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Relationship between Mediterranean diet, physical activity and emotional intelligence in Spanish undergraduates

Relación entre dieta mediterránea, actividad física e inteligencia emocional en estudiantes universitarios españoles

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Abstract. Levels of adherence to the Mediterranean diet in Spanish university students need to be verified. It is necessary to go deeper into what these are and what factors determine them. This is useful to design effective diet promotion proposals in this population. The objectives are: 1) To classify Spanish university students of Education Degrees according to their levels of Mediterranean diet, physical activity and emotional intelligence; 2) To analyse the influence of physical activity and emotional intelligence as determinants of Mediterranean diet according to lifestyle profiles. A cross-sectional study was designed with the participation of a representative sample of university students of education degrees. Participants ranged in age from 18 to 43 years (20.84±2.90). Men represented 30.2% of the sample (n=125) and women 69.8% (n=289). An online questionnaire was administered comprising the following: PREDIMED, IPAQ-SF and TMMS-24. The regression model obtained for the whole sample was: Mediterranean diet= 2.536+0.001*physical activity+0.029*emotional intelligence. The two-stage cluster classification (Ward and k-means) was validated with the MANOVA test (Pillai trace: F (6, 820) = 159.101; p ≤ 0.001; f = 1.00). It is concluded that 8% of university students' adherence to the Mediterranean diet is predicted by moderate-vigorous physical activity and emotional intelligence. Adherence to the diet is positively related to physical activity and emotional intelligence.
Keywords: lifestyles; moderate-vigorous physical activity; Spain; cluster analysis; regression model.

Resumen. Se necesita comprobar los niveles de adherencia a la dieta mediterránea de los estudiantes universitarios españoles. Es necesario profundizar en cuáles son y qué factores los determinan. Esto es útil para diseñar propuestas eficaces de promoción de la dieta en esta población. Los objetivos son: 1) Clasificar a los universitarios españoles de Grados de Educación según sus niveles de dieta mediterránea, actividad física e inteligencia emocional; 2) Analizar la influencia de la actividad física y la inteligencia emocional como determinantes de la dieta mediterránea según los perfiles de estilo de vida. Se diseñó un estudio transversal con la participación de una muestra representativa de estudiantes universitarios de Grados de Educación. La edad de los participantes osciló entre 18 y 43 años (20,84±2,90). Los hombres representaban el 30,2% de la muestra (n=125) y las mujeres el 69,8% (n=289). Se administró un cuestionario en línea que incluía: PREDIMED, IPAQ-SF y TMMS-24. El modelo de regresión obtenido para toda la muestra fue: dieta mediterránea= 2,536+0,001*actividad física+0,029*inteligencia emocional. La clasificación por conglomerados en dos etapas (Ward y k-medias) se validó con la prueba MANOVA (traza de Pillai: F (6, 820) = 159,101; p ≤ 0,001; f = 1,00). Se concluye que la adherencia del 8% de los universitarios a la dieta mediterránea es predicha por la actividad física moderada-vigorosa y la inteligencia emocional. La adherencia a la dieta se relaciona positivamente con la actividad física y la inteligencia emocional.
Palabras clave: estilos de vida; actividad física moderada-vigorosa; España; análisis cluster; modelo de regresión.

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Introduction

Lifestyle is a way of life based on identifiable patterns of behavior (WHO, 1998). Lifestyle is determined by individual characteristics, social interactions and living conditions (WHO, 1998). Diet, physical activity, tobacco, alcohol and drugs are among the most important lifestyle habits (Diolintzi et al., 2019; Herazo et al., 2020). In addition, each person's lifestyle is influenced by a particular culture, which is conditioned by values, norms, beliefs, attitudes, and skills (García, 1982). These skills include emotional intelligence (Melguizo-Ibáñez et al., 2023b). Nowadays, there is a social concern about lifestyle habits in the young population (Sanz-Martín et al., 2023a), especially with regard to university students (Flores et al., 2023; García-Castillo et al., 2024).

The Mediterranean diet is one of the most important models of healthy eating worldwide (Herrera-Ramos et al., 2023). This dietary model has been included in the list of Intangible Cultural Heritage of Humanity by UNESCO (2013). This diet is the result of the expression of the food cultures of the different civilisations that have existed in the Mediterranean region (Dernini & Berry, 2015). Furthermore, this diet is characterised by an abundant intake of vegetables, fresh fruit, dairy products, fish and olive oil and limited consumption of poultry, eggs, red meat and wine (Willett et al., 1995). People who correctly maintain a Mediterranean diet can obtain health benefits such as: cancer prevention, reduced risk of cancer mortality, reduced insulin resistance, reduced hyperinsulinaemia, optimisation of glycaemic control, increased incretins (GLP-1), cardiovascular disease, reduced blood pressure, reduced incidence of coronary heart disease, reduced incidence of ischaemic stroke, reduced incidence of cognitive impairment, reduced plasma LDL-cholesterol levels, reduced glycated hemoglobin (HbA1c) (Martínez- González et al., 2019; Martínez-Peláez et al., 2020; Mentella et al., 2019; Morze et al., 2021; Papadaki et al., 2020; Tuttolomondo et al., 2019).

Numerous scientific studies conclude that the Mediterranean diet levels of Spanish university students could be improved. Tárraga et al. (2021) found that young people

related to health sciences showed a higher adherence to the Mediterranean diet. In contrast, young people from other fields of study were found to be less adherent to the Mediterranean diet (Tárraga et al., 2021). In contrast, Riquelme-Gallego et al. (2023) found that medical students had a low adherence to the Mediterranean diet. These students showed a caloric profile characterised by an excessive intake of fat and protein and a low intake of carbohydrates (Riquelme-Gallego et al., 2023). Ejeda-Manzaneda and Rodrigo-Vega (2021) concluded that 15.31% of education science students had low adherence to the Mediterranean diet and 58.98% had medium adherence. García-Pérez et al. (2023) showed that 37.5% of law, social work and psychology students had low adherence to the Mediterranean diet and 39.7% had medium adherence. The dietary levels of Spanish university students are in line with those obtained for other population groups (Sanz-Martín et al., 2023a). Sanz-Martín et al. (2023a) showed that 11.6% of primary school students had low adherence to the Mediterranean diet, 56.66% had medium adherence and 31.74% had high adherence.

The Mediterranean diet is positively related to some determinants, such as physical activity (Carrillo-López et al., 2021; García-Pérez et al., 2023; Tárraga et al., 2021) and emotional intelligence (Melguizo et al., 2021; Melguizo-Ibáñez et al., 2023b; Sanz-Martín et al., 2023a). Just as diet can bring numerous health benefits (Martínez- González et al., 2019; Martínez-Peláez et al., 2020; Mentella et al., 2019; Morze et al., 2021; Papadaki et al., 2020; Tuttolomondo et al., 2019) and the joint practice of physical activity and development of emotional competence is also beneficial (Melguizo-Ibáñez et al., 2022).

One of the settings that favours health promotion are educational establishments (Trescastro-López et al., 2020). In these educational environments, the teacher plays an essential role (Trescastro-López et al., 2020). It is necessary to accurately identify the levels of healthy habits and the factors that condition them in order to design effective proposals (Robbins et al., 2021). Identifying the levels of Mediterranean diet among university students in Education degrees helps to raise awareness of this social problem (Robbins et al., 2021). The analysis of healthy habits according to homogeneous groups of participants makes it possible to identify priority and more contextualised lines of action (Robbins et al., 2021). This makes it possible to improve the management of available resources (Sanz-Martín et al., 2023a).

No previous studies have been found that have analysed the levels of Mediterranean diet in Spanish university students of Education and its relationship with physical activity and emotional intelligence. These results could justify the need to create proposals for the promotion of eating habits. For this reason, the present research has been designed with the following objectives:

1) To classify Spanish university students of Education Degrees according to their levels of Mediterranean diet, physical activity and emotional intelligence.

2) To analyze the influence of physical activity and emotional intelligence as determinants of the Mediterranean diet in terms of lifestyle profiles.

The hypotheses of this study are as follows:

H.1. Low adherence to the Mediterranean diet is expected to be found.

H.2. Students can be classified into three clusters according to their lifestyle profile.

H3. Physical activity and emotional intelligence may predict Mediterranean diet adherence.

Method

Participants

The study population was Spanish university students of Degrees in Education. According to data from the Ministry of Education and Vocational Training (2023), there were 150565 students during the 2022-2023 academic year.

During the months of May and June 2023, an email was sent to all universities where Education Degrees are taught. This email invited them to participate in the research. In this e-mail, the link to the questionnaire was provided and they were encouraged to send it to their students.

Non-random sampling was used, based on the criterion of recruitment by accessibility, including the 414 students who correctly answered the questionnaire. The final sample was representative of the whole target population, with a variance of 95%, a standard deviation of 50, and an estimation error of 4.81%.

Participants ranged in age from 18 to 43 years (20.84±2.90). Men represented 30.2% of the sample (n=125) and women 69.8% (n=289).

Instruments

An online questionnaire was administered for data collection. The instrument was created and administered using the Google® Forms platform (Mountain View, CA, USA). The URL link was distributed by email to the Heads of Faculties and Universities. Once they had the questionnaire, they shared it with their students. The questionnaire consisted of the following blocks of questions:

1) Socio-demographic section.

This was self-created (ad hoc) and included questions on: sex (male/female), age (years) and place of residence (including a list of the 52 Spanish provinces).

2) Mediterranean diet section.

The PREDIMED questionnaire was used to measure this variable (Schröder et al., 2011). Due to the characteristics of the sample, we used the version adapted to Spanish (Benítez-Benítez et al., 2016). This instrument is made up of 14 questions. The questionnaire offers three levels of categorization: High adherence: 12-14 points; Medium adherence: 8-11.99 points; Low adherence: 0-7.99 points.

In this study, the Mediterranean diet variable was measured as the total score obtained by the participants and an internal consistency of α=0.859 was obtained.

3) Physical activity section.

It included the Spanish adaptation of the short version of the International Physical Activity Questionnaire (IPAQ-SF) (Rodríguez-Muñoz et al., 2017). It asks about physical activity in the last seven days. The first two questions asked about the number of days per week and how long they had been vigorously physically active for at least 10 minutes. The next two questions were similar but referred to moderate physical activity. The fifth and sixth questions asked about light physical activity. The last question referred to the average daily time spent sitting on a weekday. Rodriguez-Muñoz et al. (2017) validated this instrument for Spanish university students (counts: $r=0.505$, $p<0.05$; uniaxial MVPA cut-off points: $r=0.466$, $p<0.05$; triaxial MVPA cut-off points: $r=0.486$, $p<0.05$). This questionnaire is recommended for national follow-up studies (Craig et al., 2003) and has been used in previous research (Espada et al., 2023; López-Olivares et al., 2020; Ramón-Arbués et al., 2022; Úbeda-Colomer et al., 2023). In this study the physical activity variable was measured as the minutes per week that participants engaged in moderate-vigorous physical activity.

4) Emotional intelligence section.

The Trait Meta-Mood Scale (TMMS) was incorporated. This scale was designed by Salovey et al. (1995), but the version by Fernández-Berrocal et al. (2004) was used. This instrument consists of 24 questions with a Likert-type scale (1 = Strongly disagree and 5 = Strongly agree). The instrument integrates three dimensions that measure different aspects of emotional intelligence (emotional attention, emotional clarity, and emotional repair). The TMMS-24 has been used in previous studies (Arteaga-Cedeño et al., 2022; Carbonero-Martín et al., 2022; Redondo-Rodríguez et al., 2023). In this study, emotional intelligence measured as the final score obtained on the TMMS-24 (24-120 points) was used. Strong internal consistencies were obtained (TMMS-24 total: $\alpha=0.891$, emotional attention: $\alpha=0.865$; emotional clarity: $\alpha=0.911$; emotional repair: $\alpha=0.848$).

Procedure

The study was cross-sectional and descriptive-correlational. The research design was approved by the Ethics Committee of the University of Granada (3132/CEIH/2023). In addition, the ethical principles set out in the Declaration of Helsinki were followed. Participants explicitly agreed to participate voluntarily in the study.

Data Analysis

IBM SPSS 26.0 software (International Business Machines Corporation, Armonk, NY, USA) was used for the statistical analysis. This analysis had three phases: 1) descriptive-correlational statistics of the whole sample, 2) classification of the participants into clusters and 3) descriptive-correlational statistical analysis of each cluster.

At the beginning of the first phase, the data matrix was created with the results of the participants' responses. Subsequently, the data were cleaned and the results of nine participants were removed. These were eliminated because the z-scores were outside the ± 3 interval (Chan, 2004) so as not to distort the post-test results (Hair et al., 2010). The final sample was 414 students. A descriptive and correlational statistical analysis of the variables Mediterranean diet, physical activity, and emotional intelligence was then performed for the whole sample. A multiple linear regression model was also developed. The dependent variable was the Mediterranean diet and the variables physical activity and emotional intelligence acted as independent variables (initial model: Mediterranean diet $= a + \beta 1 *$ physical activity$i1 + \beta 2 *$ emotional intelligence $i2 + \varepsilon i$). This model was tested for 1) linearity between the dependent and independent variable before applying the model (using Pearson correlation analysis), 2) independence of the model residuals (using the Durbin-Watson statistic), 3) homoscedasticity (using the scatter plot between the model prediction and the residual errors), 4) normal distribution of the errors (using the Kolmogorov-Smirnov test) and 5) non-multicollinearity between the independent variables (VIF statistic).

In the second phase, the z-scores of the variables were used to perform cluster analysis (Gil, 2011). The cluster analysis was performed in two phases, using Ward's and k-means methods. These are the most common in social science studies (Gil, 2011). Ward's agglomerative hierarchical procedure was based on the squared Euclidean distance to identify the optimal number of clusters. The k-means procedure allowed the participants to be classified into the groups established in the previous phase. The MANOVA test was applied to validate the classification into clusters. The number of clusters of membership was used as an independent variable. Mediterranean diet, physical activity and emotional intelligence were used as dependent variables. The Pillai trace statistic showed the effect between variables (Tabachnick & Fidell, 2013). Levene's statistic showed equality of error variances (Tabachnick & Fidell, 2013). Tukey (Levene's p-value ≤ 0.05) and Games-Howell (Levene's p-value > 0.05) post hoc tests were also applied.

In the third phase, the descriptive study of the variables of each of the clusters was carried out. It was also verified that the multiple linear regression model created in the first phase of the statistical analysis was valid for each cluster.

Results

Spanish university students obtained a mean score of 5.51($\pm$2.28) on the PREDIMED questionnaire. Regarding the time spent in physical activity, it is observed that young people perform 404.26 minutes per week ($\pm$462.26) of moderate vigorous physical activity. With respect to emotional intelligence, a mean score of 86.96 ($\pm$13.52) was obtained. There are positive and significant correlations between the Mediterranean diet and the rest of the variables. Table 1 shows other descriptive-correlational statistics of the participants.

Table 1.
Descriptive-correlational statistics of the research variables.

	M (SD)	CI 95%	K-S	Skewness	Kurtosis	Z-scores	2	3
1. MD	5.51 (2.28)	5.29 / 5.73	***	- 0.15	- 0.26	0.00 (1.00)	0.24**	0.19**
2. PA	404.26(462.26)	360.07/448.45	***	1.59	3.02	-0.06 (0.88)	-	0.08
3. EI	86.96 (13.52)	85.65 / 88.26	***	-0.12	0.06	0.02 (0.98)	-	-

Note: Mediterranean diet (MD); Physical activity (PA); Emotional intelligence (EI); Kolmogorov-Smirnov (K-S); p≤0.01 (**); p≤0.001 (***).

Table 2 presents the statistics of the multiple linear regression model. The variables of physical activity and emotional intelligence have been used as predictors of the Mediterranean diet.

Table 2.
Regression results for the whole sample. Predictors of the Mediterranean diet.

MD	β	SE	p-valor	VIF	R^2	Adjusted R^2	RSE	F	D-W	K-S error
PA	0.001	0.000	<0.001	1.007	0.084	0.080	2.186	18.957***	1.932	0.039#
EI	0.029	0.008	<0.001	1.007						

Note: Mediterranean diet (MD); Physical activity (PA); Emotional intelligence (EI); Residual Standard Error (RSE); Durbin-Watson (D-W); Kolmogorov-Smirnov (K-S); p≤0.001 (***); p>0.05 (#).

The regression model explains approximately 8.4% of the variance in the Mediterranean diet score. When adjusted for the number of predictors the explanation is reduced to 8%. It suggests the proposed predictors are appropriate and influence the Mediterranean diet. Despite this there is a significant amount of variance that remains unexplained. A positive relationship was observed between Mediterranean diet scores and physical activity (r=0.21, p<0.01). Each one-minute per week increase in moderate-vigorous physical activity is related to a 0.21-point increase in the Mediterranean diet score. A positive relationship was observed between Mediterranean diet and emotional intelligence (r=0.19; p<0.01). This implies that each one-point increase in the emotional intelligence score is related to a 0.19-point increase in the Mediterranean diet score. The final model obtained was Mediterranean diet = 2.536+0.001*physical activity+0.029*emotional intelligence.

By analyzing the matrix of squared Euclidean distances, the clustering history and the dendrogram resulting from Ward's method, it was decided to select three clusters. The k-means method was applied to divide the participants into each of the three clusters. Participants in cluster 1 have mean scores of 6.69(±1.56) in Mediterranean diet, 621.45(±447.24) minutes of physical activity and 79.04 (9.08) in emotional intelligence. The mean scores of the participants in group 2 are: 6.77(±1.82) in Mediterranean diet, 421.88(±399.66) minutes/week of physical activity and 100.51(±8.20) points in emotional intelligence. On the other hand, these mean scores for group 3 participants are: 3.46(±1.55) points in Mediterranean diet, 128.24(±176.59) minutes/week of physical activity and 82.51(±10.67) points in emotional intelligence. Table 3 shows the descriptive statistics for each group.

Table 3.
Descriptives of the three k-means clusters.

	N (%)			Age	Mediterranean diet		Physical Activity		Emotional Intelligence	
	Total	Male	Female		Count	z-scores	Min/week	z-scores	Count	z-scores
Cluster 1	128 (30.92)	51 (39.8)	77 (60.2)	21.05 (3.61)	6.69 (1.56)	0.51 (0.69)	635.85 (568.24)	0.47 (0.98)	79.06 (13.08)	-0.59 (0.67)
Cluster 2	132 (31.88)	39 (29.5)	93 (70.5)	20.81 (2.17)	6.77 (1.82)	0.55 (0.80)	433.92 (520.66)	0.04 (0.86)	99.53 (12.20)	1.00 (0.61)
Cluster 3	154 (37.20)	35 (22.7)	119 (77.3)	20.64 (2.80)	3.46 (1.55)	-0.91 (0.68)	142.44 (297.59)	-0.60 (0.38)	81.53 (14.67)	-0.33 (0.79)

The classification in the three clusters was validated with the MANOVA test due to the values of the Pillai trace (F (6, 820) = 159.101; p ≤ 0.001; f = 1.00). The results obtained in Levene's test were significant for physical activity (F(2,411) = 43.54; p < 0.001) and emotional intelligence (F(2,411) = 3.16; p = 0.04), therefore Tukey's post hoc was applied. For the Mediterranean diet, non-significant values were obtained (F(2,411) = 1.62; p = 0.20), so the Games-Howell post hoc was used. Table 4 shows the statistics derived from the post hoc multiple comparisons according to clusters and variables. Significant differences were found between the mean scores of all clusters for each of the three research variables. No differences were found for the Mediterranean diet between clusters 1 and 2.

Table 4.
Post hoc multiple comparisons of variables in the clusters.

	Cluster (I)	Cluster (J)	Mean Difference (I-J)	Error deviation	Sig.	Confidence Interval (95%)	
						Lower Limit	Upper Limit
MD	1	2	-0.04	0.09	0.91	-0.26	0.18
	1	3	1.42	0.08	<0.001	1.23	1.61
	2	3	1.46	0.09	<0.001	1.25	1.67
PA	1	2	0.43	0.09	<0.001	0.21	0.65
	1	3	1.07	0.09	<0.001	0.85	1.28
	2	3	0.64	0.09	<0.001	0.42	0.85
EI	1	2	-1.59	0.09	<0.001	-1.79	-1.38
	1	3	-0.26	0.08	0.01	-0.45	-0.06
	2	3	1.33	0.08	<0.001	1.14	1.53

Note: Mediterranean diet (MD); Physical activity (PA); Emotional intelligence (EI).

Table 5 shows the descriptive-correlational statistics for each research variable according to the cluster of membership. In the first cluster, there are significant relationships

between Mediterranean diet and physical activity (r=-0.31; p<0.01) and between physical activity and emotional intelligence (r=0.31; p<0.01). In the second cluster, there is a negative and significant relationship between Mediterranean diet and emotional intelligence (r=-0.21; p<0.01).

Table 5.
Descriptive-correlational statistics between variables in each cluster.

		K-S	Skewness	Kurtosis	2	3
Cluster 1	MD	0.14***	0.06	-0.57	-0.31**	0.10
	PA	0.08*	0.58	-0.20	-	0.31**
	EI	0.15***	-0.68	-0.05	-	-
Cluster 2	MD	0.13***	0.01	-0.46	-0.03	-0.21**
	PA	0.15***	0.95	0.29	-	0.06
	EI	0.10***	0.51	-0.46	-	-
Cluster 3	MD	0.19***	-0.60	0.11	-0.02	0.02
	PA	0.27***	1.39	1.32	-	-0.02
	EI	0.07	-0.38	-0.02	-	-

Note: Mediterranean diet (MD); Physical activity (PA); Emotional intelligence (EI); Kolmogorov-Smirnov (K-S); p ≤ 0.001 (***); p ≤ 0.01 (**); p ≤ 0.05 (*).

Subsequently, the multiple linear regression model was applied to each cluster to determine the prediction of the Mediterranean diet. The final model obtained for cluster 1 was: Mediterranean diet = 7.355 - 0.001*physical activity + 0.037*emotional intelligence. This model explains 12.3% of the variance of the Mediterranean diet score, adjusted for the number of predictors. There is a negative relationship between Mediterranean diet and physical activity (r=-0.31; p<0.01), implying that each minute of physical activity is associated with a 0.31-point decrease in dietary adherence. Likewise, for cluster 2 the model was: Mediterranean diet = 11.367 - 0.046*emotional intelligence. This model explains 4.3% of the variance, as there is only one predictor. There is a negative relationship between dietary adherence and emotional intelligence (r=-0.21; p<0.05), implying that each point of emotional intelligence is associated with a 0.21-point decrease in dietary adherence. In contrast, no model with these variables was found for cluster 3. Table 6 shows the statistics of the regression models.

Table 6.
Regression results for each cluster. Predictors of the Mediterranean diet.

Cluster	MD	β	SE	p-valor	VIF	R^2	Adjusted R^2	RSE	F	D-W	K-S error
1	PA	-0.001	0.000	<0.001	1.106	0.136	0.123	1.462	9.875***	1.875	0.056#
	EI	0.037	0.015	0.015	1.106						
2	EI	-0.046	0.019	<0.001	1.00	0.043	0.035	1.786	5.771***	2.164	0.049#

Note: Mediterranean diet (MD); Physical activity (PA); Emotional intelligence (EI); Residual Standard Error (RSE); Durbin-Watson (D-W); Kolmogorov-Smirnov (K-S); p≤0.001 (***); p>0.05 (#).

Discussion

The research carried out had the following objectives: 1) To classify Spanish university students of Education Degrees according to their levels of Mediterranean diet, physical activity and emotional intelligence; 2) To analyze the influence of physical activity and emotional intelligence as determinants of Mediterranean diet according to lifestyle profiles.

The mean adherence score of the students to the Mediterranean diet is 5.51 points (±2.28), so it can be considered as average adherence (Schröder et al., 2011). This is higher than that of Law, Social Work and Psychology students (4.54±3.28) (García-Pérez et al., 2023), but lower than that of teacher training students in Madrid (5.9±2.4) (Ejeda-Manzanera et al., 2021) and male (5.9±2.3) and female (5.6±2.0) students in Huelva (López et al., 2019). The mean emotional intelligence score is 86.96 (±13.52), which is a high score, as the maximum possible score is 120 points. Adherence to the Mediterranean diet is positively related to physical activity and emotional intelligence, which is related to other previous studies (Carrillo-López et al., 2021; García-Pérez et al., 2023; Melguizo et al., 2021; Melguizo-Ibáñez et al., 2023b; Tárraga et al., 2021). Furthermore, physical activity and emotional intelligence predict 8% of adherence to the Mediterranean diet.

All university students were classified into three clusters according to their levels of Mediterranean diet, physical activity and emotional intelligence. This classification was validated using the MANOVA test, obtaining significant statistics. The number of clusters is similar to that obtained by Sanz-Martín et al. (2023b) for the adolescent population of Soria (Spain). This research measured moderate-vigorous physical activity, screen time and sleep time (Sanz-Martín et al., 2023b). Each cluster of the study conducted with university students includes a similar percentage of participants (Cluster 1: 30.92%; Cluster 2: 31.88%; Cluster 3: 37.20%). In addition, in each cluster there are different mean values for the variables, as well as for the correlations between them.

The members of the first cluster are characterized by having the second highest score in Mediterranean diet, the second highest in moderate-vigorous physical activity and the worst in emotional intelligence. The mean diet score of this cluster (6.69±1.56) is higher than that obtained by García-Pérez et al. (2023), Ejeda-Manzaneda and Rodrigo-Vega (2021) and López et al. (2019). Negative and moderate correlations were found between dietary adherence and physical activity. Positive and moderate correlations were also found between physical activity and emotional intelligence. The relationship between dietary adherence and physical activity is the opposite of that found in other studies (Carrillo-López et al., 2021; García-Pérez et al., 2023; Tárraga et al., 2021). The positive relationship between physical activity and emotional intelligence is similar to those shown in previous studies (Omar et al., 2012; Shuk-Fong et al., 2009; Zysberg & Hemmel, 2018). In addition, 13.6% of the participants' Mediterranean diet is predicted by the levels of physical activity and emotional intelligence, being the cluster in which the model has the highest predictive capacity.

Students in the second cluster have the highest mean Mediterranean diet adherence score (6.69±1.56). Like the students in the first cluster, those in the second cluster have a higher score than those found in the studies of García-Pérez

et al. (2023), Ejeda-Manzaneda and Rodrigo-Vega (2021) and López et al. (2019). It is cluster with the second highest score in weekly physical activity and the highest score in emotional intelligence. There is a slight negative and significant correlation between diet and emotional intelligence. This relationship agrees with the findings of Sanz-Martín et al. (2023b) in Spanish youth. In this group no regression model including physical activity was found. In this one, emotional intelligence is the predictor of 4.3% of the variance of adherence to the Mediterranean diet.

In the third cluster, the mean age is the lowest of the three groups. This is the group with the highest number of participants and the lowest percentage of males. The mean scores for diet and physical activity are the lowest of all groups. The mean score for emotional intelligence is the second highest. The relationship between adherence to the Mediterranean diet and the other variables is not significant and approaches zero. In addition, there is no regression model to predict the mean diet adherence score.

This study has shown that moderate-vigorous physical activity and emotional intelligence are two determinants of adherence to the Mediterranean diet in Spanish undergraduate students of Education. The Mediterranean diet seems to be influenced by other factors, which could be better predictors, not having been considered in the study. These factors could directly or indirectly enhance the relationship between diet and physical and emotional variables. For example, it could be that sex positively influences physical activity levels and indirectly influences diet levels. As reported in the scientific literature, physical activity levels are higher in men than in women (Flores et al., 2021; Guthold et al., 2020; Sánchez-Castillo et al., 2019). It is possible that the sex of the participant does not directly influence the Mediterranean diet, as shown by the studies of Tárraga et al. (21) and Herrera-Ramos et al. (2023), nor emotional intelligence (Sanz-Martín et al., 2023a).

Another factor that may have influenced the results of the study is the time at which the students responded to the questionnaire. About 60% of the students presented medium burnout and about 15% severe burnout (Pellicer et al., 2023). During the months of May and June, Spanish students take final exams. These exams force them to increase their dedication to study, which increases academic burnout (Pellicer et al., 2023). These high levels of burnout during exam periods would justify that students' levels of eating and physical activity are lower than usual (Pellicer et al., 2023. This situation of low availability of free time and high levels of burnout would be aggravated by the fact that many students combine their studies with work (Finkel & Barañano, 2014; Melguizo-Ibáñez et al., 2023a).

Conclusions

Before concluding, it is necessary to note that the research objectives and hypotheses have been answered. With regard to the latter, these have been answered positively.

Students' adherence to the Mediterranean diet was found to be low (hypothesis 1).

Cluster analysis is an appropriate method to use in epidemiological studies, since it allows us to study in detail the values and relationships of the research variables in homogeneous groups. This has made it possible to verify that university students are classified into three clusters according to their levels of adherence to the Mediterranean diet, physical activity and emotional intelligence. These levels of the three variables vary from one group to another, as well as with respect to the general values of the entire population (hypothesis 2).

According to the initial regression model proposed, 8% of the adherence to the Mediterranean diet of Spanish university students of Education Degrees is predicted by moderate-vigorous physical activity and emotional intelligence (hypothesis 3). In addition, dietary adherence is positively and significantly related to physical activity and emotional intelligence. In addition, the regression model is also valid for cluster 1.

Although participants in all clusters can improve their levels of healthy habits, priority should be given to health promotion actions aimed at students in the third cluster, since their levels of adherence to diet and physical activity are low and significantly lower than those of the other groups. In addition, it would be advisable to carry out further research on the determinants of adherence to the diet of the participants in this group, since physical activity and emotional intelligence do not have a significant relationship, nor do they predict it.

The study conducted has several limitations. The first limitation refers to the type of research design. A cross-sectional study was carried out, so that healthy habits were asked about at a specific moment in time. To compensate for this limitation, the context of application of the study, the procedure followed and the characteristics of the sample have been detailed. The second limitation derives from the type of sampling used. An attempt was made to cover the population of undergraduate students in Education, without any type of sampling. It was decided to include all participants who responded to the questionnaire. Finally, there is a limitation derived from the instrument used to measure physical activity. A questionnaire was used, which is less precise than others. This limitation has been compensated for because the questionnaire used has been validated for the participant population and used in numerous previous investigations. In addition, this instrument has been widely used in epidemiological studies (Corder et al., 2008). It allows information to be collected from a large number of participants in a short time and at an acceptable cost (Dishman et al., 2004).

For future studies it would be necessary to include more healthy habits. This would allow us to know the inclusion of other determinants of the Mediterranean diet. These factors could be better predictors of adherence to the diet than moderate-vigorous physical activity and emotional intelligence. Further studies would be advisable to classify different population groups according to their healthy habits. This would open up a new field of international research and facilitate the design of more effective health promotion proposals. Health promotion proposals aimed at university students should also

be developed, especially focusing on the Mediterranean diet.

These proposals to promote a healthy diet should be guided by a new social and individual approach (Antonopoulou et al., 2020; Messing et al., 2019). At the societal level, it would be necessary to create a strong public health infrastructure (Aridi et al., 2022) and improve public policies (Kris-Etherton et al., 2020). This approach should include all educational and organizational health agents and structures (Hills et al., 2015; Stanulewicz et al., 2020). Improving adherence to the Mediterranean diet should include information campaigns and nutritional education proposals (González-García et al., 2020). This would be achieved by including elements of awareness (Kymäläinen et al., 2021) and food safety (Leung et al., 2019). Students should also have access to counseling on healthy habits (Shirley et al., 2010), which could be provided by mentors (Martin et al., 2013). This role could be played by university students of nutrition, medicine, physical activity, and sports science (Martin et al., 2013).

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