

Original Research

Adherence to the Mediterranean diet and its association with self-concept and academic and physical domain in education science students: a cross-sectional study

Eduardo Melguizo-Ibáñez¹, Félix Zurita-Ortega¹, Georgian Badicu²,
José Luis Ubago-Jiménez¹, Wilhelm Robert Grosz^{2,*}, Gabriel González-Valero³

¹Department of Didactics of Musical, Plastic and Corporal Expression, University of Granada, 18071 Granada, Spain

²Department of Physical Education and Special Motricity, Faculty of Physical Education and Mountain Sports, Transilvania University of Braşov, 500068 Braşov, Romania

³Department of Didactics of Musical, Plastic and Corporal Expression, Melilla Campus, University of Granada, 52005 Melilla, Spain

*Correspondence: wilhelm.grosz@unitbv.ro (Wilhelm Robert Grosz)

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Abstract

Background: Mediterranean diet is considered to be a healthy and convenient diet model due both to its physical and mental benefits. Therefore, the aim of the present research is to detail diet pattern, academic performance and self-concept, anxiety and physical activity practice in university students, as well as to establish relationships between the variables. **Methods:** A descriptive and cross-sectional study was carried out with a sample of 558 undergraduates at the University of Granada, using an Ad Hoc Socio-Academic Questionnaire, the PREDIMED, Self-concept Form-5 and BAI tests to collect the data. **Results:** The results obtained show that a high percentage of the sample practices more than three hours of physical activity per week, needs to improve their diet, reflects low levels of anxiety and shows higher scores in academic self-concept. **Conclusions:** A positive adherence to the Mediterranean diet shows improvements in academic performance and in the physical, social and academic aspects of "self-concept".

Keywords: mediterranean diet; anxiety; physical activity; self-concept; academic performance; sex

1. Introduction

Nowadays, the university stage plays a key role in the lives of students, however, some changes occur that have a detrimental effect on the health of young people [1–3]. These changes include an increase in exam anxiety [4], which can lead to a negative image of exams [5] and affect academic performance [6] and a low adherence to a healthy dietary pattern regardless of sex [7].

The Mediterranean diet is characterized by a higher intake of monounsaturated fatty acids, such as olive oil, instead of saturated fats [8,9] and by foods such as bread and its derived products, fruits, vegetables, nuts and a greater intake of blue fish over red meat [10]. A positive adherence to this dietary pattern leads to a number of benefits such as the prevention of cardiovascular diseases [11], different types of cancer [12] as well as cognitive-related diseases such as Alzheimer's [13] and a further increase in life expectancy [9,14,15] however, not only health benefits are found [16]. It also has a positive effect on other areas such as emotional control [17] and self-concept [18].

Self-concept is defined as a mental representation of oneself in interacting with the external environment [19]. A positive adherence to the Mediterranean diet with a low consumption of alcoholic drinks and tobacco consumption, claim to have an effective perception of mental body image, as well as with academic performance [20,21]. Fur-

thermore, diets with an excess of sugars and fats are positively associated with the development of cardiovascular diseases such as overweight and obesity [18], therefore, they have a worse physical conception of students and sedentary lifestyles, which are detrimental to students' health [22].

Physical activity plays a key factor for healthy lifestyles, the World Health Organization (WHO) establishes that, for adults, physical activity should be 150 minutes per week of moderate-intensity aerobic exercise [23]. Monitoring a positive approach to the WHO [23], combined with a healthy diet, provides a large number of health benefits, having found how an active and healthy lifestyle of regular physical activity and a diet based on healthy foods can increase life expectancy by three to four years by average [24] and may prevent illnesses related to psychological well-being caused by academic or work-related stress and anxiety [25], such as depression or circadian disorders [4,26].

Anxiety also represents a vital factor in university students' academic life, as it can increase negatively due to attempts to achieve the greatest possible academic performance [27,28], impacting negatively on physical and mental health. In this context, dietary change may play a key role, as a dietary change in favor of nuts, fruits, vegetables and oily fish reduced anxiety levels, mood swings and cop-



ing with academic challenge [29]. The emotional aspect is also affected by anxiety, since high levels of this disruptive state can lead to a process of overeating, through which this emotion is channeled, resulting in a worsening of the quality of the dietary pattern followed [30].

Finally, a worsening dietary pattern can affect young people's academic performance, because a healthy diet helps students to deal more positively with a test of an evaluative kind [31,32]. Also, a higher intake of nuts, vegetables and fruits in their dietary habits reflects an improvement in performance towards academic tasks, with better results obtained by those who follow a healthy dietary pattern compared to students who have a higher intake of pre-cooked meals with a high calorie level and a higher consumption of alcoholic and sugary drinks [33].

Therefore, in view of the above, do students at the Faculty of Education have a good adherence to a healthy dietary pattern, and does adherence to the Mediterranean diet play a key role in the control of anxiety, the development of self-concept and academic performance, and does anxiety have a negative impact on self-concept and academic performance?

Finally, the aim of the study was to determine levels of adherence to the Mediterranean diet, gender, anxiety, physical activity, self-concept and academic performance, to establish relationships between adherence to the Mediterranean diet and psychosocial and academic factors and to develop an explanatory model of the Mediterranean diet adherence and its relationship with anxiety, physical activity time, self-concept and average mark in university students.

2. Materials and methods

2.1 Design and participants

A non-experimental (ex post facto), descriptive and cross-sectional study was carried out on a sample of university students belonging to the Faculty of Educational Sciences of the University of Granada. The ages of the participants ranged from 18 to 31 years ($M = 25.09 \pm 6.22$). Respondents participated on a voluntary basis after receiving a detailed explanation of the objectives and nature of the study, giving written informed consent. A total of 27 questionnaires were eliminated as they were not properly completed, so the final sample consisted of a total of 558 students, of whom 418 were male (74.9%) and 140 were female (25.1%). Finally, a sampling error of 0.05 was assumed, taking into account a random sampling by natural groups [34], in this case, a sampling error of 0.043 with a confidence interval of 95% was obtained. Finally, the Kolmogorov-Smirnov test was used to establish the normality of the sample in order to establish the use of parametric or non-parametric tests. In this case, the results of this test showed a normal distribution and parametric tests were used.

2.2 Instruments

In order to collect socio-demographic and academic variables, an *ad hoc* questionnaire was used to compile variables such as sex, age and student's average academic record, with responses of "excellent" (9 to 10 points), "notable" (7 to 8.99 points) and "pass" (5 to 6.99 points).

The PREDIMED questionnaire [35] was used to obtain the Mediterranean diet variable. This instrument is composed by 14 items, where once all of them have been answered, a final score is obtained, which categorizes the participants' responses into three levels: low adherence (≤ 7), medium adherence (8–10) and high adherence (> 10) [36]. For this study, Omega's Alpha obtained a score of "0.791".

To collect the variable related to levels of anxiety, the Beck Anxiety Inventory [37] was used, specifically the version adapted to Spanish [38]. The questionnaire consists of 21 items (In the last week I have felt unable to relax), which are rated on a four-point Likert-type scale ranging from 0 (Not at all) to 3 (Severely), with the final test score ranging from 0 to 63. In order to obtain the final score of the test, the total sum of the items has to be added up, so depending on the score obtained, the participants' responses are categorized into one of the following levels: minimal anxiety (0 to 9 points), mild anxiety (10 to 18 points), moderate anxiety (19 to 29 points) and severe anxiety (30 to 63 points) [38]. In this research, Omega's alpha score was 0.936.

To assess the self-concept variable, we used the Self-Concept Form 5 test [39]. This consists of a total of 30 items, which are assessed using a Likert-type scale with scores ranging from 1 (Never) to 5 (Always). Each dimension assessed by this questionnaire is comprised of the following items: Academic Self-Concept (1, 6, 11, 16, 21 and 26) (I do my school work well); Social Self-Concept (2, 7, 12, 17, 22 and 27) (I make friends easily); Emotional Self-Concept (3, 8, 13, 18, 23 and 28) (I am afraid of some things); Family Self-Concept (4, 9, 14, 19, 24 and 29) (I am happy at home); Physical Self-Concept (5, 10, 15, 20, 25 and 30) (I take care of myself physically). In this study Omega's Alpha obtained a score of "0.810".

Finally, to measure the degree of physical activity (i.e., low, moderate and high), the International Physical Activity Questionnaire Short Form (IPAQ-SF) [40] was used to collect the time (in minutes) and frequency (in days) spent in activities of different intensities (During the last 7 days, on how many days did you walk for at least 10 minutes at a time?). Finally, the Omega's Alpha obtained a value of "0.845".

2.3 Procedure

A bibliographic review was carried out in order to understand the problem addressed. Afterwards, the Department of Didactics of Musical, Plastic and Corporal Expression of the University of Granada created a Google form with the specified instruments, describing the objective of

the study, as well as the acceptance of participation by sending the form. Because the data collection coincided with a high period of COVID-19 infections, telematic data collection was used. Also, to check that the questions were not randomly filled in, two questions were duplicated to ensure the reliability of the answers. Twenty-seven questionnaires had to be deleted because they were not completed in a satisfactory manner. The ethical principles of research established by the Declaration of Helsinki [41] were followed at all times, guaranteeing anonymity and respecting the rights of the participants. In addition, the Ethics Committee of the University of Granada approved the research (1230/CEIH/2020).

2.4 Data analysis

Data were analyzed using IBM SPSS Statics 25.0 statistical software (SPSS, IBM, SPSS Statistics, v.25.0 Chicago, IL, USA). The Kolmogorov-Smirnov test was used to check the normality and homogeneity of the variables. For the descriptive analysis, a study of frequencies and means was carried out, while for the comparative analysis contingency tables, T-Students for independent samples and analysis of variance (ANOVA) of a single factor were used, finding statistically significant differences by means of Pearson's Chi-Square test, establishing the significance level at 0.05. A one-way analysis of variance (ANOVA) was also performed with the Bonferroni post-hoc test for the analysis between physical-sport variables. The magnitude of the differences (effect size; ES) was obtained using Cohen's *d*. Their interpretation was established as null (0–0.19), low (0.20–0.49), moderate (0.50–0.79), or high (≥ 0.80).

To create the multigroup structural equation model, the IBM SPSS Amos 26.0 (IBM SPSS Amos. IBM Corp, Armonk, NY, USA) software was used which allows to establish relationships between the variables that make up the theoretical model (Fig. 1). In this case, the proposed model consists of eight endogenous variables (Academic self-concept, Physical self-concept, Familiar self-concept, Emotional self-concept, Average Mark, Physical Activity and Anxiety) and one exogenous variable (Mediterranean Diet Adherence). For the endogenous variables causal explanations were made by considering observed associations between indicators and measurement reliability, therefore, measurement error of observable variables was included in the model and could be controlled and interpreted as multivariate regression coefficients. One-way arrows represented lines of influence between latent variables and were interpreted from regression weights. A significance level of 0.05 was established using Pearson's Chi-square test.

Lastly, the model fit was evaluated after estimating the different parameters of the model. The goodness of fit should be assessed on the basis of Chi-square, whose associated *p*-values, not significant, indicate a good model fit, Comparative Fit Index (CFI; values above 0.95 indicate a

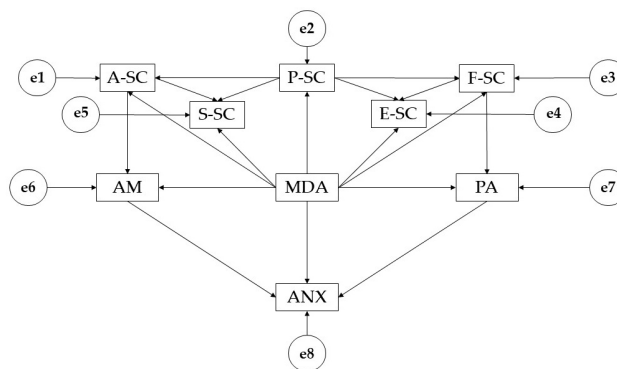


Fig. 1. Theoretical model proposed. A-SC, Academic self-concept; S-SC, Social self-concept; P-SC, Physical self-concept; E-SC, Emotional self-concept; F-SC, Familiar self-concept; MDA, Mediterranean Diet Adherence; AM, Average Mark; PA, Physical Activity; ANX, Anxiety.

good model fit), Goodness of Fit Index (GFI; values above 0.90 indicate a good model fit), Incremental Fixity Index (IFI; values above 0.90 indicate a good model fit) and Root Mean Square Approximation (RMSEA; values below 0.1 indicate a good model fit) [42,43].

3. Results

Table 1 shows that 56.8% have medium adherence to the Mediterranean diet, followed by 39.8% with high adherence and only 3.4% with low dietary quality. It is also observed that 35.9% of the sample had mild levels of anxiety, followed by 26.5% with moderate levels, 21.9% with minimal levels and only 15.7% with severe anxiety. Following with academic record average, 65.7% obtained a grade of “notable”, 21.7% a “pass” and 12.5% an “excellent”. In relation to the practice of physical activity it is observed that 46.4% have a high level of physical exercise, 29.9% show a medium level and only 23.7% reflect a low level of physical exercise. Finally, in self-concept, it is observed that the highest score is academic ($M = 3.88$), followed by family ($M = 3.43$), social ($M = 3.42$), physical ($M = 3.12$) and emotional ($M = 3.07$).

Statistically significant differences between the variable's anxiety levels and sex ($p \leq 0.001$) are also observed in Table 1, as it is evident in the minimum anxiety level as the females (32.1%) reflect higher scores than males (18.9%). However, moderate anxiety level shows higher scores for males (30.6%) than females (13.6%). Statistically significant differences ($p = 0.001$) were also found when relating the variables sex and physical activity practice. It is observed that the female sex shows a high level of physical activity (60.7%) compared to the male sex (41.9%). Finally, statistically significant differences were found when correlating sex and self-concept, showing higher scores for academic ($p = 0.001$) and emotional ($p \leq 0.001$) self-concept for males ($M = 3.94$) and ($M =$

Table 1. Characteristics of study sample according to sex of participants.

		Total (n = 558)	Females (n = 140)	Males (n = 418)	<i>p</i>
MDA	Optimum diet	39.8% (n = 222)	21.2% (n = 47)	78.8% (n = 175)	0.175
	Medium	56.8% (n = 317)	28.1% (n = 89)	71.9% (n = 228)	
	Low diet	3.4% (n = 19)	21.1% (n = 4)	78.9% (n = 15)	
ANX	Minimal	38.7% (n = 110)	37.0% (n = 80)	63.0% (n = 136)	<0.001
	Mild	26.5% (n = 180)	16.2% (n = 24)	83.8% (n = 124)	
	Moderate	17.2% (n = 133)	16.7% (n = 16)	83.3% (n = 80)	
	Severe	17.6% (n = 79)	20.4% (n = 20)	79.6% (n = 78)	
AM	Pass	21.7% (n = 109)	25.7% (n = 36)	19.9% (n = 83)	0.322
	Notable	65.7% (n = 330)	62.1% (n = 87)	68.2% (n = 285)	
	Excellent	12.5% (n = 63)	12.1% (n = 17)	12% (n = 50)	
PA	Low	23.7% (n = 119)	15.7% (n = 22)	25.4% (n = 106)	0.001
	Moderate	29.9% (n = 150)	23.6% (n = 33)	32.8% (n = 137)	
	High	46.4% (n = 233)	60.7% (n = 85)	41.9% (n = 175)	
SC	Academic	M = 3.88 SD = 0.752	M = 3.70 SD = 0.739	M = 3.94 SD = 0.747	0.001
	Social	M = 3.42 SD = 0.390	M = 3.42 SD = 0.452	M = 3.42 SD = 0.367	0.999
	Emotional	M = 3.07 SD = 0.803	M = 2.76 SD = 0.786	M = 3.17 SD = 0.784	<0.001
	Familiar	M = 3.43 SD = 0.42	M = 3.39 SD = 0.510	M = 3.45 SD = 0.398	0.134
	Physical	M = 3.12 SD = 0.812	M = 3.41 SD = 0.92	M = 3.02 SD = 0.747	<0.001

MDA, Mediterranean Diet Adherence; ANX, Anxiety; AM, Average Mark; PA, Physical Activity; SC, Self-concept.

3.17) than females, except for physical self-concept ($p \leq 0.001$), where females ($M = 3.41$) had higher scores than males ($M = 3.02$).

As shown in Table 2, statistically significant differences were obtained when correlating variables adherence to Mediterranean diet and physical activity practice ($p < 0.001$). It is noteworthy that students showing a high level of physical activity and a low adherence to the Mediterranean diet (5.3%) are much lower compared to those students showing an optimal adherence to the Mediterranean dietary pattern. Likewise, a higher percentage of participants with a low level of physical activity and low diet quality (47.4%) is also observed compared to those with optimal adherence (14%).

Table 2. Relationship between physical activity and adherence to Mediterranean diet ($p < 0.001$).

		Physical activity		
		Low	Moderate	High
Low diet	Count	9	9	1
	% MDA	47.4%	47.4%	5.3%
	% PA	7.0%	5.3%	0.4%
Medium	Count	88	97	132
	% MDA	27.8%	30.6%	41.6%
	% PA	68.8%	57.1%	50.8%
Optimum diet	Count	31	64	127
	% MDA	14.0%	28.8%	57.2%
	% PA	24.2%	37.6%	48.8%

In Table 3, statistically significant differences were also found when linking adherence to the Mediterranean diet and mean score ($p = 0.001$). It can be seen that those students who reflect an excellent average and a low diet quality (73.7%) are higher compared to students who need improvement (62.8%). Likewise, it is also shown that students who show an average of pass and need to improve their dietary pattern (27.4%) are better in comparison with students who have an optimal diet (13.1%).

Table 3. Relationship between adherence to the Mediterranean diet and average mark ($p = 0.001$).

		Average mark		
		Pass	Notable	Excellent
Low diet	Count	3	14	2
	% MDA	15.8%	73.7%	10.5%
	% AM	2.5%	3.8%	3.0%
Medium	Count	87	199	31
	% MDA	27.4%	62.8%	9.8%
	% AM	73.1%	53.5%	46.3%
Optimum diet	Count	29	159	34
	% MDA	13.1%	71.6%	15.3%
	% AM	24.4%	42.7%	50.7%

Table 4. Relationship between self-concept and adherence to Mediterranean diet.

		M	SD	F	<i>p</i>	ES (d)	95% CI
ACADEMIC	Low diet	3.86	0.629				
	Medium	3.76	0.797	10.795	<0.001	0.408 ^a	[0.235; 0.581]
	Optimum diet	4.06	0.657				
SOCIAL	Low diet	3.24	0.428				
	Medium	3.41	0.405	3.355	0.036	NP	NP
	Optimum diet	3.46	0.359				
EMOTIONAL	Low diet	3.11	0.718				
	Medium	3.09	0.811	0.316	0.729	NP	NP
	Optimum diet	3.03	0.802				
FAMILIAR	Low diet	3.50	0.328				
	Medium	3.39	0.467	4.038	0.018	0.233 ^a	[0.061; 0.405]
	Optimum diet	3.49	0.370				
PHYSICAL	Low diet	2.69	0.626				
	Medium	3.00	0.803	13.661	<0.001	0.822 ^b	[0.348; 1.296]
	Optimum diet	3.33	0.793				

Note 1: ^a Differences between average adherence and optimal diet. ^b Differences between low quality and optimal diet.

Table 4 shows significant differences ($p \leq 0.05$) in adherence to the Mediterranean diet in relation to academic self-concept, with higher scores being observed in students with an optimal level ($M = 4.06$). Likewise, the same tendency is observed in social self-concept ($p = 0.036$) ($M = 3.46$) and physical self-concept ($p < 0.001$) ($M = 3.33$) as above. However, differences were also found in family self-concept ($p = 0.018$), with better scores being obtained by students with a low diet quality ($M = 3.50$).

Regarding Table 5, no significant differences were obtained when correlating adherence to the Mediterranean diet and anxiety ($p = 0.450$).

Table 5. Relationship between anxiety and adherence to Mediterranean diet ($p = 0.149$).

		Anxiety levels			
		Minimal	Mild	Moderate	Severe
Low diet	Count	4	8	6	1
	% MDA	21.1%	42.1%	31.6%	5.3%
	% ANX	1.9%	5.4%	6.3%	1.0%
Medium	Count	121	86	49	61
	% MDA	38.2%	27.1%	15.5%	19.2%
	% ANX	56.0%	58.1%	51.0%	62.2%
Optimum diet	Count	91	54	41	36
	% MDA	41.0%	24.3%	18.5%	16.2%
	% ANX	42.1%	36.5%	42.7%	36.7%

Focusing on the proposed model and developed through the variables assessed in a sample of undergraduate students between 18 and 24 years of age showed a good fit for all indices. In this case, the Chi-square analysis showed

a significant p -value ($X^2 = 75.650$; $df = 18$; $pl = 0.000$), nevertheless, these data cannot be interpreted in an independent way due to the influence of sample and susceptibility [44], so other standardised fit indices have been employed. The comparative fit index (CFI) analysis obtained a value of 0.910, the normalized fit index (NFI) analysis had a value of 0.907, the incremental fit index (IFI) was 0.903 and Tucker-Lewis Index (TLI) had a value of 0.934, the root means square error of approximation analysis (RMSEA) also obtained a value of 0.059. Finally, the value obtained for the SRMR was 0.1225 and the Q2 obtained a value of 0.410.

Table 6 and Fig. 2 show the regression weights of the theoretical model, with relationships statistically significant at $p < 0.001$. In this case, adherence to the Mediterranean diet is positively associated with physical self-concept ($r = 0.240$), academic self-concept ($r = 0.075$), family self-concept ($r = 0.067$), physical activity ($r = 0.119$), grade point average ($r = 0.106$), anxiety ($r = 0.077$), social self-concept ($r = 0.057$) and emotional self-concept ($r = 0.048$).

4. Discussion

This study's aim is to describe adherence to the Mediterranean diet and the psycho-social and academic variables in relation to each other. In terms of adherence to the Mediterranean diet, more than half of the participants had an average adherence to the Mediterranean dietary pattern. This may be due to a lack of dietary control at university due to students opting for an excessive intake of proteins and fats instead of carbohydrates [16,32]. In addition, technology plays a negative role, as fast-food apps prioritise the speed of the meal over the quality and cooking of the food, which is more convenient for university students [45,46]. Likewise, the country of residence also

Table 6. The structural model for the theoretical model.

Associations between variables	R.W.				S.R.W.
	Estimations	S.E.	C.R.	<i>p</i>	Estimations
P-SC←MDA	1.539	0.264	5.841	***	0.240
A-SC← P-SC	0.310	0.038	8.232	***	0.335
F-SC←P-SC	0.094	0.023	4.171	***	0.178
A-SC←MDA	0.445	0.242	1.844	0.065	0.075
F-SC←MDA	0.227	0.145	1.569	0.117	0.067
PAT←MDA	0.751	0.267	2.811	0.005	0.119
AM←MDA	0.476	0.170	2.802	0.005	0.106
PAT←F-SC	0.012	0.079	0.152	0.879	0.006
AM←A-SC	0.339	0.029	11.847	***	0.447
ANX←MDA	0.386	0.213	1.814	0.070	0.077
S-SC←A-SC	0.165	0.021	7.854	***	0.319
S-SC←P-SC	0.096	0.020	4.841	***	0.200
E-SC←P-SC	-0.336	0.041	-8.102	***	-0.340
E-SC←F-SC	0.140	0.077	1.830	0.067	0.075
S-SC←MDA	0.175	0.120	1.456	0.145	0.057
E-SC←MDA	0.305	0.262	1.162	0.245	0.048
ANX←AM	-0.112	0.047	-2.386	0.017	-0.101
ANX←PAT	-0.130	0.033	-3.913	***	-0.164

Note 1: R.W., Regression Weights; S.R.W., Standardized Regression Weights; S.E., Estimation Error; C.R., Critical Ratio. Note 2: A-SC, Academic self-concept; S-SC, Social self-concept; P-SC, Physical self-concept; E-SC, Emotional self-concept; F-SC, Familiar self-concept; MDA, Mediterranean Diet Adherence; AM, Average Mark; PA, Physical Activity; ANX, Anxiety. Note 3: *** $p < 0.001$.

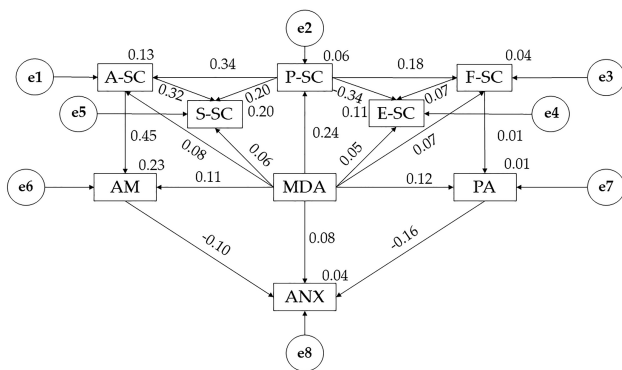


Fig. 2. Theoretical model proposed. A-SC, Academic self-concept; S-SC, Social self-concept; P-SC, Physical self-concept; E-SC, Emotional self-concept; F-SC, Familiar self-concept; MDA, Mediterranean Diet Adherence; AM, Average Mark; PA, Physical Activity; ANX, Anxiety.

plays a key role in the adherence to the Mediterranean diet, with Spanish university students showing better adherence to the Mediterranean dietary pattern than other European undergraduates [47].

Moving on anxiety, it was observed that most students showed low and light levels of anxiety; however, higher levels of anxiety were found in males than females. These

results may be due to the impact of the COVID-19 virus, which has led to increased anxiety in university students, regardless of gender [48], nevertheless, males tend to show higher levels of anxiety, due to the way they manage and channel this disruptive state [47,49]. In addition, the use of meditation plays a key role in reducing anxiety levels, as in recent years there has been an increase in the use of this type of technique in the university population to deal with anxiety generated by the academic context [49].

Following up on the variable related to physical activity, it was found that almost half of the sample showed a high level of physical activity, with the female sex spending more time doing physical activity. These results may be due to the way anxiety is channeled, as females generally tend to channel these disruptive states through physical exercise, while males tend to use techniques such as meditation [50]. However, an increase in levels of physical activity is taking place, as it generates numerous benefits for people’s physical and mental health, such as psychological satisfaction and reduced chances of suffering from cardiovascular diseases [9,51]. Looking at physical activity practice by sex, during adolescence there is a decrease in the levels of physical exercise in the male population, as they opt for sedentary activities [52,53].

According to self-concept, the male gender shows higher scores in academic and emotional self-concept, but the female gender obtains higher scores in physical self-concept. These results may be due to the fact that the female gender has greater physical capacity and attaches greater importance to this area than to others [54]. However, the male population obtains higher emotional and academic scores, due to emotional competence, which is higher for the male gender [48]. Likewise, greater emotional competence brings numerous benefits in the academic area, as it tends to generate negative emotions [46,48].

The relational analysis revealed positive relationships between time spent in physical activity and the Mediterranean diet, with better adherence to this dietary pattern in those participants who spend more time in physical activity. In the light of these results, physical care by young people through following a healthy diet as well as a high level of physical activity resides in university students, as these lead to numerous improvements in terms of academic performance, body image and emotional well-being [55,56].

Likewise, positive relationships have also been found between adherence to the Mediterranean diet and academic performance, as greater adherence to this dietary pattern is observed. In addition, it is also observed that students who obtain an optimal diet obtain higher scores in academic self-concept than students who need to improve or those who have a poor-quality diet. Given these data, adherence to a healthy and balanced dietary pattern shows better physical and mental health, which has a positive impact on the attitude towards different academic tasks [57].

In addition, a positive relationship was found between adherence to the Mediterranean diet and the social and physical areas of self-concept. Given this relationship, students who follow a healthy dietary pattern obtain higher levels of physical self-concept as they tend to improve in sports performance, well-being and body image [58]. The latter factor is key to a good social self-concept, and plays a prejudicial role when they do not meet society's standards. Furthermore, low-quality diet was found to be positively related to a higher level of family self-concept, as the family is supposed to be a key nucleus for the development of self-concept and self-image [59].

The correlational analysis shows that there are positive relationships between all areas of self-concept and adherence to the Mediterranean diet [9,60]. Positive relationships were also found between anxiety and adherence to the Mediterranean diet. These data may be due to the low nutrition education acquired by the students [5], as a positive adherence to a healthy dietary pattern has benefits in the control of disruptive states and emotions [61,62]. There is also a positive relationship between time spent being physically active and diet. In view of these results, the media play a fundamental role, since promoting healthy lifestyles will help to raise awareness of them and improve people's health [63,64].

One of the main limitations to be highlighted relates to cross-sectional research, with a single measurement being carried out at a specific and determined moment, allowing us to identify causal relationships between the variables at that moment and not being able to examine cause-effect relationships between the variables over a longer period of time. Another limitation is provided by students who took part in the research being from a very specific geographical area, therefore, it is not possible to establish generalizations in a larger sample of the national or regional geography.

In terms of future prospects, it would be very interesting to perform a longitudinal study in which all of variables presented in this study would be studied over an academic year. Likewise, it is also possible to conceive the creation of programmes based on physical activity and a healthy diet to help improve the self-concept and academic performance of university students.

5. Conclusions

Considering descriptive analysis, it is obtained that more than half of participants need to improve their diet model. Likewise, looking at anxiety levels, it can be observed low values in general, but there are higher levels in males, more than half of students show an average mark of notable and about half of students practices more than 3 hours, with higher levels in females. It is also observed that the highest scoring self-concept is academic, followed by family self-concept; however, males obtain higher scores in academic, emotional and family self-concept, while females have higher levels of physical self-concept.

The correlational analysis shows that a higher quality of dietary pattern is associated with a higher level of physical activity and a longer time spent doing physical exercise. In addition, a positive relationship was also found between a positive attitude towards Mediterranean diet and academic performance, as well as with academic, social and physical self-concept. Finally, looking at anxiety levels, it is concluded that students who obtain an optimal diet show lower levels of anxiety than students who show a low-quality diet or who need to improve their dietary pattern.

Finally, the proposed model shows positive relationships between adherence to the Mediterranean diet, time spent in physical activity, average mark, anxiety and all areas of self-concept, but negative relationships were found between average mark and anxiety, time spent in physical activity and anxiety and physical and social self-concept.

Abbreviations

A-SC, Academic Self-Concept; S-SC, Social Self-Concept; P-SC, Physical Self-Concept; E-SC, Emotional Self-Concept; F-SC, Familiar Self-Concept; MDA, Mediterranean Diet Adherence; AM, Average Mark; PA, Physical Activity; ANX, Anxiety.

Author contributions

Conceptualization—EMI and FZO; methodology—JLUJ; software—EMI and FZO; validation—GB, WRG and GGV; formal analysis—JLUJ; investigation—EMI; resources—WRG and GB; data curation—FZO and GGV; writing—original draft preparation—EMI, FZO, GGV; writing—review and editing—GGV and GB; visualization—WRG; supervision—GGV; project administration—EMI; funding acquisition—WRG. All authors have read and agreed to the published version of the manuscript.

Ethics approval and consent to participate

All procedures performed in studies involving human participants were in accordance with the ethical standards of institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards (1230/CEIH/2020). Informed consent was obtained from all individual participants included in the study.

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Conflict of interest

The authors declare no competing interests. GB is serving as one of the Editorial Board members of this jour-

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References

- [1] Fila-Witecka K, Senczyszyn A, Kolodziejczyk A, Ciulkowicz M, Maciaszek J, Misiak B, *et al.* Lifestyle Changes among Polish University Students during the COVID-19 Pandemic. *International Journal of Environmental Research and Public Health*. 2021; 18: 1–13.
- [2] Olansky S, Beaudry KM, Woods S, Barbour-Tuck E, Gammage KL, Klentrou P, *et al.* Changes in Body Composition, Energy Expenditure, and Energy Intake during Four Years of University-A Follow-Up Study. *International Journal of Environmental Research and Public Health*. 2021; 18: 1–14.
- [3] Zurita-Ortega F, Badicu G, Chacón-Cuberos R, Castro-Sánchez M. Motivational Climate and Physical Activity: A Multigroup Analysis in Romanian and Spanish University Students. *International Journal of Environmental Research and Public Health*. 2019; 16: 1–12.
- [4] Korhan M, Engin E, Guloglu B. University entrance exam anxiety of adolescents during COVID-19 pandemic: Cognitive flexibility and self-regulation. *European Psychiatry*. 2021; 64: 667.
- [5] Chacón-Cuberos R, Zurita-Ortega F, García-Mármol E, Castro-Sánchez M. Multidimensional self-concept depending on sport practice in university students of Physical Education from Andalucía. *Retos*. 2020; 174–180.
- [6] Chacón-Cuberos R, Zurita-Ortega F, Castro-Sánchez M, Espejo-Garcés T, Martínez-Martínez A, Ruiz-Rico G. The association of Self-concept with Substance Abuse and Problematic Use of Video Games in University Students: A Structural Equation Model. *Adicciones*. 2018; 30: 179–187.
- [7] San Román-Mata S, Zurita-Ortega F, Martínez-Martínez A, Padial-Ruz R, Chacón-Cuberos R, Linares-Manrique M. Adherence to Mediterranean Diet in university students from southern Spain depending on social and academic factors and religious. *Revista Española de Nutrición Humana y Dietética*. 2018; 22: 141–148.
- [8] Stanton R, To QG, Khalesi S, Williams SL, Alley SJ, Thwaite TL, *et al.* Depression, Anxiety and Stress during COVID-19: Associations with Changes in Physical Activity, Sleep, Tobacco and Alcohol Use in Australian Adults. *International Journal of Environmental Research and Public Health*. 2020; 17: 1–13.
- [9] Marchena C, Bernabeu E, Iglesias T. Are Adherence to the Mediterranean Diet, Emotional Eating, Alcohol Intake, and Anxiety Related in University Students in Spain? *Nutrients*. 2020; 12: 1–15.
- [10] Melguizo-Ibáñez E, Zurita-Ortega F, Ubago-Jiménez JL, González-Valero G. Levels of adherence to the Mediterranean diet and emotional intelligence in students of the third cycle of elementary education from the province of Granada. *Retos*. 2020; 40: 264–271.
- [11] García-Pérez L, Villodres GC, Molina-Sánchez FJ, Sánchez-Cara EM, Muros-Molina JJ. The relationship of Mediterranean Diet adherence and Physical Activity engagement with Socioeconomic Status in primary schoolchildren in the capital of Granada. *Retos*. 2021; 41: 485–491.
- [12] Mirabelli M, Chiefari E, Arcidiacono B, Corigliano DM, Brunetti FS, Maggisano V, *et al.* Mediterranean Diet Nutrients to Turn the Tide against Insulin Resistance and Related Diseases. *Nutrients*. 2020; 12: 1–37.
- [13] Muros JJ, Cofre-Bolados C, Arriscado D, Zurita F, Knox E. Mediterranean diet adherence is associated with lifestyle, physical fitness, and mental wellness among 10-y-olds in Chile. *Nutrition*. 2017; 35: 87–92.
- [14] Becerra-Tomás N, Blanco Mejía S, Vigiuliouk E, Khan T, Kendall CWC, Kahleova H, *et al.* Mediterranean diet, cardiovascular disease and mortality in diabetes: a systematic review and meta-analysis of prospective cohort studies and randomized clinical trials. *Critical Reviews in Food Science and Nutrition*. 2020; 60: 1207–1227.
- [15] Angelis A, Chrysohoou C, Tzorovili E, Laina A, Xydis P, Terzis I, *et al.* The Mediterranean Diet Benefit on Cardiovascular Hemodynamics and Erectile Function in Chronic Heart Failure Male Patients by Decoding Central and Peripheral Vessel Rheology. *Nutrients*. 2021; 13: 1–10.
- [16] Tosti V, Bertozzi B, Fontana L. Health Benefits of the Mediterranean Diet: Metabolic and Molecular Mechanisms. *The Journals of Gerontology: Series A*. 2018; 73: 318–326.
- [17] Di Maso M, Augustin LS, Toffolutti F, Stocco C, Dal Maso L, Jenkins DJ, *et al.* Adherence to Mediterranean Diet, Physical Activity and Survival after Prostate Cancer Diagnosis. *Nutrients*. 2021; 13: 1–11.
- [18] Charisis S, Ntanasi E, Yannakoulia M, Anastasiou CA, Kosmidis MH, Dardiotis E, *et al.* Mediterranean diet and risk for dementia and cognitive decline in a Mediterranean population. *Journal of the American Geriatrics Society*. 2021; 69: 1548–1559.
- [19] Andreu-Reinon ME, Chirlaque MD, Gavrilía D, Amiano P, Mar J, Colorado-Yohar SM, *et al.* Mediterranean Diet and Risk of Dementia and Alzheimer’s Disease in the EPIC-Spain Dementia Cohort Study. *Nutrients*. 2021; 13: 1–17.
- [20] Ubago-Jiménez JL, Zurita-Ortega F, San Román-Mata S, Puertas-Molero P, González-Valero G. Impact of Physical Activity Practice and Adherence to the Mediterranean Diet in Relation to Multiple Intelligences among University Students. *Nutrients*. 2020; 12: 1–12.
- [21] Ferrer-Cascales R, Albaladejo-Blázquez N, Ruiz-Robledillo N, Clement-Carbonell V, Sánchez-SanSegundo M, Zaragoza-Martí A. Higher Adherence to the Mediterranean Diet is Related to more Subjective Happiness in Adolescents: the Role of Health-Related Quality of Life. *Nutrients*. 2019; 11: 698.
- [22] Zurita-Ortega F, San Román-Mata S, Chacón-Cuberos R, Castro-Sánchez M, Muros JJ. Adherence to the Mediterranean Diet is Associated with Physical Activity, Self-Concept and Sociodemographic Factors in University Student. *Nutrients*. 2018; 10: 966.
- [23] Murray RM, Sabiston CM, Coffee P, Kowalski KC. Strengthening the relationship between physical activity and physical self-concept: the moderating effect of controllable attributions. *Psychology of Sport and Exercise*. 2021; 52: 101828.
- [24] Valero GG, Ortega FZ, Martínez A. Panorama motivacional y de actividad física en estudiantes: una revisión sistemática. *Education, Sport, Health and Physical Activity*. 2017; 1: 41–58. (In Spanish)
- [25] Tapia-López A. Gender differences in physical activity levels, degree of adherence to the Mediterranean diet, and physical self-concept in adolescents. *Retos*. 2019; 36: 185–192.
- [26] Ávila-García M, Esojo-Rivas M, Villa-González E, Tercedor P, Huertas-Delgado FJ. Relationship between Sedentary Time, Physical Activity, and Health-Related Quality of Life in Spanish Children. *International Journal of Environmental Research and Public Health*. 2021; 18: 1–11.
- [27] World Health Organization (WHO). Global action plan on physical activity 2018–2030: more active people for a healthier world. World Health Organization: Geneva, Switzerland. 2019.
- [28] Chudasama YV, Khunti KK, Zaccardi F, Rowlands AV, Yates T, Gillies CL, *et al.* Physical activity, multimorbidity, and life expectancy: a UK Biobank longitudinal study. *BMC Medicine*. 2019; 17: 108.
- [29] Watkins T, Umphress EE. Strong body, clear mind: Physical ac-

- tivity diminishes the effects of supervisor interpersonal injustice. *Personnel Psychology*. 2020; 73: 641–667.
- [30] Clarke AE, Janssen I. A compositional analysis of time spent in sleep, sedentary behaviour and physical activity with all-cause mortality risk. *International Journal of Behavioral Nutrition and Physical Activity*. 2021; 18: 25.
- [31] Alfonso SV, Lonigan CJ. Trait anxiety and adolescent's academic achievement: the role of executive function. *Learning and Individual Differences*. 2021; 85: 101941.
- [32] Ansah JP, Leow JX. Feedback Analysis of Test Anxiety and Academic Performance among Students. *International Journal of System Dynamics Applications*. 2020; 9: 100–110.
- [33] Francis HM, Stevenson RJ, Chambers JR, Gupta D, Newey B, Lim CK. A brief diet intervention can reduce symptoms of depression in young adults - A randomised controlled trial. *PLoS ONE*. 2019; 14: 1–17.
- [34] Shriver LH, Dollar JM, Calkins SD, Keane SP, Shanahan L, Wierman L. Emotional Eating in Adolescence: Effects of Emotion Regulation, Weight Status and Negative Body Image. *Nutrients*. 2021; 13: 1–12.
- [35] Fought EL, Qian W, Carson VL, Storey KE, Faulkner G, Veuglers PJ, *et al.* The longitudinal impact of diet, physical activity, sleep, and screen time on Canadian adolescents' academic achievement: An analysis from the COMPASS study. *Preventive Medicine*. 2019; 125: 2–26.
- [36] Chacón-Cuberos R, Zurita-Ortega F, Martínez-Martínez A, Olmedo-Moreno EM, Castro-Sánchez M. Adherence to the Mediterranean Diet is Related to Healthy Habits, Learning Processes, and Academic Achievement in Adolescents: a Cross-Sectional Study. *Nutrients*. 2018; 10: 1566.
- [37] Hayek J, Schneider F, Tueni M, de Vries H. Is Academic Achievement Related to Mediterranean Diet, Substance Use and Social-Cognitive Factors: Findings from Lebanese Adolescents. *Nutrients*. 2020; 12: 1–19.
- [38] Merino-Marban R, Mayorga-Vega D, Fernandez-Rodriguez E, Estrada FV, Viciano J. Effect of a physical education-based stretching programme on sit-and-reach score and its posterior reduction in elementary schoolchildren. *European Physical Education Review*. 2015; 21: 83–92.
- [39] Schröder H, Fitó M, Estruch R, Martínez-González MA, Corella D, Salas-Salvadó J, *et al.* A short screener is valid for assessing Mediterranean diet adherence among older Spanish men and women. *The Journal of Nutrition*. 2011; 141: 1140–1145.
- [40] Álvarez-Álvarez I, Martínez-González MÁ, Sánchez-Tainta A, Corella D, Díaz-López A, Fitó M, *et al.* Dieta mediterránea hipocalórica y factores de riesgo cardiovascular: análisis transversal de PREDIMED-Plus. *Revista Española De Cardiología*. 2019; 72: 925–934.
- [41] Beck AT, Epstein N, Brown G, Steer RA. An inventory for measuring clinical anxiety: psychometric properties. *Journal of Consulting and Clinical Psychology*. 1988; 56: 893–897.
- [42] Sanz J, Navarro ME. Propiedades psicométricas de una versión española del Inventario de Ansiedad de Beck (BAI) en estudiantes universitarios. *Ansiedad y Estrés*. 2003; 9: 59–84.
- [43] García F, Musitu G. AF-5: Autoconcepto Forma 5. TEA Ediciones: Madrid, Spain. 1999.
- [44] Mantilla Toloza SC, Gómez Conesa A. El cuestionario Internacional de Actividad Física. Un instrumento adecuado para el seguimiento de la actividad física poblacional. *Revista Iberoamericana de Fisioterapia y Kinesiología*. 2007; 7: 48–52. (In Spanish)
- [45] World Medical Association (WMA). Declaration of Helsinki. Ethical Principles for Medical Research Involving Human Subjects. *Jahrbuch Für Wissenschaft Und Ethik*. 2009; 14: 233–238.
- [46] McDonald RP, Marsh HW. Choosing a multivariate model: non-centrality and goodness of fit. *Psychological Bulletin*. 1990; 107: 247–255.
- [47] Bentler PM. Comparative fit indexes in structural models. *Psychological Bulletin*. 1990; 107: 238–246.
- [48] Tenenbaum G, Eklund RC. *Handbook of sport psychology*. John Wiley & Sons: New Jersey, USA. 2007.
- [49] Slack NJ, Singh G, Ali J, Lata R, Mudaliar K, Swamy Y. Influence of fast-food restaurant service quality and its dimensions on customer perceived value, satisfaction and behavioural intentions. *British Food Journal*. 2020; 123: 1324–1344.
- [50] Teichert T, Rezaei S, Correa JC. Customers' experiences of fast food delivery services: uncovering the semantic core benefits, actual and augmented product by text mining. *British Food Journal*. 2020; 122: 3513–3528.
- [51] Chacón-Cuberos R, Badicu G, Zurita-Ortega F, Castro-Sánchez M. Mediterranean Diet and Motivation in Sport: a Comparative Study between University Students from Spain and Romania. *Nutrients*. 2019; 11: 30.
- [52] Wang CY, Zhao H. The Impact of COVID-19 on Anxiety in Chinese University Students. *Frontiers in Psychology*. 2020; 11: 1–8.
- [53] Gao W, Ping S, Liu X. Gender differences in depression, anxiety, and stress among college students: a longitudinal study from China. *Journal of Affective Disorders*. 2020; 263: 292–300.
- [54] González-Valero G, Zurita-Ortega F, Ubago-Jiménez JL, Puertas-Molero P. Use of Meditation and Cognitive Behavioral Therapies for the Treatment of Stress, Depression and Anxiety in Students. A Systematic Review and Meta-Analysis. *International Journal of Environmental Research and Public Health*. 2019; 16: 1–23.
- [55] Romero-Blanco C, Rodríguez-Almagro J, Onieva-Zafra MD, Parra-Fernández ML, Prado-Laguna MD, Hernández-Martínez A. Physical Activity and Sedentary Lifestyle in University Students: Changes during Confinement Due to the COVID-19 Pandemic. *International Journal of Environmental Research and Public Health*. 2020; 17: 1–13.
- [56] Valenzuela R, Codina N, Pestana JV. University Students' Motives-for-Physical-Activity Profiles: Why They Practise and What They Get in Terms of Psychological Need Satisfaction. *Frontiers in Psychology*. 2021; 11: 1–13.
- [57] Pieh C, Budimir S, Probst T. The effect of age, gender, income, work, and physical activity on mental health during coronavirus disease (COVID-19) lockdown in Austria. *Journal of Psychosomatic Research*. 2020; 136: 110186.
- [58] Kallio J, Hakonen H, Syväoja H, Kulmala J, Kankaanpää A, Ekelund U, *et al.* Changes in physical activity and sedentary time during adolescence: Gender differences during weekdays and weekend days. *Scandinavian Journal of Medicine & Science in Sports*. 2021; 30: 1265–1275.
- [59] Povedano-Díaz A, Muñiz-Rivas M, Vera-Perea M. Adolescents' Life Satisfaction: The Role of Classroom, Family, Self-Concept and Gender. *International Journal of Environmental Research and Public Health*. 2020; 17: 1–12.
- [60] Aridi YS, Walker JL, Roura E, Wright OR. Adherence to the Mediterranean Diet and Chronic Disease in Australia: National Nutrition and Physical Activity Survey Analysis. *Nutrients*. 2020; 12: 1–15.
- [61] Rosi A, Giopp F, Milioli G, Melegari G, Goldoni M, Parrino L, Scazzina F. Weight Status, Adherence to the Mediterranean Diet, Physical Activity Level, and Sleep Behavior of Italian Junior High School Adolescents. *Nutrients*. 2020; 12: 1–12.
- [62] Conde-Pipó J, Melguizo-Ibáñez E, Mariscal-Arcas M, Zurita-Ortega F, Ubago-Jiménez JL, Ramírez-Granizo I, *et al.* Physical Self-Concept Changes in Adults and Older Adults: Influence of Emotional Intelligence, Intrinsic Motivation and Sports Habits *International Journal of Environmental Research and*

Public Health. 2021; 18: 1–15.

- [63] Melguizo-Ibáñez E, Viciana-Garófano V, Zurita-Ortega F, Ubago-Jiménez JL, González-Valero G. Physical Activity Level, Mediterranean Diet Adherence, and Emotional Intelligence as a Function of Family Functioning in Elementary School Students. *Children*. 2020; 8: 1–14.

- [64] Marfil-Carmona R, Ortega-Caballero M, Zurita-Ortega F, Ubago-Jiménez JL, González-Valero G, Puertas-Molero P. Impact of the Mass Media on Adherence to the Mediterranean Diet, Psychological Well-Being and Physical Activity. Structural Equation Analysis. *International Journal of Environmental Research and Public Health*. 2021; 18: 1–13.