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ORIGINAL ARTICLE

Assessment of diet quality and physical activity of soccer players aged 13 to 16, from the Principality of Asturias, Spain☆

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KEYWORDS
Mediterranean diet;
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Abstract
Introduction: Diet and physical activity are factors that have key roles in childhood overweight and obesity prevention. Appropriate assessment of these factors is an essential task in public health.
Objective: The main aims of the study are to assess body composition, physical activity, and adherence to Mediterranean diet of soccer players, aged 13 to 16 years old in Asturias, Spain. It also aims to evaluate the relationships between diet, physical activity, body composition, and personal characteristics.
Methods: A cross-sectional descriptive survey approach was used involving children (n = 303) with a mean age of 14.15 years (SD = 1.06), and using the KIDMED and PAQ-A questionnaires to assess adherence to Mediterranean diet and level of physical activity, respectively. Body composition was represented using the participants' body mass index.

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Results: Approximately 23.1% of the participants were overweight or obese. With regards to adherence to Mediterranean diet, 54.8% of the participants had medium adherence, while 8.9% had low adherence. PAQ-A mean score was 2.69 (SD = 0.47). Excess weight was associated with being a goalkeeper (*P* = .001), higher PAQ-A (*P* = .011), and lower KIDMED scores (*P* = .032). Correlation analysis showed an inverse association between age and PAQ-A score (r = −0.122), and a direct association between KIDMED and PAQ-A scores (r = 0.152).
Conclusion: Participants had an adequate level of physical activity. However, they had an obesogenic profile similar to that of their age population, who were not soccer players. Actions to improve adherence to healthy diet practices are highly recommended.

PALABRAS CLAVE
Dieta mediterránea;
Actividad física;
Niños;
Fútbol;
Obesidad

Evaluación de la calidad de la dieta y de la actividad física en jugadores de fútbol, de 13 a 16 años, del Principado de Asturias

Resumen
Introducción: La dieta y la actividad física son dos conductas que juegan un papel clave en la aparición de sobrepeso y la obesidad infantil. Es una tarea esencial en salud pública el análisis de su prevalencia en diferentes contextos.
Objetivo: Describir la composición corporal, el nivel de actividad física y la adherencia a la dieta mediterránea, de jugadores de fútbol, de 13 a 16 años de Asturias. Secundariamente, determinar la relación entre dieta, actividad física, composición corporal y variables personales.
Métodos: Estudio descriptivo transversal. Participaron 303 niños, con una edad media de 14,15 años (DE = 1,06). Se analizaron adherencia a la dieta mediterránea y nivel de actividad física con los cuestionarios KIDMED y PAQ-A respectivamente y se estableció su composición corporal de acuerdo con su índice de masa corporal.
Resultados: Un 23,1% de los participantes presentó exceso de peso. El 54,8% y 8,9% tenían una adherencia media o baja respectivamente a la dieta mediterránea. La puntuación media del PAQ-A fue de 2,69 (DE = 0,47). El exceso de peso se asoció con jugar de portero (p = 0,001), mayor puntuación de PAQ-A (p = 0,011) y menor de KIDMED (p = 0,032). El análisis de correlación presentó una asociación inversa entre edad y puntuación de PAQ-A (r = −0,122) y directa entre las puntuaciones de KIDMED e PAQ-A (r = 0,152).
Conclusiones: Los participantes en el estudio mostraron un adecuado nivel de actividad física. Sin embargo, presentaron un perfil obesogénico similar al de población de su edad y una potencial acción de mejora sobre la adherencia a las recomendaciones de la dieta saludable.

Introduction

Diet, nutrition and physical activity play a key role in one of the most important health problems in the paediatric population worldwide: overweight and obesity.[1] In Europe, the combined prevalence of overweight and obesity has increased from 20.6% to 21.3% between the 1999–2006 and the 2011–2016 periods in children aged 2–13 years.[2] Recent studies identify Spain as one of the countries with the highest prevalence of excess weight in Europe in children aged less than 14 years.[2,3]

In a study conducted in 6 European countries, Miguel-Berges et al. highlighted that behavioural patterns characterised by engagement in physical activity and a healthy diet were associated with lower proportions of overweight and obesity.[4] In this regard, some of the characteristics of the lifestyles that now predominate in Western societies promote obesity, such as consumption of fast food,[5] access in public spaces to foods with a high sugar and fat content[6] or activities that involve screens or diminish social interaction.[7]

Given the irrefutable evidence that proves the key role of diet and physical activity in the prevention of overweight and obesity, the impact of excess weight in the daily life of children[8,9] and the association of excess weight in childhood with the development of health problems in adulthood,[10] emphasis has been placed on the need to develop strategies to address these behaviours in the paediatric population.[11] Some of these strategies have already been implemented.

Many authors have noted that these strategies require the joint action of every involved stakeholder (family, school and health care system, government and the individual that is the target of the intervention) and should be implemented

in every setting in the life of the minor,[11] such as the school or the sports club.

In Spain, soccer is one of sports played most frequently by children and adolescents. Playing soccer requires many physical, technical and mental skills.[12] To improve physical and athletic performance and prevent injury, experts recommend adequate monitoring of energy and nutrient intake[13] and anthropometric characteristics[14] in children that practice the sport.

Although soccer is very popular and played by many in Spain, there is limited evidence on the prevalence of obesogenic behaviours in children and adolescents that play the sport. For this reason, our primary objective was to describe the weight status, level of physical activity and adherence to the Mediterranean diet of soccer player in the *infantil* (13–14 years) and *cadete* (15–16 years) player categories in the Principality of Asturias, Spain. The secondary objective was to analyse the association between diet, physical activity and weight status and of these variables with sociodemographic variables.

Material and methods

Study design

We conducted a cross-sectional study.

Framework and sample

We conducted the study in September 2018. The participants were players in the Principality of Asturias (Spain) affiliated to the soccer federation aged 13–16 years. We enrolled players of teams based off the central region of Asturias. The exclusion criteria were: failure to complete or inadequate completion of questionnaires, missing the practice session in which the data were collected and/or refusal of the legal guardian or the player to participate in the study.

Since approximately 2000 players met the criteria based on the number of licenses reported by the Real Federación Asturiana de Fútbol (Asturias Soccer Federation), we estimated a minimum necessary sample size of 267 players under the maximum uncertainty principle (expected proportion of 50%) for a 95% level of confidence and a precision of 6%. The sample was obtained by selecting soccer clubs at random until we reached the estimated sample size and then invited all the players of these clubs to participate.

Assessment tools

We obtained information regarding dietary habits through the KIDMED questionnaire.[15] This instrument includes 16 items with a yes/no answer. A ''yes'' answer to an item that can be considered negative from the perspective of adherence to the Mediterranean diet (items 6, 12, 14 and 16) results in subtraction of 1 point. A ''yes'' answer to an item that is positive in relation to the Mediterranean diet (items 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 13 and 15) results in addition of 1 point. ''No'' answers do not count towards the score. The total score, or KIDMED index, is classified into 3 categories: 8 points or greater, optimal Mediterranean diet or substantial adherence; 4–7 points, need to improve dietary habits to better fit the Mediterranean pattern or intermediate adherence; 3 points or less, very poor diet or low adherence.

We assessed physical activity through the Physical Activity Questionnaire for Adolescents (PAQ-A).[16] It evaluates physical activity in the past 7 days in physical activity classes and during free time. This questionnaire consists of 9 items rated on a 5-point Likert scale. The final score is obtained by calculating the mean of all answers, and higher scores indicate greater levels of physical activity.

We weighed players wearing their practice uniform after using the bathroom as needed. Players were measured barefoot, standing in the middle of the platform and with the weight evenly distributed between the two feet. To measure the height, the player was asked to stand straight with the heels together and the arms lying along the torso, the head held with the plane connecting the tragus of the ear and the palpable bony infraorbital rim area (Frankfort horizontal plane) parallel to the floor. Each measurement was made twice, and we used the mean of both measurements in the analysis.

We assessed weight status by calculating the body mass index (BMI) with the formula BMI = weight (kg)/height^2 (m)[17] and the BMI *z*-score (BMIz) using the software *Anthro Plus*. The weight status categories established based on the *z*-score were underweight (BMIz < −2), normal weight (BMIz between −2 and +1), overweight (BMIz > +1; obesity (BMIz > +2).[18]

We collected the data in single practice sessions, distributing the KIDMED and PAQ-A to the group of players to self-administer. We took the anthropometric measurements with a Tanita HD382 digital scale accurate to 100 g (range, 0.1−150 kg) and a Leicester Tanita HR001 portable height measure accurate to 1 mm (range, 0–2.07 m).

Study variables

We collected data on personal characteristics (age, place of residence, highest educational attainment of the legal guardians, household, setting of daily meals and position played by the participant).

We evaluated the quality of the diet based on the score obtained in the KIDMED questionnaire. We assessed the level of physical activity based on the mean score in the PAQ-A questionnaire. Lastly, we dichotomised weight status into ''no excess weight'' (underweight and normal weight) and ''excess weight'' (overweight and obesity) based on the BMIz.

Statistical analysis

We summarised the data using the mean and standard deviation (SD). We assessed the normality of the distribution of continuous data with the Kolmogorov-Smirnov test and, since the assumption of normality was met, we used the applicable parametric tests for the different analyses.

We analysed the association between weight status and personal characteristics by comparing the percentage of patients in each weight status category using the χ^2 test. To analyse the association of the KIDMED and PAQ-A scores

Table 1 Analysis of differences in the distribution by weight status based on player position (n = 303).

	Goalkeeper[a] (n = 33)	Defence (n = 96)	Midfielder (n = 132)	Forward/offence (n = 42)	χ^2	P
No excess weight	51.5%	79.2%	83.3%	71.4%	16.03	.001
Excess weight	48.5%	20.8%	16.7%	28.6%		

[a] Significant difference compared to all other positions (with Bonferroni correction).

Table 2 Comparison of mean scores in the PAQ-A and KIDMED questionnaires in the different weight status categories (N = 303).

	No excess weight Mean ± SD	Excess weight Mean ± SD	t	P
KIDMED	6.90 ± 2.204	6.24 ± 2.356	2.157	.032[a]
PAQ-A	2.65 ± 0.468	2.81 ± 0.439	2.545	.011[b]

[a] d = 0.25(low).
[b] d = 0.29 (low).

with personal characteristics and weight status, we used the Student t test or analysis of variance (ANOVA), as applicable, and calculated Cohen's d to measure the effect size. Lastly, we measured the correlation between quantitative variables (PAQ-A, KIDMED and age) using the Pearson correlation coefficient. The statistical analysis was performed with the software IBM SPSS® Statistics version 24.0.

Ethical considerations

All players participated on a voluntary basis. We obtained the written informed consent of their legal guardians to their participation. We also obtained the approval of the Research Ethics Committee of the Principality of Asturias (ref. 59/18) and informed the Department of Child Welfare of the study.

Results

Description of personal characteristics

The sample comprised 303 players, all male, aged 13–16 years, with a mean age of 14.15 years (SD = 1.06).

Of all players, 85.5% resided in urban settings. The distribution of the sample by parental educational attainment was primary education, 7.6%; secondary education, 41.9% and university degree, 50.5%. The setting where players usually had their meals was the family home in 83.5% of cases, the school in 9.9% and the home of a relative in 6.6%.

When it came to the positions played by participants, the sample included 33 goalkeepers (10.9%), 96 defences (31.7%), 132 midfielders (43.6%) and 42 forward/offence players (13.9%). Participants trained a mean of 3.36 days a week (SD = 1.038), with the potential addition of one match a week.

Description of weight status, diet and physical activity

The mean weight was 49.83 kg (SD, 11.24) and the mean height 1.58 m (SD, 0.10). The mean BMI was 19.74 kg/m^2 (SD, 2.84). We detected overweight in 58 players (18.8%) and obesity in 14 (4.3%), so 23.1% had excess weight.

In the assessment of the quality of the diet, the mean KIDMED score was 6.49 (SD, 2.13). We found optimal scores in 36.3% of the players, while 54.8% needed to improve their diet and 8.9% had a very poor diet. The mean score in the PAQ-A was 2.69 (SD, 0.47).

Association between weight status and personal characteristics

We did not find significant differences in weight status in relation to player category (P = .862), the usual setting of meals (P = .065), the place of residence (P = .410) or parental educational attainment (P = .241). However, we found differences in relation to the position of the player (Table 1).

Association between weight status, diet and physical activity

Players with excess weight had lower scores in the KIDMED (Cohen d = 0.25) and higher scores in the PAQ-A (Cohen d = 0.29) (Table 2).

Association between diet and physical activity and between these variables and personal characteristics

We did not find an association between the KIDMED score and parental educational attainment (F = 0.510; P = .601), the usual setting of meals (F = 0.500; P = .683) or the type of residential setting (t = 0.938; P = .349). We also did not find an association between the PAQ-A score and residential setting (t = 0.891; P = .374) or parental educational attainment (F = 0.710; P = .493).

Lastly, the Pearson correlation coefficient showed that the PAQ-A score was weakly associated with player age and with the KIDMED score: there was a weak decreasing trend inn physical activity with increasing age and participants

Table 3 Correlation between PAQ-A score, KIDMED score and age.

	Age (*r*; *P*)	KIDMED (*r*; *P*)	PAQ-A (*r*; *P*)
Age	–	–	–
KIDMED	−0.032; .583	–	–
PAQ-A	−0.122; .034	0.152; .008	–

with a higher level of physical activity had a better diet (Table 3).

Discussion

Our findings contribute to the evidence of the alarming prevalence of excess weight in the paediatric population in Spain and the potential improvements that could be sought by addressing behaviours directly related to the observed deficiencies in health, diet and physical activity.

It would have been reasonable to expect a minimal prevalence of overweight and obesity in this sample, as they were children that played a sport regularly. Yet, we found a prevalence of excess weight of 23.1%. This was similar to the findings of previous studies conducted in Spain, such as those published by Doménech-Asensi et al.[19] or Moral García et al.,[20] or the paediatric health survey of Asturias of 2017.[21] This prevalence simply corroborates the current trend affecting the paediatric population, whose lifestyle habits seem to have deteriorated in recent decades[5–7] to the point that even regular physical activity does not seem sufficient to counteract the shift toward an obesogenic society.

This is alarming, given the association between excess weight in childhood or adolescence and the development of health problems in adulthood.[10] In the short term, and in the context of the current study, excess weight could be a disadvantage in relation to competitiveness. The literature evinces an association between excess weight and poorer performance in soccer, directly affecting reaction times, especially in explosive movements.[22]

Another salient finding was the association between anthropometry and playing position. Goalkeepers had greater weights compared to all other positions. This was consistent with the findings of previous studies.[23,24] The association could be explained by the evident stationary nature of goalkeeping. While we did not analyse the activity of players based on their positions, it is unquestionable that goalkeepers move less compared to the rest of the players. Thus, it may be necessary to establish specific training plans for goalkeepers to achieve an even level of physical activity in all players, regardless of the position they occupy in the field.

The analysis of the data collected through the KIDMED questionnaire evinced that more than 50% of the players could improve their dietary habits to better adhere to the Mediterranean diet. Other authors of studies conducted in the paediatric population in different contexts have found similar figures ranging from 42% to 57%.[25–27] There is also previous evidence of an association between excess weight and poorer diet quality scores, which does not require detailed discussion on account of having been thoroughly documented.[5,6] However, we ought to highlight the high proportions of children and adolescents that could have a better diet. This evinces the urgent need of implementing measures to improve dietary habits. In order to make dietary changes possible, several authors recommend involving all agents that participate in the selection of the child's diet and in a variety of settings,[11] for instance the clubs where children play soccer.

When it came to physical activity, we ought to highlight that participants in our study played soccer regularly. Playing with a club entailed a mean of slightly more than 3 days of practice a week, with 1 possible additional day per week to play matches, which would explain the high scores of participants in the PAQ-A.[16]

The PAQ-A score was inversely associated with participant age. While we did not carry out additional analyses allowing us to determine the reason for this finding, previous studies have had similar results. Their authors attributed this decrease in activity with increasing age to an increase in the time spent on sedentary activities, a loss of interest or motivation to carry on with activities pursued in childhood or lack of time, among other reasons.[28]

One finding that may seem paradoxical was the association between excess weight and higher scores in the PAQ-A. It is important to consider that the age of the players corresponded to a developmental stage in which body image is an important component of personal identity and is heavily influenced by the peers.[29] The well-known fact that physical activity is a protective factor against obesity may explain why these children engage more in physical activity in pursuit of a body image meeting social expectations. In this regard, we ought to mention the data obtained in the health survey of Asturias.[21] The survey found that weight status improved with age, which may also reflect this motivation to seek social acceptance. On the other hand, increased weight is also associated with a poorer performance in soccer,[22] and therefore with a decreased likelihood to be competitive within the peer group.

Lastly, we observed an association between adherence to the Mediterranean diet and the level of physical activity, which was consistent with previous studies in similar populations.[20,30,31] It is not surprising that individuals concerned about their health have healthier habits. In this regard, Chacón et al.[32] found that children regularly engaged in competitive athletic activities or sports tended to exhibit healthier lifestyle habits, such as spending less time in sedentary leisure activities or a greater adherence to the Mediterranean diet.

The chief limitation of our study is that our findings cannot be extrapolated to other sports. Therefore, we think it could be useful to carry out similar studies to determine whether there are differences in the variables under study depending on the sport practiced by participants. On the other hand, it would also be useful if future studies analysed whether other factors associated with soccer, such as the player category or the rigour of training, may also influence the habits of interest.

To conclude, we ought to highlight that we found an obesogenic profile in the study sample that was similar to the pattern observed in the general population of the same age, with room for improvement in the adherence

to healthy dietary habits independently of the adequacy of physical activity, which varied depending on the position of the player. Our findings suggest a need to develop interventions aimed at improving dietary and physical activity habits in children that play soccer, taking advantage of the framework of the sport for their implementation.

On the other hand, it is essential and of vital importance that further research is conducted to describe weight status, diet quality and physical activity and determine their association, especially in the paediatric population and in the context of sports, as the current evidence is limited.

Conflicts of interest

The authors have no conflicts of interest to declare.

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