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The Effect of Sport Massage on Decreased Glucose in Football Players

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Abstract. This research emerged from the observed increase in football activity in Indonesia, and the associated health implications for players, specifically regarding maintained glucose levels. The objective of this study was to assess the potential effects of sports massage on decreasing glucose levels in football players. This study adopts a quantitative approach using a one-group pretest-posttest design. The population consisted of 26 football players and made use of saturated or total sampling. The data was subjected to tests for normality and homogeneity before proceeding with a paired t-test for analysis. The study employed a one-group pretest-posttest quantitative design, examining the effect of sports massage on glucose levels in 26 football players. Statistical tests confirmed the normality and homogeneity of the data. The average glucose level recorded during the pretest was 128.15, compared to the posttest average of 118.00. The results showed a statistically significant decrease in glucose levels post-massage, with a paired t-test yielding a Sig. (2-tailed) value of 0.001, which is less than the critical threshold of 0.05. This study demonstrates the positive impact of sports massage on glucose levels in football players, suggesting its potential benefits for enhancing performance and recovery in sports. Further investigations may be necessary to confirm these findings and explore the underlying mechanisms. This study pioneered in examining the unique intersection of sports massages and glucose reduction in football athletes. This study also contributes significantly to the broader scientific and sports community by providing empirical evidence on the quantifiable benefits of sports massage, a topic with limited research especially in relation to glucose levels. Policymakers could use these insights to advocate for the incorporation of sports massage therapy in athlete guidelines. Abundant opportunities exist for further exploration and confirmation of these results in diverse sporting contexts and wider athlete populations.

Key words: football; sports massage; glucose levels; athletic performance; recovery process

Abstract in Indonesia. Penelitian ini muncul dari peningkatan aktivitas sepak bola yang diamati di Indonesia, dan implikasi kesehatan yang terkait bagi para pemain, khususnya terkait kadar glukosa yang terjaga. Tujuan dari penelitian ini adalah untuk menilai efek potensial dari pijat olahraga terhadap penurunan kadar glukosa pada pemain sepak bola. Penelitian ini menggunakan pendekatan kuantitatif dengan menggunakan desain pretest-posttest satu kelompok. Populasi terdiri dari 26 pemain sepak bola dan menggunakan sampling jenuh atau total sampling. Data yang diperoleh kemudian diuji normalitas dan homogenitasnya sebelum dilanjutkan dengan uji-t berpasangan untuk dianalisis. Penelitian ini menggunakan desain kuantitatif satu kelompok pretest-posttest, yang meneliti efek pijat olahraga pada kadar glukosa pada 26 pemain sepak bola. Uji statistik mengkonfirmasi normalitas dan homogenitas data. Kadar glukosa rata-rata yang tercatat selama pretest adalah 128,15, dibandingkan dengan rata-rata posttest 118,00. Hasil penelitian menunjukkan penurunan kadar glukosa yang signifikan secara statistik setelah pemijatan, dengan uji-t berpasangan yang menghasilkan nilai Sig. (2-tailed) sebesar 0,001, yang kurang dari ambang batas kritis 0,05. Penelitian ini menunjukkan dampak positif dari pijat olahraga terhadap kadar glukosa pada pemain sepak bola, yang menunjukkan potensi manfaatnya untuk meningkatkan kinerja dan pemulihan dalam olahraga. Investigasi lebih lanjut mungkin diperlukan untuk mengkonfirmasi temuan ini dan mengeksplorasi mekanisme yang mendasarinya. Penelitian ini menjadi pelopor dalam meneliti hubungan unik antara pijat olahraga dan pengurangan glukosa pada atlet sepak bola. Penelitian ini juga berkontribusi secara signifikan terhadap komunitas ilmiah dan olahraga yang lebih luas dengan memberikan bukti empiris tentang manfaat terukur dari pijat olahraga, sebuah topik dengan penelitian yang terbatas terutama dalam kaitannya dengan kadar glukosa. Para pembuat kebijakan dapat menggunakan wawasan ini untuk mengadvokasi penggabungan terapi pijat olahraga dalam pedoman atlet. Ada banyak peluang untuk eksplorasi lebih lanjut dan konfirmasi hasil ini dalam konteks olahraga yang beragam dan populasi atlet yang lebih luas.

Kata Kunci: sepak bola; pijat olahraga; kadar glukosa; performa atletik; proses pemulihan

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INTRODUCTION

Managing glucose levels constitutes a critical challenge in the world of sports, particularly in football. This high-intensity sport demands a substantial amount of energy, primarily sourced from glucose. Maintaining optimal glucose levels can significantly enhance an athlete's performance, endurance, and recovery. Conversely, mismanagement can lead to severe consequences like hypoglycemia or hyperglycemia, threatening overall athletic performance, wellbeing, and health on a wider scale (Ratri et al., 2022).

Specifically, football athletes often encounter challenges in glucose management due to the nature of their regimen. The nature of football, with its high energy demands, accelerates glucose utilization, resulting in depletion of blood glucose levels. Moreover, sync between the diet plans and the energy requirement often fallout, leading to non-optimal glucose levels. A significant problem arises when athletes are required to recover their glucose levels rapidly to maintain or improve their performance. This demand places high pressure on interactions between nutrition, blood glucose level, and performance, bringing forth a need for efficient interventions (Bulqini et al., 2022; Rubiono & Setiawan, 2020).

Moreover, these issues become particularly acute during periods of continuous intense training or competitions, where athletes must consistently perform at peak levels. Therefore, at an individual level, unreliable glucose management practices can hamper an athlete's career and, at a group level, potentially undermine a sports team's overall performance(Armade & Putra, 2017).

Glucose management is a vital yet complex issue encountered in sports, specifically impacting football athletes. The blend of physiological, nutritional, and performance aspects demands a clear, scientifically-backed solution to enable athletes to maintain their health and optimize their performance simultaneously (Ratri et al., 2022).

Prior research in the field of sports science has explored different methods to manage athletes' glucose levels. Techniques such as dietary treatments and adjustments to training schedules have been widely examined to enhance glucose balance during intensified physical activities. However, the effectiveness of these methods can fluctuate based on various factors like the individual's condition, the nature of the sport, and the intensity of the physical exertions, creating a need for wider acknowledgment of this issue (Ferdiansyah, 2021; Gemael et al., 2020; Hendra Hasibuan et al., 2020).

One potential glucose management approach that has shown promise in preliminary studies is the application of sports massage. Some research points toward the potential of sports massage to encourage glucose redistribution and enhance recovery post-exercise. However, the existing body of research in this area is relatively sparse and frequently contradictory(Gemael et al., 2020; Hadi et al., 2021; Izuddin et al., 2022; Kamali et al., 2023).

Moreover, prior studies have predominantly examined the effect of sports massage on glucose levels in athletes from high-endurance sports other than football. There is a conspicuous absence of research on the impact of sport massage on football players' glucose levels. This gap in knowledge signifies a need for dedicated scholarly exploration.

The role of sport massage as a potential intervention to manage glucose levels, specifically in the context of football, remains largely unexplored and understudied. This gap in research constitutes a critical oversight given football's global popularity and high physical demands. It brings to the fore an opportunity for new, potentially influential research aiming to positively influence the glucose management methods employed in this sport.

In the midst of challenges such as aggressive competition schedules and high physical exertion requirements, maintaining optimal glucose levels in football players becomes pivotal. The need for innovative, efficient, and practical solutions is urgent, and this research addresses precisely that by proposing sports massage as an intervention.

The role of sports massage in sports science has been acknowledged for recovery and rehabilitation purposes. Still, its effect on blood glucose regulation represents a relatively unexplored area. This research aims to investigate sports massage's impact on football players' glucose levels, thereby potentially presenting a novel and practical solution to a prevalent problem in this field.

The significance of this research lies in its potential to contribute to the profusion of strategies available for glucose management in athletes, specifically football players. It could serve as a guide for sports coaches, physical therapists, and athletes who need to make informed decisions about effective

ways to manage glucose levels in athletes.

Moreover, if the research proves sports massage beneficial in glucose regulation among football players, it could influence sports practices and policy formulation. It could promote the integration of sports massage in training schedules and recovery plans, not merely as a method for physical recovery but also as a tool for optimal glucose regulation.

In this context, this study is set to offer a dual-purpose approach to athlete management, incorporating both physiological well-being and performance enhancement. By bridging the research gaps in this field, the study sets the stage for wider application and further investigation into the role of sports massage in sports science.

The purpose of this research is as follows to investigate the impact of sports massage on glucose levels in football players; to identify any potential benefits of sports massage in managing glucose levels during and post-physical exertion in football; to contribute to the existing body of research by examining a relatively unexplored area, the relationship between sports massage and glucose regulation; to provide practical evidence-based knowledge that could inform coaches, physical therapists, and athletes' decisions regarding glucose management strategies in football; to determine the potential of integrating sports massage into football training and recovery regimes as an effective method for glucose management; to lay the groundwork for future studies that might want to explore the role of sports massage in glucose management across other sports or athletic populations.

This research stands to provide numerous benefits to the scientific community and broader society. By investigating the impact of sports massage on glucose levels in football players, it expands the boundaries of sports science, offering a potentially novel and practical solution to a crucial issue.

In the realm of sports science, the findings may open up a new avenue of research, linking sports massage with glucose regulation. Should sports massage prove beneficial in managing glucose levels, it could invigorate interest in examining massage's other physiological benefits, driving advancements in holistic athlete management approaches.

This study specifically benefits the sporting community, including football players, coaches, and physical therapists. If sports massage is found to be an effective intervention for glucose regulation, it can guide training routines and recovery procedures, bringing about changes in sport practices and optimal athlete care (Ali et al., 2023; Cisneros et al., 2023; Ekkekakis et al., 2023; Lefebvre et al., 2023; Markström et al., 2023; Moesch, 2023).

Beyond the immediate sporting context, these research findings could influence public health policies, particularly concerning diabetes and glucose management. If sports massage can naturally regulate glucose levels, it could serve as a potential non-pharmacological strategy in controlling glucose levels or even as a preventive measure(Borque et al., 2023; Calleja-González et al., 2023; Kim & Hong, 2022; Penitente et al., 2023; Short et al., 2023; Young, 1999).

Moreover, the study benefits everyday individuals looking for holistic health practices. Shedding light on the connection between massage and glucose regulation can increase public knowledge, encouraging personal health management activities like regular sports massages. This study ultimately seeks to bridge the gap between sports science and public health, setting a precedent for future research into innovative and practical solutions for glucose management (Isern et al., 2023; Lemos et al., 2023; Ltifi et al., 2023; Madarsa et al., 2023; Soltani et al., 2023; Xu et al., 2023).

METHODS

This research employed a quantitative research approach to understand the effect of sport massage on glucose levels in football players. The method involved a series of explicit, stepwise procedures to ensure accuracy and reproducibility (Sugiyono, 2021).

Participant Selection. The initial step in our process was to recruit a sample of professional, active football players aged between 18 and 35 who have no medical conditions affecting their glucose levels or contraindicating sports massage. Their competitive football status and relatively similar lifestyle would ensure standardized conditions for the study. Preliminary Briefing. The selected participants were briefed about the study, its relevance, the processes involved, and their roles. They were reassured about the confidentiality of their personal data and their freedom to withdraw from research at any point (Sahid, 2022).

Consent Obtention. Formal written consent was achieved from each participant after explaining the study to their satisfaction. Baseline Glucose Assessments. Upon consent, initial glucose levels were measured. Taking all precautions, a standardized glucometer was used for baseline measurements, performed two hours after a meal to ensure consistency. Intervention Application. A certified massage therapist provided each participant with a 30-minute sports massage session. The therapist used techniques specific to sports massage to maintain consistent interventions across all participants (Rahmanto & Warthadi, 2022).

Post-Intervention Glucose Measurements. After the sports massage session, glucose levels were assessed again using the same glucometer and under the same conditions. The initial measurement was taken immediately after the session, followed by regular interval measurements for up to two hours. Confounding Control. To minimize confounding variables, participants were instructed to maintain their usual dietary and physical activity throughout the study. Procedure: briefing by researchers about preparation pretest what the mechanism; the researcher conducted a pretest by taking athletes' blood samples; collecting data on pretest results; players carry out physical activities, namely running for 30 minutes and continuing with the treatment sports massage; researchers do posttest by taking a blood sample; result data collection posttest. Data Analysis. The data collected was subjected to statistical analysis to compare pre- and post-intervention glucose levels. A biostatistician used SPSS software for this purpose (Harvey et al., 2023; Li et al., 2023; Marques et al., 2023; Martínez-Noguera et al., 2023; Tian et al., 2023).

RESULTS AND DISCUSSION

In this study, the data analysis follows a systematic process designed to distil meaningful conclusions from the collected data about the impact of sports massage on blood glucose levels in Karawang United FC professional football players. Initial data acquired from the glucose measurements were organized and prepared for analysis. The raw data was cleaned to ensure that it was free of discrepancies, missing values or outliers which might have skewed the analysis. Basic descriptive statistical analysis was performed to get an overview of the data. Mean and standard deviation of pre- and post-intervention glucose measurements were computed to summarize the information in a meaningful way. Inferential statistics were applied to determine whether there were significant differences between pre and post-massage glucose levels. T-tests were utilized to explore the differences between the means of the two sets of data. Furthermore, a regression analysis was performed to understand the relation between massage and glucose levels, including determining whether a linear relationship exists and making predictions based on that relationship. The null hypothesis (that there is no change in glucose levels pre and post-massage) was tested against the alternative hypothesis (that there is a significant difference in glucose levels pre and post-massage) using a predefined significance level. The results derived from the statistical tests were interpreted and contextualized. A lower post-massage glucose level would infer that sports massage has a positive effect on glucose metabolism in football players. Based on the statistical findings and their interpretation, conclusions were drawn about the effectiveness of sports massage in reducing glucose levels in football players. By adhering to this systematic approach, the research ensured accurate assessment of the impact of sports massage on glucose levels in football players. The use of inferential statistics and regression models allowed for robust confirmation or denial of the initial research hypothesis(Moleong, 2007; Agung, 2020: 364).

Table 1. Descriptive Statistics of Research Results

Descriptive Statistics

	N	Mean	Std. Deviation	Variance
Pre-Test	26	128.15	18.988	360.535
Pos-Test	26	118.00	16.514	272.720
Valid N (listwise)	26			

Data analysis is a critical aspect of the research process that involves the transformation of raw data into useful information for decision-making. For this study regarding the influence of sports massage on blood sugar reduction among Karawang United FC professional football players, various statistical

analyses were employed. Firstly, descriptive statistics illustrated the basic features of the dataset in the study. Pre- and post-intervention mean values of glucose levels were calculated at 128.15 mg/dL and 118.00 mg/dL respectively, with corresponding standard deviations of 18.988 mg/dL and 16.514 mg/dL. This preliminary data analysis indicated an average decrease in glucose levels following the sports massage. Subsequently, inferential statistics were employed to explore whether the observed reduction was of statistical significance. T-tests compared the pre- and post-massage means, with the null hypothesis stating no difference in glucose levels before and after the intervention. Finally, regression analysis extrapolated these findings to predict impacts of sports massage on blood glucose levels in broader contexts. In essence, could a formulaic relationship be deduced between the two variables? The amalgamation of these analytical tools allowed this research to draw significant conclusions from its data. Furthermore, the precision of the data analysis process gives strength and validity to the conclusions, providing a strong scientific contribution to the field of sport and health sciences. Additionally, the data analysis process seeks not only to affirm or refute the initial hypothesis but also to uncover patterns and relationships that may prompt further research. The themes and hypotheses originating from this study offer new direction for future research endeavors, potentially leading to the development of new therapies and interventions in sports science and healthcare.

Table 2. Normality test *Shapiro-Wilk*

Tests of Normality						
	Kolmogorov-Smirnov[a]			*Shapiro-Wilk*		
	Statistic	df	*Sig.*	*Statistic*	*df*	*Sig.*
Pre-Test	.128	26	*.200*[*]	*.966*	*26*	*.526*
Post-Test	.105	26	*.200*[*]	*.962*	*26*	*.438*

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

The Shapiro-Wilk test was applied to assess the normality of the pre-test and post-test distribution of blood glucose levels in the soccer players. Normality of data is an assumption for many statistical tests, as it ensures accurate and reliable results. A p-value (Significance or "Sig.") higher than 0.05 indicates that the distribution does not significantly deviate from normality, hence the null hypothesis of the Shapiro-Wilk test (the data comes from a normal distribution) is not rejected. For the pre-test (before sports massage therapy), the observed p-value was 0.526. Given that this is larger than the typical threshold (0.05), the results are not significant enough to reject the null hypothesis, and we conclude that the pre-test blood glucose data does not deviate significantly from a normal distribution. The same case applies to the post-test (after sports massage therapy), where the p-value was found to be 0.438 which is also greater than 0.05, suggesting the post-test blood glucose data also follows a normal distribution. The results from both the pre-test and post-test Shapiro-Wilk normality tests show that the distribution of blood glucose levels among the soccer players, both prior to and following sports massage therapy, are statistically normal. This is an important quality check before performing the subsequent hypothesis tests such as the paired t-test.

Table 3. Homogeneity Test Results

Test of Homogeneity of Variances					
		Levene Statistic	**df1**	**df2**	**Sig.**
Results	Based on Mean	.006	1	50	.940
	Based on Median	.005	1	50	.943
	Based on Median and with adjusted df	.005	1	45.746	.943
	Based on trimmed mean	.006	1	50	.936

The test for homogeneity of variances is used to determine if the variances are the same across all groups. A significance (Sig.) level greater than 0.05 suggests that the variances are equal, leading us to conclude that the data distribution is homogeneous. Here, the Levene's test has been employed to

examine the homogeneity of variances between the pre-test and post-test blood glucose levels in the soccer players. The test yields a p-value (Sig.) of 0.940 when based on mean, 0.943 when based on median, 0.943 when based on median with adjusted degrees of freedom, and 0.936 when based on a trimmed mean. As all these values are greater than 0.05, we can conclude that there is no significant evidence to reject the null hypothesis, which states that the variances are equal across the groups. Hence, the distribution of the data is confirmed to be homogeneous. Homogeneity of variances is an essential assumption for parametric statistical tests, as it indicates that all groups have the same variance, ensuring a more reliable result.

Table 4. Paired Sample T Test Results

Paired Samples Test									
		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Pre-Test – Post Test	10.154	14.022	2.750	4.490	15.817	3.692	25	.001

The results from the paired samples t-test show a significant decrease in blood glucose levels in football players after receiving sports massage. The mean difference between pre-test and post-test glucose levels is 10.154, with a standard deviation of 14.022. The significance level of $0.001 < 0.05$ suggests a significant reduction in glucose levels post-massage. Furthermore, the study by Malinga (2018) substantiates this finding, suggesting that sports massage improves blood flow, relaxes muscles, and stimulates the body's work system, thereby reducing body tension and restoring organ and muscle function to normal. The efficacy of sports massage in reducing lactic acid levels is also supported by another study, showing a decrease of 62% in lactic acid levels post-massage. A study conducted on FIK UNJ students found significant reductions in blood sugar levels after 30 minutes of ergocycle activity compared to treadmill activity. Pre massage and post massage blood glucose levels in soccer players from Karawang United FC further confirmed these findings. Average levels decreased from 128.15 pre-massage to 118.00 post-massage. The normality tests showed data distribution to be normal, and the homogeneity test indicated the data was homogeneous. Sports massage has a significant impact on lowering blood glucose levels in the bodies of football players (Hidayatullah et al., 2016).

The study explores the physiological effects of sports massage on athletes, specifically how it helps regulate blood glucose levels. Post-match muscle tension and fatigue are common issues faced by football players, which can also lead to an increase in glucose levels due to metabolic changes in the body caused by intense physical activity. The massage acts on the muscular system to enhance blood circulation and nutrient delivery, contributing to a decrease in glucose levels. Moreover, the findings underscore the importance of incorporating sports massage into training regimes for football players to promote better physical health and performance. With regular massage therapy, it assists in the management of blood glucose levels, which is beneficial for energy regulation and overall athletic performance. The research conducted provides significant insights into the necessity and effectiveness of sport massages for football athletes, offering a holistic approach for improving athletic performance and maintaining optimal health. Therefore, more comprehensive training programs that include sports massage should be promoted and adopted within the sports community to enhance player performance and well-being(Anderson et al., 2023; Colón-López & García, 2023; Harvey et al., 2023; Hossain et al., 2023; Marques et al., 2023; Proppe et al., 2023).

The novelty of this research lies in its focus on the connection between sports massage and glucose levels in football players. While previous studies have widely documented the benefits of sports massage on athletic performance, and reduction of muscular tension and fatigue, this study uniquely explores the metabolic impact of the massage, specifically its effect on glucose levels. The results of this study provide a novel perspective, demonstrating that sports massage could have a significant impact on glucose regulation, a crucial component of energy balance in the body, which is significantly crucial for endurance and performance during matches. Therefore, this study adds new insights to existing knowledge, suggesting that sports massage may be an effective strategy not only for muscle recovery,

post-match fatigue, and injury prevention but also for metabolic function related to glucose levels in football athletes(Ban et al., 2023; Boat et al., 2022; Li et al., 2023; Skoradal et al., 2023; Strock et al., 2023; Tian et al., 2023).

CONCLUSION

In conclusion, our study accomplished its stated objective of investigating the effects of sports massage on glucose levels in football players. The findings suggest that sports massage does significantly reduce blood glucose levels post-massage, highlighting its crucial role in metabolic function, energy regulation, and ultimately, athletic performance. This highlights the importance of incorporating sports massage into training regimes and healthcare approaches for athletes. The research therefore brought a novel perspective to the discourse on sports massage, emphasizing not just its physiological benefits relating to muscle relaxation, but also its influence on the metabolic aspects of an athlete's physiology. Future research should continue to explore this area, looking at the long-term effects of sports massage on the performance and wellbeing of athletes across different sports and at all levels. For future studies, it would be beneficial to expand the sample size to include athletes from different sports, ages, and skill levels for a more comprehensive understanding of the effects of sports massage on glucose metabolism. Comparisons could also be made between pre-match and post-match massage routines to optimize the benefits of this intervention. Additionally, analyzing the long-term effects of sports massage on glucose levels would present value because it would provide insights into how habitual sports massage influences metabolic regulation, overall health, and athletic performance over time. Furthermore, integrating physiological parameters such as heart rate, blood pressure, and lactate levels could provide additional insights into the interconnected benefits of sports massage.

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