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Set of nutritional recommendations to develop dietary strategies in athletes

Conjunto de recomendaciones nutricionales para desarrollar estrategias dietéticas en atletas

Conjunto de recomendações nutricionais para desenvolver estratégias alimentares em atletas

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ABSTRACT

This study is based on a nutritional characterization of athletes, attended from an academic and scientific point of view by the Luis Vargas Torres Technical University, of Ecuador. It draws the attention of coaches and teachers of this sports pedagogical center that, despite having the appropriate basic conditions for the practice of sports, unfavorable sports results are shown. Among the data collected in the exploratory study (survey of coaches and interviews with managers and teachers), the insufficient nutritional dietary regimen received by athletes was highlighted. The objective was to propose a set of nutritional recommendations that allow perfecting the dietary strategies that athletes need to remain in



an optimal state in their sports practice and health. The diagnosis was based on measurement and statistical analysis such as the correlation of intensity (Sprints) and carbohydrate intake and the correlation of intensity and protein intake. After analyzing the results, a group of dietary recommendations focused on improving the sports training situation are designed and established. It is suggested that future research delve into this area, to validate and improve the proposed analytical framework.

Keywords: nutritional recommendations, dietary strategy for athletes, university sports

RESUMEN

Este estudio partió de una caracterización nutricional en atletas, atendidos desde el punto de vista académico y científico por la Universidad Técnica "Luis Vargas Torres", de Ecuador. Llamó la atención a entrenadores y profesores de este centro pedagógico deportivo que, a pesar de contar con las condiciones básicas adecuadas para la práctica del deporte, se mostraron resultados deportivos desfavorables. Entre los datos recogidos en el estudio exploratorio (encuesta a entrenadores y entrevista a directivos y profesores) se destacó el insuficiente régimen dietético nutricional recibido por los deportistas. Se planteó como objetivo proponer un conjunto de recomendaciones nutricionales que permita perfeccionar las estrategias dietéticas que necesitan los atletas para mantenerse en un estado óptimo en su práctica deportiva y su salud. El diagnóstico, se sustentó en la medición y análisis estadísticos como la correlación de intensidad (Sprints) e ingesta de carbohidratos y la correlación intensidad e ingesta de proteínas. Después de analizar los resultados, se diseñaron y establecieron un grupo de recomendaciones dietéticas enfocadas en mejorar la situación formativa deportiva. Se sugiere que futuras investigaciones profundicen en esta área, para validar y mejorar el marco analítico propuesto.

Palabras clave: recomendaciones nutricionales, estrategia dietética para atletas, deporte universitario



RESUMO

Este estudo partiu de uma caracterização nutricional em atletas, atendida do ponto de vista acadêmico e científico pela Universidade Técnica "Luis Vargas Torres", do Equador. Chamou a atenção dos treinadores e professores deste centro pedagógico desportivo que, apesar de apresentarem as condições básicas adequadas à prática desportiva, apresentavam resultados desportivos desfavoráveis. Dentre os dados coletados no estudo exploratório (pesquisa com treinadores e entrevistas com dirigentes e professores), destacou-se o insuficiente regime alimentar nutricional recebido pelos atletas. O objetivo foi propor um conjunto de recomendações nutricionais que permitissem aperfeiçoar as estratégias alimentares que os atletas necessitam para se manterem num estado ótimo na sua prática desportiva e saúde. O diagnóstico foi baseado em medições e análises estatísticas como a correlação de intensidade (Sprints) e ingestão de carboidratos e a correlação de intensidade e ingestão de proteínas. Após a análise dos resultados, foi desenhado e estabelecido um conjunto de recomendações dietéticas focadas na melhoria da situação do treino desportivo. Sugere-se que pesquisas futuras se aprofundem nesta área, para validar e aprimorar o arcabouço analítico proposto.

Palavras-chave: recomendações nutricionais, estratégia alimentar para atletas, esportes universitários

INTRODUCTION

In recent years it has been proven that the health of athletes worldwide has been affected by various problems, some research points to adversities associated with doping (Cabrera and Castillo, 2022), others link it to genetic manipulations (Córdova et al., 2020). Osteoporosis is also a health problem that attacks athletes, especially if it is because their body is predetermined to suffer from this disease and there is a lack of effective detraining or an unequal distribution of loads in training sessions (Sabata, 2021). On the other hand, there are many researchers who address the issue of nutrition as a significant and crucial



component for health and good sports performance. (Carrasco, 2020; Fuente et al., 2024; Iturriaga, 2020; Monteiro et al., 2020).

There is a direct relationship between the sports results of the athlete and the nutritional diet that he receives in his training and development as an individual in the social and sports environment. This relationship is a reality that is reflected in the behavioral manifestations that are perceived during the active stage on the sport; however, demonstrating the effects of this relationship scientifically to improve methodological work in training is a challenge, especially in the statistical environment. The research presented is focused on this weakness.

Statistical analysis and sports nutrition in sports have become a critical area in the search for optimal performance and comprehensive health of athletes. (Morales et al., 2017; Ramírez et al., 2024). Applied statistics provides an invaluable tool for uncovering the complex patterns and trends associated with nutrition in dynamic sports such as handball, soccer, basketball or baseball; this serves as a reference and even as an analysis of directly related indicators (Castro et al., 2020).

The importance of this approach lies in the ability to use quantitative data to better understand the specific physical demands of each sport, identify efficient nutritional patterns, and personalize nutritional strategies that maximize sports performance (Chen et al., 2023; Haubenstricker et al., 2023; Mihajlovic et al., 2023). The application of statistical analysis not only allows a deeper understanding of individual nutritional needs, but also predicts trends over time to adjust for fluctuations in performance and injuries or changes to the training program (Fernández, 2020; Ponce et al., 2021).

Some research has been developed that uses statistical analyzes to examine the nutritional levels of the athlete or the practitioner of physical activity, some of them dedicated to dietary intake (Redondo del Río., et al 2016); to sports nutritional supplements (López and Sánchez, 2018); to the ability to pay attention based on maintaining an adequate weight and diet quality (Carrillo, 2022) and to the control of physical activity to treat diabetes Mellitus (Vega and Mejía, 2023).



The studies presented provide a solid basis for the integration of statistical data, with detailed information on sports nutrition; however, research is needed in more specific and distinctive environments to validate and expand the practical applicability of these approaches in different physical-sports contexts, which is why the objective of this work focuses on proposing a set of nutritional recommendations that allow perfecting the dietary strategies that athletes need to stay in an optimal state, in relation to their sports practice and their health.

MATERIALS AND METHODS

For the selection of the sample, 150 university students, athletes from the Luis Vargas Torres Technical University, in Ecuador, were included. These young people participated in ball games, preferably in a competitive setting. Inclusion criteria such as age, sex, level of experience and physical health of the participants were applied to guarantee the representativeness and validity of the results.

A multidisciplinary approach was used that combined sports metrics and detailed nutritional data. Using this measurement technique belonging to the empirical method, data on sports performance was collected, such as distances traveled, game intensity, active time, and caloric intake, the proportions of macronutrients/micronutrients and the hydration of each athlete.

Descriptive statistics were used to analyze the variables and establish correlations between them, using Pearson's correlation and Jamovi statistical software. The Pearson correlation is a statistical measure that evaluates the strength and direction of the linear relationship between two continuous variables, this produces a correlation coefficient that varies between -1 and 1, where:

- A coefficient of +1 indicates a perfect positive correlation, meaning that the variables move in the same direction.
- A coefficient of -1 indicates a perfect negative correlation, meaning the variables move in opposite directions.



- A coefficient of 0 indicates that there is no linear correlation between the variables.

The proposed analytical framework was based on the collection and analysis of detailed statistical data on sports performance, as well as nutritional information specific to each athlete.

RESULTS

Practical example in soccer: integration of statistical and nutritional data

To illustrate the proposed approach, a soccer player is considered, whose statistical and nutritional data are exhaustively analyzed. The focus is on key variables including duration of play, specific position on the field, total distance covered, intensity of play (measured in short, fast sprints) and nutrient intake in terms of carbohydrates and proteins.

Tabla 1 Resultados estadísticos del jugador A

Jugador	Duración del Juego (min)	Posición	Distancia Recorrida (km)	Intensidad (Sprints)	Ingesta de Carbohidratos (g)	Ingesta de Proteínas (g)
Jugador A	60	Lateral	6.5	25	1200	90

In table 1, player A is a winger who plays for 60 minutes. The descriptive statistical analysis focuses on evaluating the relationship between the intensity of the game and nutritional intake, specifically, carbohydrates and proteins. During the analysis, it is observed that, despite the high intensity of the game with 25 short and fast sprints, carbohydrate intake is below what is recommended to maintain optimal performance. This indicates the need to adjust the nutritional strategy to ensure adequate energy replenishment during moments of high intensity.

Table 2. Statistical results of player B and C



Tabla 2 Resultados estadísticos de los jugadores B y C

Jugador	Duración del Juego (min)	Posición	Distancia Recorrida (km)	Intensidad (Sprints)	Ingesta de Carbohidratos (g)	Ingesta de Proteínas (g)
Jugador B	65	central	7.2	30	1400	95
Jugador C	55	extremo	5.8	20	1100	85

In Table 2, Player B (middle) has a slightly longer game duration (65 minutes) compared to the average player (62.5 minutes). It also covers a greater distance of 7.2 km, indicating outstanding physical performance in terms of mobility in the field. The intensity measured in sprints is higher (30), which suggests that the player performs a significant amount of explosive actions during the game. Carbohydrate and protein intake are slightly higher than average, consistent with more intense physical demands. In general, this player shows outstanding physical performance with a longer duration of the game, greater distance traveled and significant intensity. His nutritional intake reflects these demands.

Player C (extreme) has a slightly shorter game duration (55 minutes) compared to the average player and although the distance traveled is slightly less (5.8 km), it is a significant figure and relates to the specific functions of his position on the field. The intensity in terms of sprints (20) is below average, which reveals that he performs fewer explosive actions.

Carbohydrate and protein intake are lower than average, which is due to the slightly shorter duration of the game and the lower sprint intensity. This player, as an extreme, has a slightly shorter duration of play and a lower intensity in terms of sprints. His nutritional intake adjusts to these demands and is slightly lower than average. Descriptive statistical analysis expresses significant correlations between carbohydrate intake and distance traveled or frequency of sprints, providing valuable information for adjusting your diet. This continuous analysis process contributes to the personalization of nutritional strategies and significantly improves performance and health throughout the season.



Table 3. Correlation of Intensity (Sprints) and Carbohydrate Intake

Tabla 3. Correlación de Intensidad (Sprints) e Ingesta de Carbohidratos

		Intensidad (Sprints)	Ingesta de carbohidratos (g)
Intensidad (Sprints)	R de Pearson		
	valor p		
Ingesta de Carbohidratos (g)	R de Pearson	0.982	
	valor p	0.121	

The table shows the Pearson correlation coefficients (Pearson's R) and the p values (level of significance) for the relationship between sprint intensity and carbohydrate intake, and we obtain:

- The Pearson correlation coefficient (R) is 0.982.
- The p value associated with this correlation is 0.121.

The Pearson correlation coefficient indicates a very strong and positive correlation between sprinting intensity and carbohydrate intake, suggesting that as sprinting intensity increases, carbohydrate intake increases. However, the p value (0.121) is greater than the typical significance level of 0.05, indicating that this correlation is not statistically significant and means that although the relationship between sprinting intensity and carbohydrate intake is strong In the sample analyzed, it is possible that this association is due to chance and does not reflect a true relationship in the population.

Table 4. Correlation Intensity and Protein Intake

Tabla 4. Correlación Intensidad e Ingesta de proteínas

		Intensidad (Sprints)	Ingesta de carbohidratos (g)
Intensidad (Sprints)	R de Pearson		
	valor p		
Ingesta de Carbohidratos (g)	R de Pearson	NaN	
	valor p	1.000	



The correlation table provided presents the Pearson correlation coefficients (Pearson's R) and p values (significance level) for the relationship between sprinting intensity and protein intake and shows:

The Pearson correlation coefficient (R) between sprint intensity and protein intake is NaN (not a number), indicating that there is no apparent correlation between these two variables.

The p value associated with this correlation is 1.000. The absence of a numerical value for the Pearson correlation coefficient (NaN) suggests that there is no linear relationship between sprinting intensity and protein intake.

The p value of 1,000 reflects that there is no statistical significance in the relationship between these two variables and represents that any apparent association between sprinting intensity and protein intake may be the result of chance and does not reflect a true relationship in the population.

Based on the results achieved, through the application of these statistical coefficients, a set of dietary recommendations are proposed to improve the health and physical condition of athletes, among these recommendations are the following:

1. Consume carbohydrates during exercise to maintain normal blood sugar levels and avoid physiological fatigue; it must be ensured that the diet contains an adequate amount of iron to improve muscles and receive the oxygenation they need.
2. It is necessary for athletes to take care of the contribution of proteins in their daily diet, in order to conserve nitrogen reserves and avoid muscle wasting.
3. The nutrient needs of different foods must be covered according to the information they receive about nutrition.
4. Hydrate as abundantly and frequently as possible.
5. Unlike usual nutritional planning, the estimation of the amount of hydrocarbons (HC) in an athlete's diet should not be estimated according to the total calories in the diet, but, ideally, should be estimated in relation to the body weight; thus, based on the hours of daily training, the recommended grams of HC are (7):



- 1 hour/day = 6-7 gr. of HC/kg of weight
- 2 hours/day = 8 gr. of HC/kg of weight
- 3 hours/day = 9 gr. of HC/kg of weight
- 4 hours/day = 10 gr. of HC/kg of weight (Hernández and Soria, 2019).

DISCUSSION

This study is linked to recent research that emphasizes the importance of personalized dietary strategies for athletes, in order to optimize performance and health, such as those of Pascual et al. (2023) and Rosario et al. (2023) who highlight the value of integrating statistical data with nutritional information to adapt dietary plans.

The findings obtained demonstrate significant correlations between nutrient intake and athletic performance metrics. This work supports the idea that athletes must pay careful attention to their dietary habits to support optimal performance. Coaches and nutritionists can use the results to develop tailored nutrition plans that address each athlete's individual needs to improve performance and recovery.

In comparison with other works related to statistical analyzes to visualize the nutritional problems of athletes or practitioners of physical activity, it has been proven that there are some differences and coincidences that make this work a contribution that enriches the development of science in this area of knowledge, especially if it is based on the articles consulted (Carrillo, 2022; López and Sánchez, 2018; Redondo del Río., et al 2016; Vega and Mejía, 2023)

The study presented is considered to contribute to the understanding of the evolution of the complex relationship between nutrition and athletic performance. By integrating statistical analysis with nutritional data, a methodological framework is provided for future research in sports nutrition, with an interdisciplinary approach that relates the complex interactions between dietary factors and athletic outcomes.

In this way, the importance of personalized nutrition in optimizing athletic performance and the need for further research that addresses the limitations and validation of these



findings is highlighted; however, the results contribute to the growing body of evidence supporting individualized dietary strategies for athletes.

CONCLUSIONS

The study highlighted the need for personalized dietary strategies for athletes, based on the result of significant correlations between nutrient intake and athletic performance. This underlined the importance of addressing the individual needs of each athlete in terms of their diet to optimize their performance and overall well-being.

Through the integration of statistical data with detailed nutritional information, a methodological framework was offered for future research in sports nutrition. By providing empirical evidence on the relationship between nutrition and athletic performance, it is contributed to the advancement of understanding of this interdisciplinary area and its practical application in the field of sports.

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The author declares that there are no conflicts of interest.

Author's contribution:

The author is responsible for writing the work and analyzing the documents.



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