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Workplace nutrition education promotes sustainable eating and Mediterranean diet adherence among university employees: a quasi-experimental pre-post study

La educación nutricional en el trabajo fomenta una alimentación sostenible y el seguimiento de la dieta mediterránea entre los trabajadores de universidad: estudio cuasiexperimental pre-post

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ABSTRACT

Introduction: Workplaces are key settings for promoting healthy and sustainable dietary behaviours, yet evidence on nutrition education interventions addressing both outcomes remains limited. This study aimed to evaluate the effectiveness of a workplace nutrition education programme to improve dietary knowledge, promote sustainable food choices, and increase adherence to the Mediterranean diet among academic and non-academic university employees.

Methods: A quasi-experimental pre–post intervention study was conducted among 75 academic and non-academic university employees at Universidad Isabel I. This intervention included three face-to-face nutrition education workshops lasting 30-40 min: healthy diet, food labelling, and planning your healthy menu. Posters summarising key messages were displayed after each workshop. Participants completed an online questionnaire before and after the workshop series. The questionnaire included study-specific items and items adapted from validated instruments, and collected sociodemographic data, health data, exploratory self-reported anthropometric and body weight perception data, nutritional knowledge and practices, understanding of visual plate tools, food planning, diet environmental impact, food choice, shopping habits, food-labelling use, ability to identify healthy foods, and adherence to the Mediterranean diet (range: 0–13 points).

Results: The nutritional intervention significantly improved dietary knowledge ($p = 0.003$), with awareness of visual plate tools increasing from 72% to 100% ($p < 0.001$). Meal planning practices also improved ($p < 0.05$). Environmentally sustainable actions (e.g., buying local, seasonal produce) increased from 3.71 to 4.31 actions ($p = 0.016$), and Mediterranean diet adherence increased from 8.31 to 8.81 points ($p = 0.034$). While food-labelling consultation frequency remained unchanged, participants found it easier to identify healthy products ($p = 0.002$). No significant changes were observed in exploratory anthropometric or body weight perception measures.

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Conclusions: Workplace nutrition education effectively improved university employees' dietary knowledge and practices, promoted sustainable food choices, and enhanced adherence to the Mediterranean diet.

Funding: This study received financial support from Universidad Isabel I for practical materials and informational posters.

Keywords: Feeding Behaviour; Diet, Mediterranean; Food Labelling; Diet, Healthy; Health.

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RESUMEN

Introducción: La educación nutricional en el trabajo puede favorecer elecciones alimentarias saludables y sostenibles, incluida la dieta mediterránea, aunque la evidencia sobre su efectividad sigue siendo limitada. El objetivo fue evaluar la efectividad de un programa de educación nutricional en el entorno laboral para mejorar los conocimientos sobre alimentación, promover elecciones alimentarias sostenibles y aumentar la adherencia a la dieta mediterránea entre personal universitario académico y no académico.

Métodos: Se realizó un estudio cuasiexperimental pre-post en 75 empleados universitarios académicos y no académicos de la Universidad Isabel I. La intervención incluyó tres talleres presenciales de educación nutricional de 30-40 minutos: alimentación saludable, etiquetado de alimentos y planificación de un menú saludable. Tras cada taller se colocaron carteles con los mensajes clave. Los participantes completaron un cuestionario en línea antes y después de la intervención. El cuestionario incluyó preguntas específicas del estudio y otras adaptadas de instrumentos validados, recogiendo datos sociodemográficos y de salud, medidas antropométricas y percepción del peso autoinformadas (exploratorias), conocimientos y prácticas nutricionales, comprensión de herramientas visuales del plato, planificación alimentaria, impacto ambiental de la dieta, elección de alimentos, hábitos de compra, uso del etiquetado alimentario, identificación de alimentos saludables y adherencia a la dieta mediterránea (0-13 puntos).

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Resultados: La intervención nutricional mejoró significativamente los conocimientos sobre alimentación (p = 0,003), aumentando el conocimiento de las herramientas del plato del 72 % al 100 % (p < 0,001). También mejoró la planificación de las comidas (p < 0,05). Las acciones sostenibles aumentaron de 3,71 a 4,31 (p = 0,016) y la adherencia a la dieta mediterránea de 8,31 a 8,81 puntos (p = 0,034). Aunque la frecuencia de consulta del etiquetado alimentario no cambió, los participantes identificaron con mayor facilidad alimentos saludables (p = 0,002). No se observaron cambios significativos en las medidas antropométricas exploratorias ni en la percepción del peso.

Conclusiones: Un programa de educación nutricional en el entorno laboral universitario mejora los conocimientos y las prácticas alimentarias, fomenta elecciones sostenibles y favorece la adherencia a la dieta mediterránea

Financiación: Este estudio recibió financiación de la Universidad Isabel I para material práctico y carteles informativos.

Palabras clave: Conducta alimentaria; Dieta mediterránea; Etiquetado de alimentos; Dieta saludable; Salud.

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HIGHLIGHTS

- Workplace nutrition education improves dietary knowledge and practices.
- A programme of three workshops and posters increased sustainable food choices.
- The intervention successfully promoted adherence to the Mediterranean diet.
- Workplaces are effective settings for fostering healthier, sustainable lifestyles.

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INTRODUCTION

The workplace is an important setting for promoting healthy eating, as adults spend approximately two-thirds of their waking hours at work[1]. Workplace nutrition interventions can improve dietary habits by increasing fruit and vegetable consumption while reducing energy, saturated fat, cholesterol and ultra-processed food intake[2], in addition to improving employee productivity and quality of life[3]. Workplace food choices are influenced by contextual factors such as work demands, time constraints, food availability and access to healthy and sustainable food options, which may vary according to occupational roles[4].

Promoting healthy eating in the workplace also contributes to several United Nations Sustainable Development Goals (SDGs), particularly good health and well-being (SDG3), reduced inequalities (SDG10) and responsible consumption and production (SDG12). Dietary habits both influence and are affected by climate change, with implications for food production, availability and nutritional quality[5–9].Accordingly, public health organisations such as the Spanish Agency for Food Safety and Nutrition (AESAN) have incorporated environmental sustainability into updated dietary guidelines[10]. Universities therefore represent an important setting for integrating nutrition strategies that support the SDGs [11]. However, evidence on the effectiveness of nutrition education interventions in promoting sustainable dietary behaviours remains limited.

The Mediterranean diet is consistent with sustainability principles, having a lower environmental impact than Western dietary patterns while reducing cardiovascular and metabolic risk and improving quality of life[12,13]. To support its adoption, nutrition education tools such as visual plate models and food labelling have been developed. For example, MyPlate (MyPlate.gov) and the Harvard Healthy Eating Plate (Healthy Eating Plate) illustrate healthy meal composition through food group distribution, while food labelling helps consumers make healthier food choices and has been associated with increased vegetable intake and reduced energy and fat consumption[14].

Building on these educational approaches, the aim of this study was to evaluate the effectiveness of a workplace nutrition education programme in improving dietary knowledge

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and practices, promoting sustainable food choices, and increasing adherence to the Mediterranean diet among university employees.

METHODS

Participants and study design

This study had a quasi-experimental single-group design with pre-post measurements. A non-probabilistic convenience sampling strategy was used. The intervention was conducted among academic and non-academic staff at Universidad Isabel I. All university employees (n = 232), including 110 academic staff and 122 administrative and service staff, were invited to participate by institutional email. Inclusion criteria were being a university employee aged ≥ 18 years, voluntarily agreeing to participate, completing both the baseline and post-intervention questionnaires, and attending at least one workshop. Participants who did not complete the post-intervention questionnaire or attend any workshop were excluded. Of the 112 participants who completed the baseline questionnaire, 37 were excluded; therefore, 75 participants (32.3% of all university employees) were included in the final analysis.

No formal a priori sample size calculation was performed; the final sample was determined by the number of eligible employees who completed the study. Participants received study information, and questionnaires were anonymized to ensure confidentiality.

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Participants received study information, and questionnaires were anonymized to ensure confidentiality.

This study complies with the provisions of the Declaration of Helsinki and the current legal regulations on biomedical research (Law 14/2007, of June on biomedical research). This study was approved by the Ethics Committee of the Universidad Isabel I.

Intervention

The intervention, implemented from February to April 2024, consisted of three monthly group-based nutrition education workshops. Each workshop lasted 30–40 min and was delivered in person at the University campus. The workshops were as follows:

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1. Healthy diet: This workshop covered the concepts of a healthy and sustainable diet, a visual tool based on the MyPlate [15] and Harvard Healthy Eating Plate[16] models, adapted for the Spanish population, and recommendations on healthy and sustainable food consumption based on AESAN recommendations[10]. Based on this information, participants were encouraged to establish behavioural goals related to food consumption and sustainability (e.g., increasing fruit and vegetable intake), to be reviewed at the following workshop.
2. Food labelling: This workshop provided practical guidance on choosing labelled foods. Participants were advised to assess the number of ingredients, type of fat, meat content in processed products, and sugar content. The workshop also addressed the advantages and limitations of mobile applications for interpreting food labels and concluded by reviewing whether participants had achieved the objectives set in the previous workshop.

   Based on this information, participants were encouraged to establish individual behavioural goals related to the Mediterranean Diet Adherence Screener (MEDAS)[17] components (e.g., increasing fruit and vegetable intake), which were reviewed at the beginning of the third workshop. Specific messages promoting Mediterranean dietary behaviours, including increased fruit and vegetable consumption, use of extra virgin olive oil, preference for fish, and reduced consumption of red and processed meats, were delivered and reinforced during the third workshop.
3. Planning your healthy menu: During this workshop, the steps for creating a healthy menu were explained and the participants developed their own menu using a template. This was based on the topics covered in previous workshops and took into account the plate visual tool, food frequency consumption and food temporality[10].

After every workshop, posters summarizing the most important ideas were hung at the university.

Data collection

Participants completed the same online questionnaire before and after the intervention through a Google Forms link sent by email. The post-intervention questionnaire additionally

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included questions on workshop attendance. Part of the questionnaire was specifically developed for this study, whereas several items were adapted from previously validated instruments and modified, when necessary, to fit the study objectives and target population. The origin of the items included in each section is described below.

The questionnaire included the following sections:

I. Sociodemographic data: This section collected information on participants' relationships with Universidad Isabel I, their educational level and net monthly income, age and sex.

II. Anthropometric: This section included self-reported weight, height, body weight perception based on the General Nutrition Knowledge Questionnaire–Revised (GNKQ-R)[18], and body image assessment using the Body Mass Index (BMI) model by Harris CV et al.[19]. These variables were collected to characterize the sample and as exploratory contextual measures, but they were not considered primary outcomes of the intervention.

III. Nutritional knowledge and practices, and diet environmental impact: This section assessed nutritional knowledge, understanding of the visual plate tool, meal planning, environmental impact, and food choice. Items were adapted from validated questionnaires, including the GNKQ-R[18] and a study on food sustainability among Spanish university students by Gaspar MCMP et al.[20].

IV. Food labelling: This section corresponded to the "Attitudes towards nutrition information" dimension of a questionnaire developed for the Spanish population as part of a doctoral thesis and subjected to formal content validation (Content Validity Index = 0.91). It evaluated participants' shopping habits, use of food labels, and ability to identify healthier food products[21].

V. Mediterranean diet: This section assessed adherence to the MEDAS[17]. The questionnaire omitted the alcohol consumption item, based on current evidence indicating that there is no safe level of alcohol intake[22]. Scores ranged from 0 to 13.

The complete questionnaire is provided in Appendix S1 (Supplementary Material).

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Statistical analysis

Results are presented as mean ± standard deviation (SD) or relative frequency (%). Differences in proportions before and after the intervention were assessed using the McNemar test. Changes in ordinal variables and continuous variables that did not follow a normal distribution were analysed using the Wilcoxon signed-rank test. Normality was assessed using the Shapiro-Wilk test. Statistical analyses were performed using IBM SPSS Statistics version 29 (IBM Corp., Chicago, IL, USA). Statistical significance was set at $P < 0.05$.

RESULTS

The final sample included 75 participants (56 women and 19 men), with a mean age of 34.20 (8.12) years. Overall, 66.7% (n = 50) were administrative staff and 33.3% (n = 25) were university teachers. Most participants (90.7%, n = 68) had at least a university degree, whereas 9.3% (n = 7) held a technical qualification.

At baseline, mean body weight was 66.01 (12.85) kg. As exploratory contextual measures, no significant changes were observed in body weight, perceived weight status or perceived body silhouette after the intervention (all $p > 0.05$; Table S1, Supplementary Material).

Nutritional knowledge and practices, and environmental impact of diet

Significant improvements were observed in self-reported food knowledge ($p = 0.003$). Awareness of visual plate tools increased from 72% at baseline to 100% after the intervention ($p < 0.001$). Concerns about food remained unchanged ($p = 0.725$) (Figure 1). Use of visual plate tools for meal planning and meal planning based on food variety, nutritional balance, and dietary needs also increased significantly ($p < 0.001$ and $p = 0.002$, respectively) (Figure 1).

The number of dietary actions to reduce environmental impact increased from 3.71 (1.78) to 4.31 (1.89) ($p = 0.016$). The proportion of participants considering the environmental impact of food increased significantly ($p < 0.001$), as did the proportion taking the following actions to reduce the environmental impact of their diet: buying local produce, using seasonal produce and avoiding plastic packaging ($p < 0.05$). No significant changes were observed for the remaining actions (Table 1).

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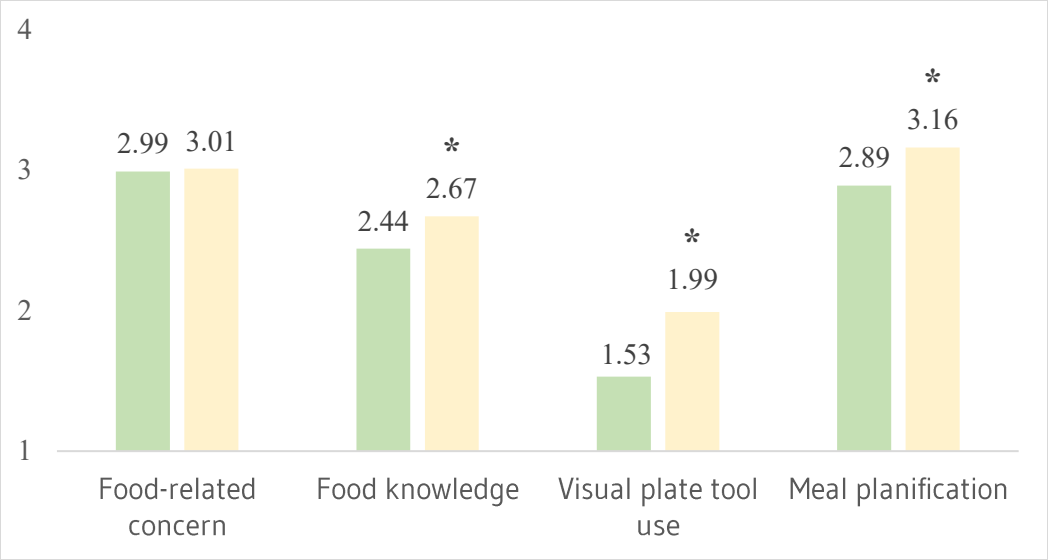


Figure 1. Changes in self-reported nutrition knowledge during the nutrition education intervention.

Note: Green and yellow bars indicate pre- and post-intervention values, respectively. Data are presented as means. *Statistically significant difference between pre- and post-intervention values ($p < 0.05$).

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Table 1. Change in the proportion of participants who considered the environmental impact of food and took different actions to reduce it after the nutritional intervention (n = 75)

Variable	Pre-intervention	Post-intervention	p-value
Consideration of the environmental impact of food	29.33%	50.67%	**<0.001**
Use of local products	37.33%	42.67%	0.540
Use of seasonal products	49.33%	64.00%	**0.046**
Avoid plastic packaging	49.33%	64.00%	**0.046**
Use of cloth bags	69.33%	74.67%	0.502
Buy locally	44.00%	57.33%	**0.024**
Choose organic or ecological foods	8.00%	18.67%	0.061
Buy products with sustainable production	8.00%	5.33%	0.724
Reduce consumption of animal products	29.33%	34.67%	0.502
Recycling or reusing	66.67%	66.67%	1.000
Grow some of food at home	7.00%	2.67%	0.074

Data described as relative frequency (%).

Food labelling

Before the intervention, 91.77% of participants were responsible for food purchasing, compared with 88.00% after the intervention, without significant differences (p = 1.000). Regarding food labelling, no significant changes were observed in consultation frequency, the number of label aspects consulted, or the importance of food labelling in purchasing decisions (p > 0.05). However, participants found it easier to identify healthy products after the intervention (P = 0.002) (Table 2).

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Table 2. Changes in consultation of food labelling during the nutrition education intervention (n = 75)

	Pre-intervention	Post-intervention	p-value
Frequency of food labelling consultation	3.023 (0.79)	3.15 (0.67)	0.158
Number of food labelling issues consulted	3.43 (1.66)	3.65 (1.45)	0.168
Importance of food labelling in purchasing decisions[a]	2.83 (0.62)	2.91 (0.50)	0.309
Easy to identify healthy products[b]	2.28 (0.65)	2.59 (0.66)	**<0.002**

Data described as mean (standard deviation). [a] Rated from none (1) to much (4). [b]From not simple (1) to very simple (4).

The main reasons for consulting food labels before and after the nutritional intervention are shown in Figure 2. Before and after the intervention, the main reason was to identify healthy foods, increasing from 60.00% to 77.33% (p = 0.009), whereas consulting labels out of curiosity or routine decreased from 18.67% to 8.00% (= 0.043).

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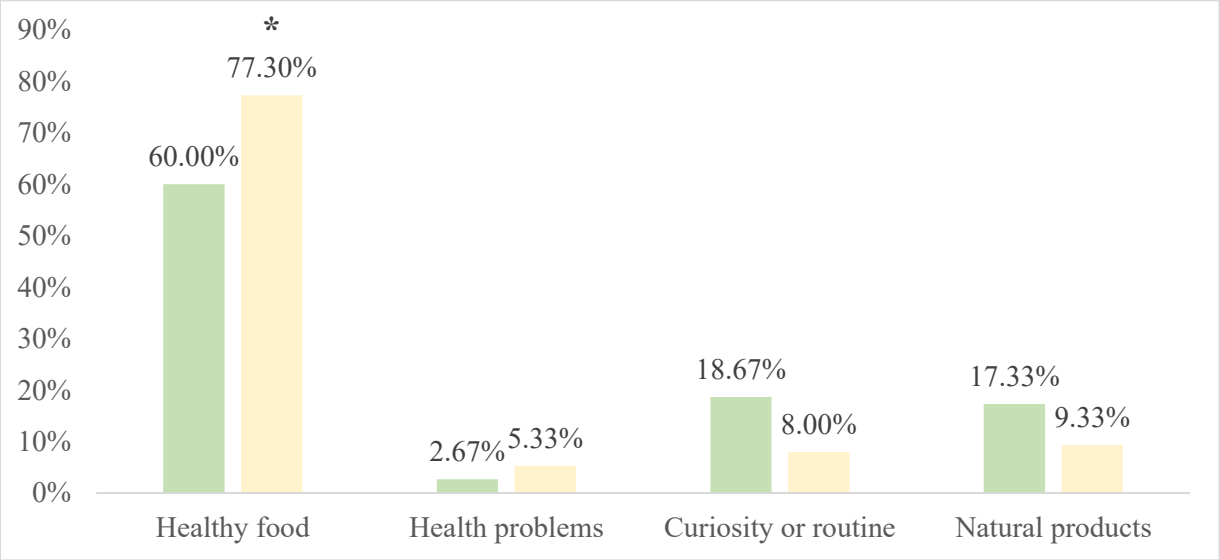


Figure 2. Reasons for consulting food labels before and after nutritional intervention.
Note: Green bars indicate pre-test values and yellow bars indicate post-test values. Data are presented as means. *Statistically significant difference between pre-test and post-test values ($p < 0.05$).

Table 3 shows the food label elements checked by participants before and after the intervention. After the nutritional intervention, the proportion of participants who checked the country of origin in purchasing decisions increased ($p = 0.022$), whereas no changes were observed in the remaining label elements ($p > 0.05$).

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Table 3. Change in the proportion of participants who considered the different aspects of food labelling when making purchase decisions (n = 75)

	Pre-intervention	Post-intervention	p-value
Nutritional information	74.67%	78.67%	0.646
Ingredients	74.67%	81.33%	0.383
Expiration dates	77.33%	81.33%	0.579
Country of origin	34.67%	49.33%	**0.022**
Preservation and use	24.00%	34.67%	0.099
Trade name of the food	16.00%	18.67%	0.803
Health claims	13.33%	6.67%	0.228
Nutrition claims	28.00%	14.67%	**0.055**

Data described as relative frequency (%).

Mediterranean diet

Mediterranean diet adherence significantly improved after the nutritional intervention, as reflected by an increase in MEDAS scores from 8.31 (2.09) to 8.81 (2.26) (p = 0.034). Item-by-item analysis showed no statistically significant changes, although favourable trends were observed in several dietary components (Table S2, Supplementary Material).

DISCUSIÓN

This study evaluated the effectiveness of a group-based nutrition education programme delivered in the workplace in improving dietary knowledge and practices, promoting sustainable food choices, and increasing adherence to the Mediterranean diet among academic and non-academic university employees. The main findings were that the programme: 1) improved nutritional knowledge and meal planning practices; 2) increased sustainable dietary behaviours to reduce environmental impact; 3) improved the ability to

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identify healthy products using food labelling; and 4) increased adherence to the Mediterranean diet.

The nutrition education programme improved participants' nutritional knowledge, particularly their perceived food knowledge, familiarity with visual plate tools, and meal planning skills. These findings are consistent with previous studies showing that nutrition education interventions improve dietary knowledge among adults. For example, McCarthy et al. reported that a six-month MyPlate-based intervention improved dietary habits and nutrition knowledge compared with calorie counting[23], while Schwartz et al. found that MyPlate users reported healthier dietary patterns[24]. Similarly, the increased use of the Harvard Healthy Eating Plate and improved meal planning based on food variety and nutritional balance suggest that participants translated theoretical knowledge into daily practice, a key step in dietary behaviour change according to the Transtheoretical Model[25].

As previously mentioned, dietary habits have a significant impact on climate change. Environmental awareness was assessed through a specific question asking participants whether they considered the environmental impact of their food choices (yes/no), together with a composite score reflecting the number of sustainable dietary actions they reported (range 0–10). In this context, participants significantly increased both their awareness of the environmental impact of food choices and the number of sustainable dietary actions following the intervention. These findings are consistent with those of Monroe et al., whose five-week *Green Eating Project* improved green eating behaviours, self-efficacy and knowledge among university students[26]. Similarly, text message-based interventions providing practical implementation strategies have also been shown to increase sustainability awareness and promote plant-based diets among young adults[5].

Certain behaviours, such as reducing animal product consumption or consistently choosing organic or certified sustainable foods, did not change significantly after the intervention. These findings are consistent with previous evidence showing that individuals are more likely to adopt simple environmentally friendly behaviours than those requiring greater economic or cultural changes[27]. The adoption of sustainable dietary behaviours may also be influenced by workplace contextual factors, such as time constraints and food availability[4].

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Regarding the impact of the nutritional intervention on food-labelling use, no significant changes were observed in consultation frequency, the number of label elements reviewed, or the importance attributed to food labelling in purchasing decisions[21]. However, participants found it significantly easier to identify healthy products after the intervention, suggesting improved label interpretation despite the absence of immediate behavioural changes. Moreover, more participants reported consulting labels to identify healthy foods, whereas fewer did so out of curiosity or habit, indicating more purposeful use of food-labelling information. These findings are consistent with previous evidence showing that nutrition labelling influences consumers' perceptions of food healthfulness, supporting its role in promoting healthier food choices[21].

These findings are consistent with previous research showing that, although Spanish consumers express interest in nutritional information, their understanding and use remain limited[21]. Likewise, Contento et al. suggested that nutrition education interventions can improve motivation and awareness, although behavioural changes often require continued reinforcement, consistent with our findings[28].

Regarding the specific aspects of food labelling, participants more frequently considered the country of origin when making purchasing decisions after the intervention. Interestingly, although participants increasingly reported consulting food labels to identify healthier foods, the only specific labelling element that increased significantly was the country of origin. This may suggest that participants broadened their concept of healthy food choices to include sustainability-related aspects, while continuing to consider nutritional information. This may reflect greater awareness of the environmental impact of food choices, consistent with our previous findings and with evidence from the European Parliament Research Service showing that consumers often associate food origin with higher quality, safety and sustainability[33].

Although changes in food-labelling practices were modest, these findings are encouraging and support the need for practical, visually engaging educational strategies to achieve greater changes in food purchasing and consumption behaviours.

The intervention was explicitly based on the core principles of the Mediterranean diet, particularly increasing plant-based food consumption. Accordingly, MEDAS scores increased

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significantly after the intervention, indicating greater adherence to this dietary pattern. These findings are consistent with previous studies showing that Mediterranean diet-based educational interventions effectively improve diet quality across different cultural contexts[29]. Roset-Salla et al. reported that Mediterranean diet education not only improved nutritional knowledge but also promoted lasting changes in eating habits, contributing to better public health[30]. Although adherence to the Mediterranean diet is influenced by multiple socioeconomic, cultural and environmental factors, the improvement in MEDAS scores observed after the intervention suggests that promoting this dietary pattern may be an effective strategy to improve health while supporting sustainability goals.

Strengths and limitations

This study has several limitations that should be considered. Firstly, the relatively small sample size, the non-probabilistic convenience sampling strategy and the single-centre design limit the generalizability of the findings. However, the sample reflects the real-world participation achieved after inviting all university employees to take part in the intervention. Secondly, the lack of follow-up prevented assessment of the long-term sustainability of the observed changes in dietary habits and knowledge. Thirdly, as most data were self-reported through online questionnaires, recall and social desirability biases may have been introduced. Finally, nutritional knowledge and food labelling skills were assessed through self-perception rather than standardised measures, limiting the objectivity of the findings.

Despite these limitations, the real-world implementation of the programme demonstrates its feasibility and enhances its ecological validity. The combination of practical educational tools and sustainability-related content improved dietary knowledge and behaviours while providing a multidimensional approach to nutrition education. Lastly, the participation rate achieved (32.3% of all university employees), including both academic and administrative staff, supports the internal validity of the findings and suggests that similar workplace interventions are feasible.

Future programmes should incorporate longer-term strategies, including periodic educational reinforcement and practical activities, such as plant-based cooking workshops,

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urban gardening projects and participatory sessions with local food producers. Such approaches could strengthen the link between personal and planetary health, supporting the transition towards more sustainable, healthy and equitable food systems.

CONCLUSIONES

This study demonstrated that a workplace-based nutrition education programme consisting of three workshops and reminder posters improved dietary knowledge, healthier food practices and adherence to the Mediterranean diet among university employees. The intervention also increased awareness of the environmental impact of food choices, supporting more sustainable dietary behaviours. These findings highlight the workplace as a strategic setting for implementing nutrition education initiatives that promote both health and sustainability. Future research should evaluate the long-term maintenance of these behavioural changes, their impact on objective health outcomes, and the scalability of similar programmes across diverse institutional settings to contribute to broader public health and environmental goals.

AUTHOR CONTRIBUTIONS

Conceptualization: A.A., P.P.A., M.M.F. Data curation: P.P.A., M.M.F. Formal analysis: M.M.F. Funding acquisition: A.A., M.M.F. Investigation: A.A., P.P.A., I.R.R., M.M.F. Methodology: A.A., P.P.A., I.R.R., M.M.F. Project administration: A.A., M.M.F. Resources: A.A., P.P.A., M.M.F. Supervision: M.M.F. Visualization: A.A., P.P.A., I.R.R., M.M.F. Writing – original draft: A.A., P.P.A., I.R.R., M.M.F. Writing – review & editing: A.A., P.P.A., M.M.F.

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CONFLICT OF INTEREST

P.P.A. serves as an Associate Editor of the Revista Española de Nutrición Humana y Dietética. The other authors declare no conflicts of interest. All authors are responsible for the content of this article.

DATA AVAILABILITY

Data are available upon reasonable request from the corresponding author.

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