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ANÁLISIS DE LA INGESTA ENERGÉTICA Y NUTRICIONAL DE JUGADORES DE DIFERENTES POSICIONES EN UN EQUIPO DE FUTBOL

ENERGY AND NUTRITIONAL INTAKES IN TRAINING DAYS OF SOCCER PLAYERS ACCORDING TO THEIR PLAYING POSITIONS

Cristina Conejos[1,2]

Antonio Giner[2]

Jordi Mañes[1]

José M. Soriano[1]

[1]Laboratory of Nutrition. Faculty of Pharmacy. University of Valencia. Av. Vicent Andrés Estellés s/n, 46100 Burjassot, Spain.
[2]Medical Team. Valencia C.F. Carretera Valencia-Ademuz KM 9. 46182 Paterna, Spain

RESUMEN

En este artículo se estudia la ingesta de energía y nutrientes de futbolistas profesionales durante los días de entrenamiento, de acuerdo a su posición de juego, siendo 22 jugadores cuyas edades se encuentran en un rango entre los 19 y los 24 años completaron un diario de 7 días. Para el Índice de Masa Corporal (IMC), los valores más altos y más bajos (22.7 y 24.2 kg m-2) se obtuvieron con los delanteros y los medio-centros, respectivamente, pero no hay diferencias significativas en cuanto la edad y el IMC entre los futbolistas estudiados de acuerdo a su posición de juego. Existen diferencias significativas ($p<0.005$) entre los medio-centros y delanteros, y entre los delanteros y los defensas en cuanto al peso de los deportistas estudiados. Además, hay diferencias significativas ($p<0.005$) con respecto a la altura entre ellos. La media del consumo energético ES de 12.7, 14.0, 14.8 y 12.2 MJ día-1 para delanteros, medio-centros, defensas y porteros, respectivamente. Los futbolistas estudiados consumían una dieta alta en proteínas y grasas, pero bajas en carbohidratos en comparación con los valores de referencia reflejados en varias revisiones de algunos grupos como son la Asociación Dietética Americana/Dietistas Canadienses/Colegio Americano de Medicina del Deporte, Villegas y Zamora y los valores sugeridos y consensuados en la Conferencia de la FIFA/Centro de Investigación y Evaluación Médica. Seis (folato, vitamina A y K, zinc, selenio y yodo) de los 22 micronutrientes consumidos se encontraban en cantidades inadecuadas. Además, la relación calcio/fósforo para todos los jugadores es más baja que las recomendadas para la población española. Los clubs de futbol deben de tener en cuenta el consumo energético y nutricional de sus futbolistas de acuerdo a sus posiciones de juego puesto que podrían ayudar a incrementar el rendimiento, además de reducir la fatiga.

Palabras clave: Ingesta nutricional. Fútbol. Posición de juego. Dietista deportivo.

SUMMARY

The paper provides a study of energy and nutritional intakes of elite soccer players during training days, according to playing position. Twenty-two players aged 19 to 24 years completed a 7-days method. For body mass index (BMI), the highest and lowest value (22.7 and 24.2 kg m-2) was for forwards and midfielders, respectively, but no significant differences in age and BMI were detected among soccer players according to their playing positions. Significant differences ($p<0.005$) were found between midfielders and forwards, and forwards and defenders in the weight of the studied soccer players. Furthermore, significant differences ($p<0.005$) were found for height among them. Mean energy intake was 12.7, 14.0, 14.8 and 12.2 MJ day-1 for forwards, midfielders, defenders and goalkeepers, respectively. The studied players consumed a diet with too much proteins and fat and low in carbohydrates in comparison with reference values reported by several groups as are the American Dietetic Association/Dietitians of Canada/American College of Sports Medicine, the review of Villegas and Zamora and the values suggested in the FIFA's Medical Assessment and Research Centre (F-MARC) Consensus Conference. Six (folate, vitamin A and K, zinc, selenium and iodine) out of twenty-two micronutrients were ingested in inadequate amounts. Furthermore, the calcium/phosphorus ratio for all players is lower than the Spanish recommended value. More attention on the part of soccer club should be focused on the energy and nutrient intake for the soccer players according to their playing position due to that could help to increase the physical and athletic performance and reduce the fatigue.

Key words: Nutritional intake. Soccer. Playing position. Sport dietitian.

CORRESPONDENCIA:
José M. Soriano
Av. Vicent Andrés Estellés s/n, 46100 Burjassot, Spain
E-mail: jose.soriano@uv.es

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INTRODUCTION

Soccer is one of the most popular team sports worldwide and is characterized by high-intensity intermittent activity and places heavy demands on the aerobic pathways[1] as changes in speed and direction are required approximately once every 5 seconds throughout a game. An average professional soccer player covers about 8000-12000 m during a 90-min match[2]. The nutritional and workload needs can not be the same for defenders, forwards, midfielders and goalkeepers. Midfielders run the longest distances (up to 11-11.5 km) compared to forwards or defenders[3-5], whereas goalkeepers run around 4 km[6]. This last playing position must be able to jump from one pole of the net to the other. In the last years, several studies[4,7,8] reflected the importance of working differentially with soccer players according to their playing position. According to the FIFA/F-MARC Consensus Conference[9], soccer is a team sport but the variability in players' role dictates that monitoring to determine individual requirements should be an essential part of a player's nutrition strategy. Nutritional intake should be different on training days or on match day due to the differences in energy expenditure. Rico-Sanz[10] suggests that for this value should be about 16.7 and 15.9 MJ day-1 on training and match days, respectively, for male soccer players.

The aim of this study was to characterize the energy and nutrient intakes of the soccer player according to their playing positions due to that a good diet next to well-trained soccer players can enhance physical and athletic performance.

MATERIALS AND METHODS

Subjects

Twenty-two boy's soccer players participated in this study which was carried out at a training camp. Participants were aged 19 to 24 years (22.0±1.3) and all were members of the Valencia Football Club. They were grouped according to their playing positions as are forwards or attackers (n=7), defenders or fullbacks (n=6), midfielders (n=6) and goalkeepers (n=3). According to the study design approved by the Committee on Ethical Research of the University of Valencia (Spain), a written consent was obtained from each of the participating soccer players.

Anthropometry

All the anthropometric measurements were taken three times by the same dietitian according to the Anthropometric Standardization Reference Manual[11]. Body mass index (BMI) was calculated as body weight (in kilograms) without shoes and with light clothing, divided by height (in meters) squared. Body weight was measured with a Plenna scale (model MEA 07400, USA; accuracy of 100 g). Height was measured with Seca stadiometer (model 208, Germany; accuracy of 0.5 cm).

Nutrient analysis

The soccer players completed a 7-days method, helped by the dietitian of the Club. Quantities were estimated using a photographic collection of food portions, household measures and standard weights. Furthermore, data about all foods and beverages consumed since the previous day, including methods of food preparation, description of ingredients and condiments consumed were compiled. The daily average quantities are converted into energy and nutrients through the DIAL program, version 1.02 for Windows XP (Alceingenieria, Madrid, Spain). Dietary intakes of nutrients were compared with reference values reported by several groups as are the American Dietetic Association/Dietitians of Canada/American College of Sports Medicine[12], the review of Villegas and Zamora[13], and the values suggested in the FIFA/F-MARC Consensus Conference[9].

Statistical analysis

Statistical analysis, for their different playing positions, was carried out with two-tailed paired t test (P-value). Data were analyzed using the Statistics Package for the Social Sciences (SPSS Version 12.0).

RESULTS

The highest and lowest value (22.7 and 24.2 kg m^{-2}) of BMI was for forwards and midfielders, respectively. No significant differences in age and BMI were detected among soccer players according to their playing positions. Significant differences ($p<0.005$) were found between midfielders and forwards, and forwards and defenders in the weight of the studied soccer players. Furthermore, significant differences ($p<0.005$) were found for height among them.

Energy and nutrient intakes are shown in Tables 1 and 2. Mean energy intake was 12.7, 14.0, 14.8 and 12.2 MJ day^{-1} for forwards, midfielders, defenders and goalkeepers, respectively. Furthermore, these values are shown with body mass (kJ kg^{-1}) due to that the body mass of the studied soccer's differed in degree of physical development. The contribution of each macronutrient to the total caloric intake was not significantly different among the four playing positions (Table 1). The highest value of the total caloric intake for protein, fat and carbohydrates were among for forwards, midfielders and defenders, respectively. Significant differences were found forwards and defenders in mean dietary fibre ($p<0.005$). No significant differences in profile of fat intake were detected among playing positions of studied soccer players (Table 1). The PUFA/SFA ratio is higher than 0.5 for forwards, defenders and goalkeepers. However, the (PUFA+MUFA)/SFA values are <2 for all studied soccer players. The daily cholesterol intake values are too high for all studied players, except for goalkeepers (223 mg day^{-1}).

TABLE 1.
Mean values and standard deviations of the energy, macronutrients, fibre and of profile of fat intake of the studied young soccer players

	Forwards	Midfielders	Defenders	Goalkeepers
Energy				
Per day (MJ day^{-1})	12.7±2.9	14.0±6.2	14.8±2.6	12.2±4.6
kJ/kg body weight	193.6±26.5	200.3±32.1	213.1±15.8	80.2±31.5
Protein				
Per day (g)	138.7±27.5	144.8±56.9	144.5±19.9	142.8±100.1
Energy ratio (%)	18.4	17.8	16.9	17.9
Fat (g)				
Per day (g)	120.3±59.6	131.6±62.6	124.5±36.1	109.8±45.3
Energy ratio (%)	34.7	35.6	32.2	34.9
Carbohydrate				
Per day (g)	342.5±92.9	382.1±187.2	419.1±98.3	320.3±11.9
Energy ratio (%)	45.7	44.8	48.4	44.2
Dietary fibre (g)	16.3±6.0[a]	24.7±17.5	27.2±3.4[a]	21.8±13.1
MUFA (g)				
Per day (g day^{-1})	36.0±24.9	53.0±24.9	50.3±18.5	42.7±14.9
Energy ratio (%)	10.7	14.4	13.1	13.7
PUFA (g)				
Per day (g day^{-1})	28.6±21.4	19.5±6.4	22.6±6.0	23.0±16.5
Energy ratio (%)	8.1	5.5	5.9	6.9
SFA (g)				
Per day (g day^{-1})	41.2±19.4	47.9±28.2	40.4±16.9	33.2±12.0
Energy ratio (%)	11.9	12.7	10.5	10.8
PUFA/SFA	0.7	0.4	0.6	0.6
(PUFA+MUFA)/SFA	1.6	1.6	1.9	1.9
Cholesterol (mg)	363.0 ±183.1	383.9±209.6	450.5±248.9	223.0±131.6

[a]p<0.005 for differences between forwards and defenders

Table 2 reflects the values of vitamin intakes, being similar for all playing position. However, the intake of folate and vitamin C were significantly higher in defenders than in forwards ($p<0.005$). Furthermore, significant differences in this last vitamin were found between midfielders and defenders ($p<0.005$). The mineral intake is demonstrated in the Table 2 and only potassium was found significant differences between forwards and defenders ($p<0.005$). None of the soccer player reported the use of vitamin/mineral supplements during the study. In the soccer club, the assessment of biochemical and hematological parameters is a common practice being the prescriptions of the vitamin and/or mineral supplements carried out by the medical team to prevent or correct deficiencies.

DISCUSSION

The highest value of BMI is found in the midfielders. According to the Laviano and Shenkin[14] this playing position is important due to that they should be heavier than the other players due to that need to be skilled and talented but not necessarily in adequate physical condition. In contrast, forwards are athletes that have to run much more than midfielders to create opportunities in soccer game, being important an adequately BMI as in this study, but we reflected a deficiently values in some nutrient intakes being a possibly performance-limiting factor.

In our study, the lowest and highest values of energy intake are obtained by the goalkeepers and defenders (Table 1), respectively, while

TABLE 2.
Mean values and standard deviations of vitamin and mineral intakes of the studied young soccer players according to their playing positions

	Forwards	Midfielders	Defenders	Goalkeepers
Thiamin (mg)	2.1±0.4	3.1±1.4	2.4±0.8	2.9±1.9
Riboflavin (mg)	2.7±0.9	2.8±0.8	2.9±0.9	2.8±2.0
Niacin (mg)	51.3±10.3	53.3±21.1	58.2±12.8	51.3±43.8
Panthotenic ac. (mg)	7.3±2.2	7.0±3.9	7.3±1.7	8.5±8.0
Vitamin B6 (mg)	2.9±0.5	3.4±1.8	3.6±0.9	3.8±2.4
Biotin (μg)	54.6±35.4	32.3±25.5	39.1±19.4	71.7±56.8
Folate (μg)	250.0±65.7[a]	345.7±213.3	390.7±27.9[a]	448.7±276.5
Vitamin B12 (μg)	4.1±2.4	7.2±4.1	7.6±3.1	6.1±3.3
Vitamin C (mg)	63.8±30.1a	85.1±59.9[b]	162.2±44.0[a,b]	185.5±121.6
Vitamin A (μg)	517.5±126.2	1245.3±669.7	1488.6±827.2	1864.7±900.5
Vitamin D (μg)	5.6±4.9	15.5±12.7	14.9±6.1	15.4±10.2
Vitamin E (mg)	24.6±11.6	19.2±5.8	20.4±6.5	30.4±24.7
Vitamin K (μg)	50.6±31.5	182.0±142.8	144.4±59.4	163.7±119.3
Sodium (mg)	3492.0±1556.2	4745.8±1872.5	3556.5±1295.7	4085.7±2498.3
Potassium (mg)	3352.0±368.7[a]	4501.0±2023.7	4582.0±425.5[a]	4970.7±2467.9
Calcium (mg)	1361.5±549.0	1592.3±996.1	1208.4±457.1	1499.7±1035.9
Magnesium (mg)	477.5±183.4	429.6±242.7	437.5±72.7	484.0±301.2
Phosphorus (mg)	1822.2±395.8	2497.3±1040.2	2304.6±371.9	2482.7±1993.9
Iron (mg)	13.4±3.7	18.9±9.7	22.6±6.8	15.5±10.2
Zinc (mg)	11.1±3.1	15.6±5.9	14.5±3.8	13.5±10.9
Selenium (μg)	51.3±16.4	99.6±77.6	118.3±58.8	126.2±115.3
Iodine (μg)	109.9±54.6	113.7±73.8	106.1±27.1	100.5±98.1

[a]p<0.005for differences between forwards and defenders; [b]p<0.005 for differences between midfielders and defenders

Inocencio da Silva Gomes, *et al*.[8] reflected these values in defenders and midfielders, respectively. Ruiz, *et al.*[15] found a value of energy intake per kilogram of body mass for young soccer (228.4 kJ kg^{-1}) higher than old player (171.5 kJ kg^{-1}). Rico-Sanz[10] suggest that energy expenditure for males soccer players should be about 16.7 and 15.9 MJ day^{-1} on training days and on match day, respectively, in contrast Maughan and Burke[16] ranged this value from 8.5 and 17 MJ in soccer players during training periods needs. Our results (Table 1) on training days show that is less than the Rico-Sanz's value but is situated in the range of Maughan and Burke[16]. Recently, the FIFA/F-MARC Consensus Conference[9] indicated that the typical energy costs of training or match-play in elite men players are about 6 MJ.

Lemon[17] suggests protein intake should be around 1.4-1.7 g kg^{-1} day^{-1} and, recently, the study of Boisseau, *et al.*[18] reflected an estimated average requirement of 1.2 g kg^{-1} day^{-1} and a recommended daily allowance of 1.4 g kg^{-1} day^{-1} of soccer players aged 14 years being these values below that our studied protein intake (Table 1). Several authors[15,19-21] obtained, for protein, a 15, 15.2, 14.4 and 16%, respectively, of daily energy intake for soccer players. Clark[22] clarified that the training diet should be comprised of 12-15% of daily energy intake but in match-play, the oxidation of proteins contributes less than 10% of the total energy production, according to Bangsbo[23], Lemon[17] and Escanero, *et al.*[24].

Literature[15,25-27] reflects that diets of soccer players with low carbohydrate content have made a great impact on performance during a competition since players with depleted muscle glycogen stored have lower average speed and cover less distance during the second half of the match. Schokman, *et al.*[28] suggest that carbohydrate recommendations for soccer players are more appropriately expressed as g kg^{-1} rather than a percentage of total energy intake. According to the FIFA/F-MARC Consensus Conference[9] and the American Dietetic Association/Dietitians of Canada/American College of Sports Medicine[12], the soccer players require 5-7 g of carbohydrate per kilogram of body mass during periods of moderate training, rising to about 10 g kg^{-1} during intense training or match play. Our study is carried out in intense training being the intake of carbohydrates lower than the suggestion of FIFA/F-MARC Consensus Conference[9]. According to our values (Table 1), several studies[15,29] reflected a deficiency in dietary fibre intake, except in the study of Iglesias-Gutierrez, *et al.*[20] which obtained a higher fibre intake (24 g day^{-1}).

Villegas and Zamora (1991)[13] suggested for total fat, ≤30% of daily energy intake including ≤10% of saturated fatty acids (SFA), 20% of monounsaturated fatty acids (MUFA) and 5% of polyunsaturated fatty acids (PUFA). Fat in our study (Table 1) shows higher than this value, being one of the most important negative factors related to performance[7]. Iglesias-Gutierrez, *et al.*[20] obtained 38% of total energy intake for fat, but a lower value of SFA (9%) in comparison with our date (Table 1). Clark[22] suggested consuming less than 30% of total fat for soccer players for training diet. In our study, all soccer players consumed an excess of fat being the highest value obtained in midfielders in contrast with defenders (Table 1). Our suggestion is recommended the PUFA/SFA ratio higher than 0.5 and the (PUFA+MUFA)/SFA ratio should be >2. In our study (Table 1), this idea of PUFA/SFA is reflected in forwards, defenders and goalkeepers. According to current Spanish guidelines[30], the fat quality of the diet, judging from the (PUFA+MUFA)/SFA ratio, was satisfactory (recommended:> 2). Because fat quality was acceptable, the diet of this soccer players could be improved by only a small reduction in fat intake and enhancing the carbohydrate rich food. For the cholesterol, forwards, midfielders and defenders (Table 1) exceed the value of 300 mg/day.

In our micronutrient intake assessment (Table 2), most of the analyzed nutrients were ingested in adequate amounts, which are sixteen out of twenty-two micronutrients examined. The lowest intake of vitamin A and K are established in forwards (Table 2). Vitamin A is an antioxidant nutrient important in protecting the cell membranes from oxidative damage. Furthermore, the folate intake (Table 2) is below in for forwards, midfielders and defenders. According to our

study, Garrido, *et al.*[29] obtained folate intake for elite Spanish adolescent soccer players below in the study of de Sousa, *et al.*[31] reflected inadequately intake of folate, for adolescents from sports federations including soccer, because the intake of vegetables was low in this population group.

The intake of calcium is adequate for all studied players but the calcium/phosphorus ratio (Table 2) obtained is lower than the recommended by Villegas and Zamora[13] which is Ca/P = 2/1, due to the increased intake of beverages like colas and other soft drinks, especially those that use phosphoric acid as acidifier, among the studied soccer players. In our study, they have iodine intakes (Table 2) below than 150 μg day-1 in all players and forwards, defenders and goalkeepers have zinc intakes (Table 2) below than 15 mg day$^{-1(13)}$. The zinc plays in growth, building and repair of muscle tissue and energy production. Furthermore, the selenium intake (Table 2) is below in comparison with 70 μg day^{-1} for forwards. Several nutrients (vitamin A, selenium and zinc) in our study are implicated in oxidative damage and stress fracture. Their below values could be implicated in the muscular injuries that the soccer players from Valencia club suffered frequently in the last years[32].

CONCLUSION

In conclusion, a diet with too much protein and fat, low in carbohydrates and with inadequate amount of micronutrients (folate, vitamin A and K, zinc, selenium and iodine) can reduce the physical and athletic performance and increase the fatigue. For this reason, knowledge about different nutritional needs according to the playing position in the soccer game is very important to assess the diets. The nutritional and workload needs can be ordered from the following: goalkeepers < forwards ~ defenders < midfielders. In the near future, sports federations and clubs and soccer players and their families will receive nutritional counseling from sport dietitian throughout and beyond their playing years in order to increase the physical and athletic performance, nutritional knowledge and reduce the fatigue.

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