



REVIEW ARTICLE

Using a Biomechanical Analysis Approach to the Accuracy of Shooting Throws in Petanque Sport: Literature Review

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Abstract

Study Purpose. The purpose of this study was to determine how biomechanical analysis can be used in petanque shooting techniques.

Materials and methods. This review study followed the PRISMA standards for systematic reviews and meta-analyses. Studies had to be published within the previous five years, from January 2019 to July 2023. (1) shooting petanque; (2) biomechanical analysis were the keywords used in the search process. Scopus and the Science and Technology Index (SINTA) were used for study.

Results. This review consists of nine studies. In five research articles, motion analysis was considered, which resulted in a discussion of the direction and angle of petanque throw biomechanics. Four research articles deal with the analysis of petanque shooting accuracy, leading to a discussion of angle, direction, arc, and focus.

Conclusions. Biomechanical analysis helps to understand intensity, speed, and posture for better bidding, improved performance, and reduced risk of injury, while increasing speed and efficiency, preventing muscle imbalances, and achieving better technical positions in shooting petanque sports.

Keywords: biomechanical, accuracy, shooting, petanque.

Introduction

The character of Petanque sports tends to require accuracy, anyone who wants to play Petanque no matter what age, position, gender is allowed to play this sport (Yulingga Nanda Hanief, 2019). Based on the purpose of its main mechanics, petanque games are included in sports that have the aim of achieving maximum accuracy. This means that the throw made must be right on a specific target to get the winning point (Apriani et al., 2021). Various studies have explored different aspects of the sport of petanque. Development of a shooting training model for beginners, emphasizing the importance of throwing accuracy (Badaru, Hasmyati, et al., 2021). Assessing interest in petanque among visitors to specific courses, and finding a mix of low to very

high interest (Sahruni et al., 2023). The results highlight the need for training and development in this sport, especially in terms of human resources (Yahya Andi Amry, 2021). The results of the evaluation evaluated the athletes' shooting ability, identifying a need for improvement in this area (Isdarianti et al., 2022). These studies collectively underscore the importance of training, development and skill enhancement in the sport of petanque.

A systematic literature review is a method used to analyze, synthesize, and summarize the existing literature on a particular topic (Dwidienawati et al., 2023). This method involves a rigorous and systematic approach to collecting and analyzing data from relevant sources (Moher et al., 2015). The purpose of a systematic literature review is to provide a clear and objective summary of the current state of knowledge on a particular topic, identify gaps in the literature and suggest areas for future research. This method is widely used in various fields including education healthcare, sports science, psychology, social science, and business and management (Amjad & Fernandes, 2023).

Various studies have explored the application of biomechanical technology in sport, highlighting its potential in injury prevention, technique improvement and performance optimization (Leckrone, 2021). Biomechanics is the study of human movement and the interaction between forces acting on the human body (Toma & Irawan, 2022). Research in this area has been conducted in several different contexts. Biomechanical analysis in relation to shooting throws in the sport of petanque. It explains how biomechanics affect ball flight and the importance of an accurate ball impact point for a correct shot (Ariwijaya et al., 2021). Various studies have explored the biomechanical aspects of shooting in various sports. Apply mathematical and physical methods to analyze shots, focusing on arm trajectory, shot direction, angle, effort, and velocity (Zhen et al., 2015). The results of another study highlighted the challenge of maintaining postural stability in precision sports such as shooting, proposing a measurement chain to evaluate this aspect (Words, 2000). These studies collectively underscore the importance of biomechanical factors in shooting performance.

Accuracy training One of the factors that can affect the accuracy of shooting in petanque sports so that it is inaccurate and imprecise includes a lack of arm muscle strength and a lack of analyzing biomechanics (Badaru, Kasmad, et al., 2021). The results of the study where accuracy is the ability of an athlete to direct the ball to the intended target or target with a good and perfect landing (Istikomah, 2023). Accuracy in the biomechanical analysis approach is closely related to the accuracy of the shooting point distance and shot power, because of one's ability to control free movements towards a target.

There have been many studies conducted in the past that have resulted in several developments in improving shooting accuracy in petanque sports, including a model of shooting skills training in petanque sports (Sutrisna et al., 2018), android-based petanque sport module (Wulandari & Wibowo, 2022), Learning Media Video Tutorial Basic Techniques of Petanque Throwing (Ayu et al., 2022)

The main purpose of analyzing the biomechanics of petanque pointing motion is to find out errors in movement and ball motion will create optimal movement, find out errors in performing techniques completely and accurately, and create athletes who have the opportunity to become champions especially in matches. Petanque games are included in sports that have the aim of achieving maximum balance and accuracy. This means that the throws made must be right on certain targets to get the winning points. The character of petanque sports tends to require accuracy, anyone who wants to play petanque no matter how old, position, gender is allowed to play this sport. In accordance with the main purpose of petanque sports into the sport to achieve maximum accuracy.

Materials and methods

The words "Biomechanical Analysis" and "Petanque Sports" were searched for in articles published from Sinta (Science and Technology Index) and Scopus Collections (Science Citation Index Expanded. Social Science Citation Index. Arts & Humanities Sams Citation Index) from 2019 to 2023. As shown in the flow chart (Figure 1), a total

sample of 9 articles was obtained from a total of 137 articles by following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. (PRISMA) (Moher et al., 2015) during the identification, suitability screening, and inclusion phases.

The following variables were taken into account in the literature review (a) annual trend of articles published between 2019 and 2023 (b) distribution of first author's institution (c) number of authors (d) field of study (training, health, other education management or mixed) (e) type of study (experimental, descriptive correlational, longitudinal) and (1) average number of citations per article.

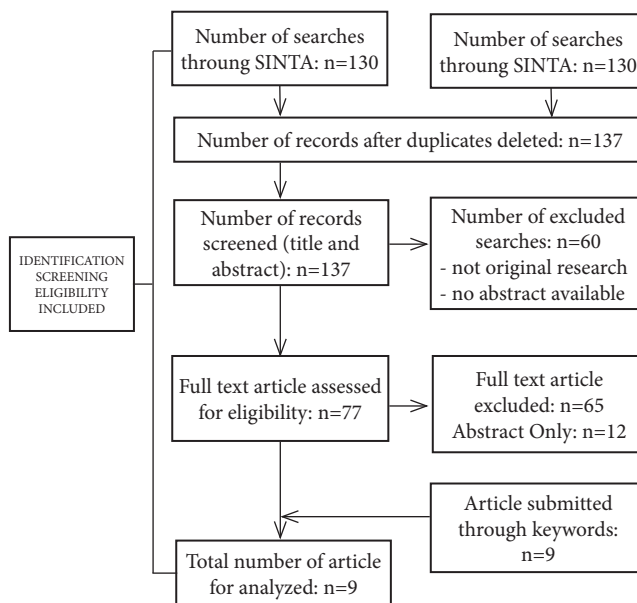


Fig. 1. Flowchart for what is used to select articles

The literature review considered the following variables: (a) the annual trend of articles published between 2019 and 2023; (b) the distribution of publications at the first author's institution; (c) the number of authors; (d) the field of study (health training education management, or mixed); (e) the type of study (experimental descriptive correlational, or mixed); and (f) the average number of citations per article.

Statistical Analysis

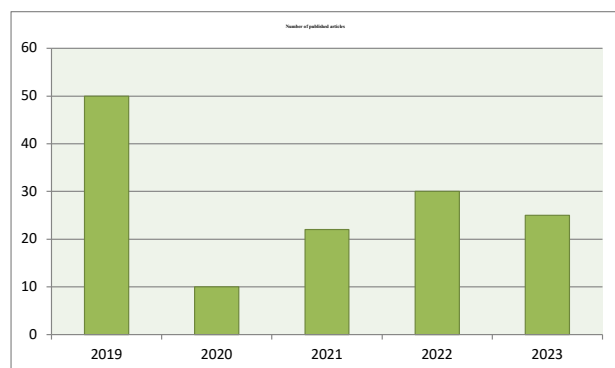
The abstract article title and keywords were focused on as these things are sufficient to generate reliable and usable article inti for follow-up research. Only open access articles were included in this review study as the authors did not want to exclude anyone who did not have access to their research. The following inclusion and exclusion criteria were used to obtain only relevant studies.

Result

Various time periods can be seen in the evolution of the number of publications, as depicted in Figure 2 First. there has been a marked increase in scientific output from 2019 (50 articles). Then in the following year there was a decrease in 2020 (10 articles) in the year there was an increase in 2021

Table 1. Changes in the number of publications per year

Year Published	Number of Articles	Percentage
2019	50	33%
2020	10	8 %
2021	22	16%
2022	30	25%
2023	25	18%
Total	137	100%

**Fig. 2.** Graph of Changes in the Number of Publications per Year

(22 articles) in the following year there was an increase in 2022 (30 articles) and in the following year 2023 (25 articles).

Based on the literature the biomechanical analysis that can be applied in the petanque shooting throw technique is shown in the table above. The review consists of nine studies. In five research articles, motion analysis is discussed, resulting in a discussion of the direction and angle of petanque throw biomechanics. Four research articles discuss the analysis of petanque shooting accuracy, which results in a discussion of angle, direction, arc, and focus. Based on throwing mechanics in petanque, the main goal is expected to produce accuracy in throwing and shooting.

Table 2. Study summary table

Topic	Sample	Results	Source
Biomechanical analysis of pointing and shooting petanque on athletes TC PON XX Papua	Athlete	Angle, Direction	Sinaga & Ibrahim (2020)
Biomechanical analysis of concentration and coordination on the accuracy in petanque shooting	Students	Angle, Direction, and Focus	Awang et al. (2019)
Analysis of Pointing Motion in Petanque Sport	Athlete	Angle, Direction	Bustomi et al. (2020)
Analysis of Backswing and the Use of Star Excursion Balance Test (SEBT) on the Results of Petanque Shooting Throws	Athlete	Angle, Direction	Awang Irawan & Sirodjul Munir (2021)
Analysis Of The Level Of Shooting Ability Of Petanque Athletes	Athlete	Angle, Direction	Ulpiana et al. (2022)
Analysis of Pointing Motion in Squatting Position from Biomechanical Aspects	Athlete	Angle, Direction	Paulina & Irawan (2022)
Analysis of pointing accuracy on petanque standing position: Performance and accuracy	Athlete	Angle, Direction, and Focus	Irawan et al. (2022)
Accuracy Training Program: Can Improve Shooting Results of Petanque Athletes	Athlete	Angle, Direction, and Focus	Phytanza et al. (2022)
Investigation into the mechanisms leading to explosion of pétanque balls	Athlete	Angle, Direction, Curvature, and Focus	Loser et al. (2011)

Biomechanical analysis is used to address the problems that occur in petanque shooting and provide recommendations on what is needed to improve performance.

Discussion

Based on the results of the study, there are four main indicators that determine shooting, namely backswing angle, swing, release angle, and ball height. The four indicators are interrelated and influence each other. the backswing angle will affect the swing speed, and the swing speed will affect the release angle of the ball, and these three indicators will produce the maximum height of the ball. In shooting there is no definite reference to the four indicators (Sinaga & Ibrahim, 2020). There are three indicators in determining the results of the shooting throw movement, namely the backswing angle, swing speed, and release angle, if the backswing angle, the release angle is small then the swing speed must be large in order to reach the target at a distance of 8 meters. Vice versa, if the backswing angle and release angle are large, the swing speed needed is also small in order to reach the target at a distance of 8 meters, this is in accordance with what was stated by (Cahyono et al., 2018). These three indicators affect the results of shooting throws, if one indicator is more dominant then other indicators are required to adjust because these three indicators are interrelated. Seeing the acquisition of shooting precision samples with an average score of 19.6 and included in the “medium” category, so it is necessary to increase shooting practice so that it can achieve maximum results.

Various studies have explored the factors that influence shot accuracy in petanque. That eye-hand coordination, concentration, and confidence play an important role in shot accuracy. Further demonstrating the effectiveness of shooting drills using obstacles in improving shooting game ability (Saifulamri Alkhusaini et al., 2021). Other research also argues that the development of a petanque shooting training model for beginners, by emphasizing the importance of training to achieve high throwing accuracy (Badaru, Hasmyati, et al., 2021). Then the results of another study comparing the effects of concentration and

coordination training on shooting game ability, found that both were significant but concentration training gave better results (Lubis & Permadi, 2021). These studies collectively highlight the importance of physical and mental training in achieving shot accuracy in petanque. Utilizing biomechanics for training allows for smart practice planning so that you can get the most out of it in the shortest amount of time and in the safest way possible.

The study of sports biomechanics helps people understand how the body reacts to intensity, angles and postures in sports. In other words, studying sports biomechanics helps players choose the sport that suits them best. When poor form and technique are used, biomechanical analysis can highlight the details and help understand the stress that poor technique puts on joints and surrounding tissues. Biomechanical analysis can help athletes of all ages and abilities to improve performance or reduce pain. In summary, the biomechanical benefits of improving speed and strength are as follows, and help eliminate muscle imbalances, which means less wear and tear on ligaments and joints, and better training technique

Sports biomechanics is the study of the mechanical principles of human movement and how they apply to sports performance. Over the past fifty years, there has been considerable development in motion analysis systems and computer simulation modeling of sports movements, the relevance and importance of functional variability of sports techniques has also been recognized (Tai et al., 2023). Factors such as self-concept of subject ability, previous subject experience, and future career aspirations influence sports science students' elective biomechanics enrollment decisions. Sports biomechanics research often relies on ordinary least squares (OLS) regression, but statistical learning methods such as ordered regression models can be used to handle high-dimensional data sets and improve variable selection. These models have been used to reduce the number of variables and identify key predictors of performance in sports biomechanics research (Kipp & Warmenhoven, 2022).

Biomechanics is a field that combines engineering, physics (specifically mechanics), and knowledge of the workplace environment. General biomechanics is a branch of biomechanics that studies the basic laws governing the organic human body at rest and in motion. Biomechanics is a study that specializes in analyzing segments of human body motion, one of which is quantitative data on angles in degrees (Hughes et al., 2021). Studying the impact of these components has two main advantages. First of all, this research enables training that improves skills while reducing the risk of injury. In addition, it improves performance and physical fitness in terms of strength, cardiovascular and flexibility. Performing biomechanical analysis has many benefits as it provides a wealth of data for different types of human movement analysis. Especially, biomechanical analysis can improve athletes' performance (increase their performance) and reduce the risk of injury.

Conclusions

Based on the results of the use of biomechanical analysis in petanque shooting techniques based on literature and research. Six articles focused on motion analysis, examin-

ing biomechanical area and speed in petanque shooting. The remaining articles discuss shooting technique, focusing on speed, area, distance and focus. Biomechanical analysis helps understand the impact of intensity, speed, and posture in shooting and helps players get more accurate shots. Analysis of biomechanical techniques can help athletes improve performance and reduce the risk of injury. Benefits of biomechanical analysis include increased speed and strength, reduced muscle imbalances, and better stance technique.

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Conflict of Interest

The authors reported no potential conflicts of interest.

References

- Yulingga Nanda Hanief, A. M. I. P. (2019). Petanque: Apa saja faktor fisik penentu prestasinya. *Jurnal Keolahragaan*, 7(2), 116. <https://doi.org/10.21831/jk.v7i2.26619>
- Apriani, L., Sari, M., & Alpen, J. (2021). Studi Eksperimen Pada Unit Kegiatan Mahasiswa Petanque Universitas Islam Riau: Meningkatkan Kesegaran Jasmani Melalui Permainan Hadang dan Bentengan. *Jurnal MensSana*, 6(1), 50–55. <https://doi.org/10.24036/menssana.06012021.19>
- Badaru, B., Hasmyati, H., Juhanis, J., & Anwar, N. I. A. (2021). Shooting Training Model Development Of Petanque For Beginners. *Halaman Olahraga Nusantara (Jurnal Ilmu Keolahragaan)*, 4(2), 167. <https://doi.org/10.31851/hon.v4i2.5304>
- Sahrani, A. Y., Warwuru, P. M., & Marlissa, D. (2023). *Interests in Petanque Sports Field Visitors Andi Makkasau Parepare City*. 1, 106–112.
- Yahya, A. A., & Haeril, H. (2021). PKM Solialisasi dan Pengembangan Olahraga Petanque Kabupaten Jeneponto. *Jurnal Pengabdian Olahraga Masyarakat (JPOM)*, 2(1), 15–18. <https://doi.org/10.26877/jpom.v2i1.8579>
- Isdarianti, N. L., Jafar, M., Masri, M., & Wiyanto, A. (2023). Evaluasi Kemampuan Shooting Cabang Olahraga Petanque Pada Atlet Rampagoe Petanque Club USK Tahun 2022. *Journal of Physical Activity and Sports*, 3(3), 161–167. <https://doi.org/10.53869/jpas.v3i3.184>
- Dwidienawati, D., Zainal, M., & Gandasari, D. (2023). Is Turnover Relationship to Performance Linear Or U-Inverted? A Systematic Literature Review. *Journal of Intercultural Communication*, 109–119. <https://doi.org/10.36923/jicc.v23i2.80>
- Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., Shekelle, P., & Stewart, L. A. (2015). Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Systematic Reviews*, 4(1), 1. <https://doi.org/10.1186/2046-4053-4-1>
- Amjad, A., & Fernandes, G. (2023). The systematic review in the field of management sciences. *Scientific Papers*

- of Silesian University of Technology. *Organization and Management Series*, 2023(170), 9–35.
<https://doi.org/10.29119/1641-3466.2023.170.1>
- Leckrone, T. J. (2021). *The Application of Biomechanical Technology in Sports*. Senior Honors Theses. 1068. <https://digitalcommons.liberty.edu/honors/1068>
- Toma, H. P., & Irawan, F. A. (2022). Analisis Biomekanika Gerak Pukulan Jarak Jauh Pada Atlet Woodball Universitas Negeri Semarang. *Riyadhoh: Jurnal Pendidikan Olahraga*, 5(1), 38. <https://doi.org/10.31602/rjpo.v5i1.6340>
- Ariwijaya, A., Candra, A. T., Mustain, A. Z., Studi, P., Jasmani, P., Rekreasi, D., Olahraga, F., & Kesehatan, D. (2021). Analisis Biomekanika Akurasi Tendangan Sudut Berdasarkan Variasi Titik Impact. *SPRINTER: Jurnal Ilmu Olahraga*, 2(1), 126–131. <https://doi.org/10.46838/spr.v2i1.99>
- Zhen, L., Wang, L., & Hao, Z. (2015). A biomechanical analysis of basketball shooting. *International Journal of Simulation Systems, Science & Technology*, 16, 1-1. <https://ijssst.info/Vol-16/No-3B/paper1.pdf>
- Words, K. E. Y. (2000). *Instrumentation And Measurement Methods Applied To Biomechanical*. <https://ojs.ub.uni-konstanz.de/cpa/article/view/2249>
- Badaru, B., Kasmad, M. R., Indah, N., & Anwar, A. (2021). Effect of Accuracy and Muscle Strength Training on the Result of Shooting Throws in Petanque. 11, 56–67. <https://pdfs.semanticscholar.org/6480/ae2c0900d2048be8f1b0ee9c2f378a8c5191.pdf>
- Istikomah, N. (2023). Hubungan Fleksibilitas Bahu dengan Hasil Shooting pada Atlet Petanque DKI JAKARTA. *Jurnal Segar*, 12(1), 60–72. <https://doi.org/10.21009/segar/1201.06>
- Sutrisna, T., Asmawi, M., & Pelana, R. (2018). Model Latihan Keterampilan Shooting Olahraga Petanque Untuk Pemula. *Jurnal Segar*, 7(1), 46–53. <https://doi.org/10.21009/segar/0701.05>
- Wulandari, A. M., & Wibowo, A. K. (2022). Pengembangan elektronik modul olahraga petanque berbasis android. *Multilateral: Jurnal Pendidikan Jasmani Dan Olahraga*, 21(1), 57. <https://doi.org/10.20527/multilateral.v21i1.11324>
- Ayu, K., Saputri, L., & Suwiwa, I. G. (2022). Media Pembelajaran Video Tutorial Teknik Dasar Lempar Petanque. *Jurnal Mimbar Ilmu*, 27(2), 254–261. <https://doi.org/10.23887/mi.v27i2>
- Sinaga, Friska Sari Gracia, & Ibrahim, I. (2020). Analysis Biomechanics Pointing Dan Shooting. *Jurnal Ilmiah Ilmu Keolahragaan*, 3(3), 66–75. <https://doi.org/https://doi.org/10.24114/so.v3i2.15196>
- Awang, F., Fajar, D., Permana, W., Akromawati, H. R., & Yang-Tian, H. (2019). Biomechanical Analysis of Concentration and Coordination on The Accuracy in Petanque Shooting. *Journal of Physical Education, Sport, Health and Recreation*, 8(2), 96–100. <https://doi.org/10.15294/active.v8i2.30467>
- Bustomi, A. O., Hidayah, T., Okilanda, A., & Putra, D. D. (2020). Analisis Gerak Pointing Pada Olahraga Petanque. *Journal Sport Area*, 5(1), 65–75. [https://doi.org/10.25299/sportarea.2020.vol5\(1\).4807](https://doi.org/10.25299/sportarea.2020.vol5(1).4807)
- Awang Irawan, F., & Sirodjul Munir, A. (2021). Analisis Backswing dan Penggunaan Star Excursion Balance Test (SEBT) Terhadap Hasil Lemparan Shooting Petanque. *Journal of Sport Science and Education*, 6(2), 197–204. <https://doi.org/10.26740/jossae.v6n2>
- Ulpiana, L., Permadi, A. G., & Asy'ari, M. (2022). Analisis Tingkat Kemampuan Shooting Atlet Petanque. *Gelora: Jurnal Pendidikan Olahraga Dan Kesehatan IKIP Mataram*, 8(2), 40. <https://doi.org/10.33394/gjpok.v8i2.4927>
- Paulina, J. D., & Irawan, F. A. (2022). Analisis Gerak Pointing Posisi Jongkok Ditinjau dari Aspek Biomekanika. *Journal of Sport Coaching and Physical Education*, 7(1), 65–71. <https://journal.unnes.ac.id/sju/index.php/jscpe/article/view/56861>
- Irawan, Ghassani, D. S., Permana, D. F. W., Kusumawardhana, B., Saputro, H. T., Fajaruddin, S., & Bawang, R. J. G. (2022). Analysis of pointing accuracy on petanque standing position: Performance and accuracy. *Journal Sport Area*, 7(3), 456–465. [https://doi.org/10.25299/sportarea.2022.vol7\(3\).10183](https://doi.org/10.25299/sportarea.2022.vol7(3).10183)
- Phytanza, D. T. P., Burhaein, E., Indriawan, S., Lourenço, C. C. V., Demirci, N., Widodo, P., Widiyono, I. P., Irawan, Y. F., Sutopo, W. G., Parmadi, M., Azizah, A. R., Saleh, M., Hadiatmo, A., & Susanto, A. (2022). Accuracy Training Program: Can Improve Shooting Results of Petanque Athletes Aged 15-20 Years? *International Journal of Human Movement and Sports Sciences*, 10(1), 121–130. <https://doi.org/10.13189/saj.2022.100117>
- Loser, R., Piskoty, G., Al-Badri, A., Tuchschnid, M., Schmid, P., & Leemann, A. (2011). Investigation into the mechanisms leading to explosion of pétanque balls. *Engineering Failure Analysis*, 18(2), 633–648. <https://doi.org/10.1016/j.engfailanal.2010.09.029>
- Cahyono, E., Rendi, & Nurkholis. (2018). Analisis Backswing Dan Release Shooting Carreau Jarak 7 Meter Olahraga Petanque Pada Atlet Jawa Timur. *Jurnal Prestasi Olahraga*, 1(1), 1–5. <https://ejournal.unesa.ac.id/index.php/jurnal-prestasi-olahraga/article/view/24169>
- Saifulamri Alkhusaini, Muhammad, & Nurhidayat, N. (2021). Keterampilan Shooting Pada Permainan Petanque. *Jurnal Porkes*, 4(2), 69–75. <https://doi.org/10.29408/porkes.v4i2.3865>
- Lubis, M. R., & Permadi, A. G. (2021). Perbedaan Pengaruh Latihan Konsentrasi Dan Latihan Koordinasi Terhadap Peningkatan Kemampuan Shooting Game Atlet Petanque Undikma. *JISIP (Jurnal Ilmu Sosial Dan Pendidikan)*, 5(2). <https://doi.org/10.58258/jisip.v5i2.2005>
- Tai, W. H., Zhang, R., & Zhao, L. (2023). Cutting-Edge Research in Sports Biomechanics: From Basic Science to Applied Technology. *Bioengineering*, 10(6), 2–5. <https://doi.org/10.3390/bioengineering10060668>
- Kipp, K., & Warmenhoven, J. (2022). Applications of regularized regression models in sports biomechanics research. *Sports Biomechanics*, 1–19. <https://doi.org/10.1080/14763141.2022.2151932>
- Hughes, G. T. G., Camomilla, V., Vanwanseele, B., Harrison, A. J., Fong, D. T. P., & Bradshaw, E. J. (2021). Novel technology in sports biomechanics: some words of caution. *Sports Biomechanics*, 1–9. <https://doi.org/10.1080/14763141.2020.1869453>

Застосування методу біомеханічного аналізу для визначення точності кидків на вибивання у петанку: огляд літератури

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Авторський вклад: А – дизайн дослідження; В – збір даних; С – статаналіз; D – підготовка рукопису; Е – збір коштів

Реферат. Стаття: 6 с., 2 табл., 2 рис., 34 джерела.

Мета дослідження. Метою дослідження було визначити, як біомеханічний аналіз може бути застосований у техніках вибивання куль у петанку.

Матеріали і методи. Дане оглядове дослідження проводилося відповідно до стандартів PRISMA з метою здійснення систематичних оглядів і мета-аналізів. Дослідження мали бути опубліковані протягом попередніх п'яти років, з січня 2019 року по липень 2023 року. (1) вибивання куль у петанку; (2) біомеханічний аналіз використовувалися як ключові слова в процесі пошуку. Для проведення дослідження використовували наукометричні бази даних Scopus та Індекс науки і технологій (SINTA).

Результати. Представлений огляд складається з дев'яти досліджень. У п'яти наукових статтях було розглянуто аналіз руху, що спричинило обговорення напрямку і кута біомеханіки кидка у петанку. У чотирьох статтях проведено аналіз визначення точності вибивання куль у петанку, внаслідок чого були розглянуті питання кута, напрямку, дуги та фокусування.

Висновки. Біомеханічний аналіз допомагає зрозуміти інтенсивність, швидкість і позицію для покращення ведення гри, підвищення результативності та зменшення ризику травм, одночасно збільшуючи швидкість та ефективність, запобігаючи розвитку м'язового дисбалансу, а також досягаючи кращих технічних позицій у змаганнях з петанку при вибиванні куль.

Ключові слова: біомеханічний, точність, вибивання, петанк.

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