average right wrist hyperextension angle of 218, 45^{o}. The analysis of kinematic data in this study found the relationship between the success and weakness of athletes influenced by muscle mass or power, arm length and height, as well as intense training. This study limitation also found that the result of speed and time in the backhand short serve technique needs more efficiency at the centre of the movement, and power is in the active wrist. Hopefully, future research can discuss certain parts or angles, such as the active wrist, to be more specifically described with other supporting literacy to make it more complex so that this article can become one of the standard references for research on the theme of analysis and motion kinematics.

ACKNOWLEDGMENT

The researcher wants to Thank all relevant parties who contribute to the study and to PB Pendowo Semarang City, which has given permission and opportunities to researchers so that they can conduct research properly there.

REFERENCES

Afrizal, J. (2013). *Biomekanika dan Olahraga*. http://joeniafrizal.blogspot.com/2013/10/biomekanika-dan-olahraga.html

Arikunto, S. (2009). *Prosedur Penelitian Suatu Pendekatan Praktik* (E. 6 (ed.)). Rineka Cipta.

Arjunnaja, Irawan, F. A., & Purnomo, P. S. (2022). Journal of Sport Coaching and Physical Education Analisis Gerak Tendangan Shooting Menggunakan Punggung Kaki pada Atlet Popda Kabupaten Temanggung. *Journal of Sport Coaching and Physical Education*, *7*(1),

27–36.

Carboch, J., & Smocek, P. (2020). Serve and Return in Badminton: Gender Differences of Elite Badminton Players. *International Journal of Physical Education, Fitness and Sports*, *9*, 44–48. https://doi.org/10.34256/ijpefs2014

Dermawan, M. R. (2019). *Upaya Meningkatkan Keterampilan Servis Backhand Pendek Bulutangkis Melalui Media Audio Visual Pada Siswa SMAN 8 Pekanbaru*. Universitas Islam Riau, Pekanbaru.

Gawin, W., C, B., H, H., & D, B. (2013). How to attack the service: an empirical contribution to rally opening in world-class badminton doubles,. *International Journal of Performance Analysis in Sport*, *13*, 860–871.

Grice, T. (2016). *Bulu Tangkis : petunjuk praktis untuk pemula dan lanjut* (Ed 1, Ceta). PT RajaGrafindo Persada.

Hinda Zhannisa, U., & Sugiyanto, F. (2015). *Model Tes Fisik Pencarian Bakat Olahraga Bulutangkis Usia Di Bawah 11 Tahun Di Diy a Model of Physical Test for Talent Scouting in Badminton Skill Under 11 Years Old in Diy*. *3*(1), 117–126. http://journal.uny.ac.id/index.php/jolahraga

Hussain, I., Ahmed, S., Bari, M. A., Ahmad, A., Mohammad, A., & Khan, A. (2011). *Analysis of Arm Movement in Badminton of ForehandLong and Short Service Analysis of Arm Movement in Badminton of ForehandLong and Short Service*. *2 (03)*(June).

Hussain, I., Ahmed, S., Mohammad, A., Khan, A., & Arshad Bari, M. (2011). Videographical Analysis of Short Service in Badminton. *Journal of Education and Practise*, *2*(2), 1–6.

Irawan, F. A., Chuang, L.-R., Peng, H., & Huang, S. (2016). A Biomechanical Baseball Pitching : Is the curveball generating higher risk of injuries than fastball on young pitchers ? *CJSB*, *2004*, 55–63.

Irawan, F. A., Jannah, S. P., Permana, D. F. W., Nurrachmad, L., & Anam, K. (2021). Mawashi Geri in Karate Junior Cadet Class : Kinematic Analysis. *Journal of Hunan University*, *Vol.48*(No.9), pp.437–443.

Irawan, F. A., Nomi, M. T., & Peng, H. (2021). Pencak Silat Side Kick in Persinas ASAD : Biomechanics Analysis. *International Journal of Human Movement and Sports Sciences*, *Vol.9*(No.6), pp.1230–1235. https://doi.org/10.13189/saj.2021.090617

Irawan, F. A., Nurrahmad, L., & Permana, D. F. W. (2020). The Association of Arch Height Index and Arcus Pedis on Agility : An Overview of Sport Science College Students. *International Journal of Innovation, Creativity and Change*, *14*(11), 669–676. https://doi.org/DOI: 10.53333/IJICC2013/141108

Irawan, F. A., & Permana, D. F. W. (2020). Parent-Child Fun Games sebagai Upaya Meminimalisasi Smartphone Addiction pada Anak di Madrasah Ibtidaiyah. *Jurnal Pemberdayaan Masyarakat Mandiri*

Indonesia, *1*(1), 1–8.

Irawan, F. A., Setiowati, A., Permana, D. F. W., & Sandiyudha, T. B. (2019). *Augment Reality Human Anatomy (ARMY) as Learning Media in Sport Science*. *362*(Acpes), 46–49. https://doi.org/10.2991/acpes-19.2019.10

Kharim, M. A., & Nurkholis. (2018). *Analisis Backswing Dan Release Ketepatan Pointing Half Lob Jongkok Pada Jarak 7 Meter Olahraga Petanque*. 1–6.

Listanto, B. (2021). *Kontribusi Kekuatan Otot Lengan Terhadap Kemampuan Servis Panjang Bulutangkis Pada Club PB. Bank Riau Kepri Pekanbaru*.

Mariotto, F. L., Zanni, P. P., & de Moraes, G. H. S. M. (2014). What is the use of a single-case study in management research? *RAE Revista de Administracao de Empresas*, *54*(4), 358–369. https://doi.org/10.1590/S0034-759020140402

Musofan. (2007). *Hubungan power otot lengan, panjang lengan, dan tinggi badan terhadap hasil forehand smash bulutangkis pada anggota PB. RSL Purbalingga*. Universitas Negeri Semarang.

Nandika, R., Hadi, D. T., & Ridho, Z. A. (2017). Pengembangan model latihan strokes bulutangkisberbasisfootworkuntukanakusia pemula (U-15). *Gladi Jurnal Ilmu Keolahragaan*, *08*(02), 103–111. https://doi.org/https://doi.org/10.21009/GJIK.082.03

Singh, A. P., & Mishra, V. B. (2020). A biomechanical analysis of badminton forehand service. *Vidyabharati International Interdisciplinary Research Journal*, 71–73.

Sumanjaya, S. A. (2015). *Hubungan Tingkat Pengetahuan Teknik Dasar Terhadap Penguasaan Ketrampilan Bulutangkis* (Vol. 2015) [Universitas Pendidikan Indonesia]. http://eprints.ums.ac.id/14213/2/BAB_I.pdf

Sumardi, Simanjuntak, V. G., & Atiq, A. (2015). *Pengaruh Model Pembelajaran Mandiri Terhadap Hasil Belajar Servis Pendek Backhand Bulutangkis SMPN 8 Pontianak*. 1–7.

Taufan, A., Dewantara, B., & Alsaudi. (2016). Pengaruh Strategi Pembelajaran Dan Konsep Diri Terhadap Keterampilan Smash Bulutangkis. *Jurnal Sport Area*, *15*(1), 10–22. https://doi.org/10.20527/multilateral.v15i1.2480

Texier, B. D., Cohen, C., Quéré, D., & Claneta, C. (2012). Shuttlecock dynamics. *Procedia Engineering*, *34*(July 2012), 176–181. https://doi.org/10.1016/j.proeng.2012.04.031

Wahyuningsih, S. (2013). Metode Penelitian Studi Kasus: Konsep, Teori Pendekatan Psikologi Komunikasi, dan Contoh Penelitiannya. *UTM PRESS Bangkalan - Madura*, 119.

Wardana, Z. S., & Dra. Ika Jayadi, M. (2017). Analisis ketepatan servis

panjang forehand pada atlet PB. Suryanaga surabaya kategori remaja putra (Ditinjau Dari Sport Video Analysis Kinovea). *Jurnal P Endidikan Kepelatihan Olahraga (JPKO)*, 1–23.

Wijaya, A. (2017). Analisis gerak keterampilan servis dalam permainan bulutangkis (Suatu Tinjauan Anatomi, Fisiologi, dan Biomekanika) Kata. *Indonesia Performance Journal*, *1*(2), 106–111.

https://doi.org/10.29407/js_unpgri.v8i4.18383
8 (4) 2022 | 342-354