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# A nutrition education intervention in adolescents who play soccer: The IDEHA-F project

María del Mar Fernández-Álvarez[1,2], Rubén Martín-Payo[1,2], Rebeca García-García[1,2,3], Marcelino Cuesta[1], and Sergio Carrasco-Santos[1,2,3]

[1] Universidad de Oviedo, [2] Instituto de Investigación Sanitaria del Principado de Asturias, and [3] Servicio de Salud del Principado de Asturias

## Abstract

**Background:** Diet and physical activity are prioritised in behavioural interventions given their influence on major child health issues. The objective of this study was to assess the feasibility of an educational intervention, based on the Behaviour Change Wheel model, on adherence to healthy eating habits in adolescent soccer players in Asturias, Spain. **Method:** This pilot study involved 319 soccer players (mean age=14.19 years; SD=1.089), who were distributed into a control group (CG) and an intervention group (IG). The response variables were: the usage rate of, adherence to, and acquisition of knowledge of the Mediterranean diet. The intervention included posters, a web-app, and practical activities. **Results:** The mean score on the knowledge questionnaire was 2.53 for the CG and 3.42 for the IG (p <.001). A weak direct correlation was observed between diet knowledge and KIDMED scores (r =.222, p =.013). The total pre-test KIDMED (p <.001) and diet knowledge ( p =.05) scores explained approximately 33% of the total post-test KIDMED score. **Conclusions:** The combined use of posters and a web app as intervention tools have been shown to be feasible in order to provide information on healthy eating habits to adolescents who play soccer and to help them maintain those eating habits.

***Keywords:*** Mediterranean diet; knowledge; motivation; adolescents; soccer .

## Resumen

***Intervención educativa sobre alimentación en futbolistas adolescentes: proyecto IDEHA-F.*** **Antecedentes:** alimentación y actividad física son objeto de abordaje prioritario, mediante intervenciones conductuales, dada su influencia sobre los principales problemas de salud infantil. El objetivo de este estudio fue evaluar la factibilidad de una intervención educativa, basada en el modelo Behaviour Change Wheel, sobre adherencia a la alimentación saludable en adolescentes jugadores de fútbol del Principado de Asturias. **Método:** estudio piloto sobre 319 jugadores de fútbol, edad media 14,19 años (DE= 1.089), distribuidos en grupo control (GC) e intervención (GI). Las variables de respuesta fueron: tasa de uso, adherencia y adquisición de conocimientos en relación con la dieta mediterránea. La intervención estuvo compuesta por 3 elementos: carteles, web-app y actividades prácticas. **Resultados:** la puntuación media del cuestionario de conocimientos fue de 2.53 y 3.42 en GC y GI, respectivamente (p<.001). Se observó correlación directa baja entre conocimientos y puntuación de KIDMED (r=.222, p=.013). La puntuación total de KIDMED en PRE (p<.001) y los conocimientos (p=.05) explicaron aproximadamente el 33% de la puntuación total de KIDMED en POST. **Conclusiones:** la combinación de carteles y el uso de una web-app como herramientas han demostrado factibilidad para aportar información sobre la alimentación saludable y mantener su calidad en adolescentes que juegan al fútbol.

***Palabras clave:*** dieta mediterránea; conocimiento; motivación; adolescentes; fútbol.

Diet and physical activity are two of the behaviours of greatest concern for Western societies due to their close relationship to the most prevalent diseases. Specifically in the child population, dietary patterns considered to be unhealthy have been shown to be associated with cardiometabolic disorders (Rocha, Milagres, Longo, Ribeiro, & Novaes, 2017) and obesity (Albataineh, Badran, & Tayyem, 2019).

In Europe, 1 in 8 children aged between 7 and 8 years old are obese. The figures for this health issue are particularly poor in Cyprus, Italy, Greece, Malta, and Spain (European Commission, 2018). It therefore seems necessary to continue to implement strategies to help combat obesity in order to improve the health of the population and the development of effective and efficient healthcare systems (European Commission, 2018).

The effects of educational programmes in the prevention of obesity in children and adolescents have been carefully studied. Interventions for the reduction of the obesogenic profile in populations aged 6 to 18 years old have been shown to be more effective when they did not focus exclusively on diet, rather on practising physical activity (Brown et al., 2019; Ells et al., 2018; Mead et al., 2017). Although there seems to be a consensus in this respect, this is not the case with respect to the duration of the interventions and strategies used, where greater heterogeneity has been observed. It has therefore been suggested that these interventions and strategies be adapted to the context in which they

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Corresponding author: Rubén Martín Payo
Facultad de Medicina y Ciencias de la Salud
Universidad de Oviedo/ISPA
33006 Oviedo (Spain)
e-mail: martinruben@uniovi.es

are to be implemented (Al-Khudairy et al., 2017; Racey, O'Brien, Douglas, Marquez, Hendrie, & Newton, 2016). For instance, in school settings, it is advised that interventions be high-intensity, contacting participants at least once a month, with a duration of between 5 weeks and 6 months (Racey et al., 2016).

In terms of strategies, the conclusions of a review conducted by Sisson, Krampe, Anundson, & Castle (2016) should be highlighted, as they recommend focusing interventions on children while incorporating creative and fun educational activities. One tool that combines these characteristics and has been shown to be effective in reducing weight in the child population is websites. As pointed out by Antwi, Fazylova, Garcon, Lopez, Rubiano, & Slyer (2012), using websites for this purpose facilitates the development of personalised interventions and, therefore, of interventions that are adapted to the needs of the population in question.

Another aspect discussed in the literature is the role to be played by parents. Although there seems to be no consensus on this (Kelishadi & Azizi-Soleiman, 2014; Racey et al., 2016; Schlechter, Rosenkranz, Guagliano, & Dzewaltowski, 2016), most authors recommend that parents participate either directly or indirectly (Gómez-Castillo, López-Pina, Torres-Ortuño, López-Durán, & Ricarte-Trives, 2018; Kim, Park, Park, Lee, & Ham, 2016; Sisson et al., 2016).

Several theoretical models have been used to structure educational interventions aimed at changing diet-related behaviours (Sisson et al., 2016; Pereira, et al., 2018). This study uses the Behaviour Change Wheel (BCW) model developed by Michie, van Stralen, & West (2011). The backbone of this model is known as COM-B, which stands for capability, opportunity, motivation, and behaviour. The authors of the model indicate that a change in behaviour requires changes in at least one of the other 3 components and determines which interventions may be implemented to modify each of the components (Michie, Atkins, & West, 2014). This model has recently been used for different behavioural purposes, such as improving adherence to pharmacological treatments (Curtis, Lebedev, Aguirre, & Lobitz, 2019), identifying barriers to implementing an immunisation programme for children (Alexander, Brijnath, & Mazza, 2014), or promoting healthy eating habits among minors (Chai, May, Collins, & Burrows, 2019).

Most of the interventions found have been implemented in school settings (Kelishadi et al., 2014; Racey et al., 2016; Sisson et al., 2016), perhaps because schools are educational environments where children spend many hours a year. Other settings share these characteristics, such as sports clubs, and therefore seem to be suitable for educational interventions aimed at improving the quality of children's diets. However, no studies have been found that describe the effectiveness of this type of intervention in schools. For this reason, the objective of this study is to assess the feasibility of an educational intervention, based on the BCW model, on the adherence to healthy eating habits of adolescent grassroots soccer players in the Principality of Asturias, Spain.

## Method

### *Participants*

A randomised pilot trial was conducted with the soccer teams as the randomisation units, which were assigned to either the intervention group (IG) or to the control group (CG) in order to avoid cross-contamination between participants on the same team. During the 2018/2019 season, 330 adolescent soccer players from the Principality of Asturias in Spain were included in the study. The players belonged to five different teams which had been randomly selected from clubs that had teams in the categories of "youth" and "junior" during the 2018/2019 season and were headquartered in the central area of Asturias. The participants were aged between 13 and 16 years old (M = 14.19, SD = 1.089), with a mean of 3.36 (SD = 1.037) training days per week.

All players participated voluntarily. The principles enshrined in the Declaration of Helsinki were upheld. Specifically, consent was obtained in writing from the players' legal guardians to participate in this study. In addition, permission was requested from the Research Ethics Committee of the Principality of Asturias, and the Spanish Public Prosecutor's Office for Minors was informed.

All players authorised to participate were included in the study once they had returned the informed consent form signed by their legal guardians. The following criteria for withdrawal were considered: (1) failing to complete or completing inappropriately the questionnaires after the intervention; (2) being absent from the training session in which the information was collected; (3) requesting to withdraw from the study by the player's legal representative or by the player concerned.

### *Instruments*

In order to meet the objective proposed, the following response variables were considered: the usage rate of the Mediterranean diet; adherence to the Mediterranean diet; acquisition of knowledge of the Mediterranean diet after the intervention.

The adherence rate was expressed as the percentage of adolescents who agreed to participate in the study and completed the assessments. The usage rate was considered to be the percentage of adolescents who performed each of the activities which were outlined in the intervention separately: consulting educational posters on healthy eating habits; accessing the web app of the study, which focused on healthy eating behaviours and included information adapted to the age and needs of the participating players; and carrying out practical activities proposed on the web app. Participants were then asked whether they had consulted and carried out the activities proposed using a dichotomous response option (yes or no).

The information relating to dietary patterns was assessed using the KIDMED questionnaire (Serra-Majem et al., 2004). This instrument is a self-report questionnaire consisting of 16 dichotomous questions with a yes/no answer. Items 6, 12, 14, and 16 have a negative connotation according to the Mediterranean diet standards, so one point is subtracted if answered positively. Conversely, items 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 13, and 15 have a positive connotation according to the Mediterranean diet standards and an affirmative response adds one point. Therefore, the test scores may range from 0 (minimum adherence) to 12 (maximum adherence). The results of the questionnaire may be interpreted qualitatively using three categories: ≤ 3 = low adherence (low-quality diet); 4-7 = medium adherence (need to improve the eating pattern to adapt it to the Mediterranean model); ≥ 8 = high adherence (optimal Mediterranean diet). The results may also be interpreted quantitatively according to the test score ($\alpha$ =.641).

Knowledge was measured with an ad hoc self-report survey that included five questions with four possible options, but only

one true option. The questions answered correctly added 1 point each. Unanswered questions and questions answered incorrectly neither added nor subtracted points. The final score was the total sum of correct responses (range: 0 = less knowledge; 5 = more knowledge).

In addition, personal variables were collected: age (in years), place of residence (rural or urban), and place where meals are consumed (usual residence, other residence, or school canteen).

*Procedure*

Data was collected from the CG and the IG simultaneously. The first round of data collection was carried out at the beginning of the study, in September 2018, during a training session. The second measurement was performed in May 2019, i.e. at the end of the study and once the IG had received the intervention (post-test). Data related to personal variables and diet was collected pre-test. In addition to the aforementioned data, data related to knowledge and participation was collected post-test (only from the IG).

A 6-month educational intervention on eating behaviours was developed for the IG, which was designed following the BCW theoretical framework (Table 1). The participants in the CG did not receive any type of intervention. However, they received a document at the end with all the information previously received by the players in the IG. The behaviour change strategies used, according to Behaviour Change Techniques V.1 (Michie et al., 2013), were the following: goal setting, action planning, self-monitoring of behaviour, social support, information about health consequences, pros and cons, instructions, behaviour substitution, credible source, and reward.

Even though it was not a tailored intervention, it was designed to adapt to the characteristics and preferences of the adolescents. A nurse, a physiotherapist, and a nutrition technician participated in the development and implementation of the intervention. The intervention included 3 key elements: posters, a web app, and practical activities. The collaboration and involvement of sports club managers was also requested in order to create a social environment conducive to change.

The posters featured content related to the characteristics of a healthy diet (a food wheel, a food pyramid, the number of daily servings of dairy products, fruits and vegetables, carbohydrates, and what to eat before each match). The posters were displayed on the walls of the changing rooms and changed every two weeks. The coaches were entrusted with the task of persuading the participants to read them.

The web app included information relating to different nutritional aspects, such as: recommendations on the frequency and quantity of consumption of the different food groups according to the Spanish Society of Community Nutrition (SENC, by its Spanish acronym); the functions of the different nutrients contained in foodstuffs; the effects of each foodstuff on health and sports performance; and specific recommendations regarding what foodstuffs to consume on both training and match days. In addition, forms with questions regarding the content of both the posters and the web app were included in the web app on a bi-monthly basis. The aim of these forms was to motivate players to read the information on both the web app and the posters.

The practical activities were designed to be carried out together with the parents. These included preparing healthy recipes or identifying and photographing spaces involving aspects of a healthy diet.

Finally, a contest was held as a motivating strategy. The adolescents received points for responding correctly to the questions on the web app and for carrying out the practical activities. The score ranking was established by team, that is, the score of each player was added to the total of their team. At the beginning of the competition, information was provided on the activities, how they were scored, the collective nature of the score, and the chance to win a final reward for the team with the highest score.

*Data analysis*

The means and standard deviations (SDs) were calculated for the description of the sample, usage rate, and knowledge acquisition. Percentages were used as appropriate, according to the nature of the variables. Fulfilment of the normality criterion in the distributions of the quantitative variables was verified using the Kolmogorov-Smirnov test and the corresponding parametric tests were conducted for subsequent analyses.

Specifically for the IG, the relationships between usage rate and knowledge acquisition and usage rate and the KIDMED score were analysed using analysis of variance. In turn, Pearson's test was used to assess the correlation of KIDMED mean scores with knowledge acquisition. Finally, a multiple regression analysis was performed taking the post-test KIDMED score as the dependent variable and taking the following variables as the independent

*Table 1*
Needs and Intervention functions included in the intervention

| COM-B | Needs addressed by the intervention | Intervention functions |
|---|---|---|
| Psychological capability | Knowledge regarding the characteristics of a healthy diet | Education |
| Physical capability | Skills for preparing a healthy diet | Training |
| Social opportunity | Generating a positive culture in the teams and families regarding the implementation of a healthy diet | Enablement<br>Environmental restructuring |
| Physical opportunity | Means for implementing a healthy diet | Environmental restructuring |
| Reflective motivation | Assessing the health and sports performance benefits of eating a healthy diet | Education<br>Persuasion<br>Incentivisation |
| Automatic motivation | Feeling part of the group | Persuasion |

variables: area of residence; mean number of individuals living together at home; self-perceived state of health; self-perceived weight; self-perceived healthy diet; participation in the different elements of the intervention, and the pre-intervention KIDMED score.

All analyses were performed using the statistical package IBM® SPSS® Statistics version 24.0. The statistical significance threshold for the results was set at $p \leq .05$.

## Results

### *Description of the sample*

Table 2 shows the basic characteristics of the sample. The study was completed by 319 adolescents, which means that the percentage of data lost when comparing the pre-test and the post-test was 3.3% ($n$ = 11. CG = 5, IG = 6).

### *The effect of the educational intervention on the KIDMED and knowledge scores*

Considering the total sample, the pre-test mean KIDMED score was 6.24 (SD = 2.01), whereas the post-test score was 6.19 (SD = 2.01).

The comparison of the mean scores between the groups revealed no differences at either point in time. However, improved scores were observed after the intervention in the IG, but were not statistically significant (Table 3).

The mean scores for the food-related knowledge questionnaire, measured only at post-test, were 2.53 (SD = 1.162) and 3.42 (SD = 1.132) for the CG and the IG respectively. This difference was found to be statistically significant ($t$ = 6.467, $p$ < .001).

*Table 2*
Description of the characteristics of the sample at the beginning of the study

| | |
|---|---|
| Area of residence | |
| % Urban | 85.9 |
| % Rural | 14.1 |
| Self-perceived state of health | |
| % Fair, poor, or very poor | 4.1 |
| % Good or very good | 95.9 |
| Self-perceived weight | |
| % Overweight | 83.0 |
| % Not overweight | 17.0 |
| Self-perceived healthy diet | |
| % Yes | 92.5 |
| % No | 7.5 |
| Mean number of individuals living together at home (SD) | 3.72 (0.799) |
| Mean number of training days per week (SD) | 3.36 (1.037) |

*Table 3*
Pre- and post-test mean KIDMED scores for each group and differences between groups (ANOVA)

| | Pre-test | Post-test |
|---|---|---|
| Mean for the CG (SD) | 6.14 (2.12) | 5.98 (1.99) |
| ($n$) | ($n$ = 161) | ($n$ = 156) |
| Mean for the IG (SD) | 6.34 (1.90) | 6.39 (2.03) |
| ($n$) | ($n$ = 169) | ($n$ = 163) |
| $t$, $p$ | .169, .681 | 1.833, .068 |

### *The relationship (in the IG only) between KIDMED and each of the following: usage rate, knowledge, personal variables, and self-perception variables*

Of the total 163 participants in the IG, 85.27% ($n$ = 139) answered the questions regarding participation in the activities proposed in the intervention. Table 2 shows the percentages of participation in each of the activities proposed, as well as the mean KIDMED questionnaire score according to participation.

Of the adolescents who answered the participation questions, 10.07% reported that they had not carried out any of the activities ($n$ = 14). In contrast, the posters had been consulted by 100% of the participants ($n$ = 125) (Table 4).

An analysis of the variance was performed using the post-intervention KIDMED questionnaire score as the dependent variable and using the web app and the practical activities as factors. The poster consultation was excluded because posters were consulted by 100% of the participants. The web app consultation was the activity that was associated with the highest KIDMED score ($d$ = .358, low/medium) (Table 5).

Correlation analyses were conducted to determine the relationship between knowledge about healthy eating habits and the KIDMED score. In general, a direct but weak association was observed between having a higher level of knowledge and having higher KIDMED scores ($r$ = .222, $p$ = .013).

Finally, a multiple regression analysis was performed taking the post-test KIDMED score as the dependent variable and taking the following variables as the independent variables: area of residence; mean number of individuals living together at home; self-perceived state of health; self-perceived weight; self-perceived knowledge of a healthy diet; consulting the web app; participation in the practical activities; and the pre-intervention KIDMED score. The pre-test total KIDMED score ($\beta$ = .509, $p$ < .001) and

*Table 4*
Percentages of participation in the activities proposed in the intervention and mean KIDMED scores according to participation

| Consulting the posters | Consulting the web app | Performing the practical activities | $n$ (%) | Mean KIDMED score (SD) |
|---|---|---|---|---|
| Yes | No | No | 38 (27.34) | 5.974 (2.212) |
| Yes | No | Yes | 3 (2.55) | 4.000 (2.000) |
| Yes | Yes | No | 42 (30.22) | 6.214 (1.842) |
| Yes | Yes | Yes | 42 (30.22) | 6.381 (2.175) |

*Table 5*
Analysis of the effect of performing the activities proposed on the KIDMED questionnaire scores

| | KIDMED score | |
|---|---|---|
| | $F$ | $p$ |
| Consulting the web app | 4.071 | .046 |
| Performing the practical activities | 1.934 | .167 |
| Consulting the web app and performing the practical activities | 2.714 | .102 |

the knowledge score ($\beta$=.150, $p$=.05) explained approximately 33% of the post-test KIDMED total score.

## Discussion

The results of this study contribute to demonstrating the feasibility of using digital tools, in this case a web app combined with other tools, on the determinants that influence behaviour change in the adolescent population. No statistically significant differences were found in the KIDMED questionnaire scores between the CG and the IG in the post-test. However, a trend towards an improved KIDMED score could be observed in the adolescents who received the intervention. It is important to note that the KIDMED baseline scores were already very acceptable, better than those described in previous studies on similar populations (García Cabrera, Herrera Fernández, Rodríguez Hernández, Nissensohn, Román-Viñas, & Serra-Majem, 2015; Iaccarino Idelson, Scalfi, & Valerio, 2017; Mistretta et al., 2017), which may have contributed to the failure to observe significant improvements.

In accordance with expert recommendations (Turner-McGrievy et al., 2017), in the intervention design phase, factors that could influence the success of the intervention, such as the location of the intervention, the resources available, or the information channels preferred by the participants, were analysed. Given the context and the experiences reported in previous studies (Hamel & Robbins, 2013; Racey et al., 2016; Sisson et al., 2016), the use of a web app, combined with other non-digital resources, was chosen as the tool which, a priori, would ensure greater levels of participation and effectiveness.

As can be observed in previous reviews (Brown et al., 2019; Racey et al., 2016; Sisson et al., 2016), most nutrition interventions are usually conducted in school settings and are often combined with physical activity behaviours. However, and despite the limited literature on the subject, the research team decided to conduct the intervention on players in soccer clubs, this being one of the main innovations of this study.

The aspects that led the research team to choose soccer clubs for this study, besides sharing the aforementioned characteristics of schools, were that soccer is a major sport and that physical activity was ensured because, on average, the children trained more than 3 days a week. This allowed us to focus the intervention on one behaviour only, nutrition, which contributes to the effectiveness of educational interventions (Michie et al., 2014). Thus, the two behaviours that most influence excess weight in the population included in the study (Brown et al., 2019) would be close to health recommendations.

More than 85% of the children participated in the activities proposed in the intervention. This may be considered to be a success of the intervention in terms of usage rate. Previous studies on interventions in minors involving a website as an educational resource reported similar participation percentages, regardless of the duration of the intervention or the strategies used (Rangelov, Della Bella, Marqués-Vidal, & Suggs, 2018).

Of all the components of the intervention, the consultation of the posters and the web app enjoyed the greatest participation. The posters had been strategically located and the coaches had been assigned the task of encouraging the players to consult them. The appropriate location, as well as the persuasion exercised by the coaches, with persuasion being a function that contributes to generating a social environment conducive to change (Michie et al., 2014), may have contributed to the success of the consultation of the information included in the posters. It should be noted that the web app was consulted by more than 60% of the children. Despite the fact that its content was nutrition-related, and therefore cannot be considered to be a subject of special interest for children, there is no doubt that technology has a special appeal for this population group and therefore must be taken into account when implementing health education strategies.

As indicated in the theoretical model used (Michie et al., 2014), knowledge acquisition through educational strategies contributes to developing the willingness to change behaviours, for example, by influencing psychological capability or reflective motivation (Michie et al., 2011). The results of the present study suggest that knowledge of the characteristics of the Mediterranean diet has had a positive effect on the KIDMED score. However, it should also be noted that knowledge has a limited effect on behavioural determinants and that sometimes additional strategies need to be implemented.

In this sense, the low involvement of the parents should be noted. Their participation was regarded as an indirect resource to make it easier for the children to carry out the practical activities. However, as the results indicate, the implementation of these activities, and therefore their effect, could clearly be improved upon. These circumstances have been reported on previous occasions. Assigning parents tasks to be carried out in their homes, without any supervision, often leads to a distortion between what they actually do and what the educators had planned (Overcash et al., 2019). On the other hand, involving them in an indirect manner has also often been associated with poorer intervention results (Kim et al., 2016). Future studies in similar contexts should design their interventions with parental involvement in mind. To this end, some authors suggest planning specific and simple objectives or tasks as a solution (Cravener et al., 2015). In addition, Nepper & Chai (2016) highlight the importance of identifying the barriers that parents may have in promoting healthy eating habits in children. Although these barriers have not been addressed in the present study, some of the barriers highlighted by these authors may be present in the parents involved in the present study, such as lack of time or the belief that healthy eating is expensive. It should also be noted that many environments facilitate the exposure of children to unhealthy foods (Martín Payo, Sánchez Díaz, Suárez Colunga, García García, Blanco Díaz, & Fernández Álvarez, 2019), which may also be a barrier to the effective development of interventions (Nepper et al., 2016).

Finally, it is worth noting that having a high pre-test KIDMED score was the best predictor of the post-test KIDMED score. The short period of time between the two points in time may explain this finding. Nevertheless, as indicated in a review by Kwasnicka, Dombrowski, White, & Sniehotta (2016), it is advisable to carry out interventions that include motivating factors that help the population to maintain healthy behaviours, as these can deteriorate over time. This may be achieved, for example, by providing supporting resources or by performing environmental restructuring. In the present study, these motivating actions have been taken into account, which may have contributed to maintaining the quality of the diet of the population studied. Other factors that have typically stood out for their influence on diet, such as body image perception (Ramos Valverde, Rivera de Los Santos, & Moreno Rodríguez, 2010), have not been shown to be significantly related.

Among the limitations of the present study is the non-inclusion of female players. The results of this study may therefore be considered applicable to male players only. The pre-test level of knowledge was not measured. As a result, the knowledge-related results cannot be strictly attributed to the intervention. A cluster randomised sampling method was used, so the results may be influenced by the so-called "design effect". Finally, since this is a pilot test, the performance of the questionnaire scores measuring dietary quality has not been studied over time, which would be interesting in order to assess the stability of the results presented here.

The results obtained suggest that this intervention, which combines the use of posters and a web app, is feasible as a tool for providing information on healthy eating habits and for maintaining the quality of the diet of adolescents who regularly engage in a high level of physical activity. It should be stressed that measures to ensure the participation of parents should be implemented in future interventions.

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