# The Self-Efficacy Scale for Adherence to the Mediterranean Diet (SESAMeD): A scale construction and validation

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## Abstract

The Mediterranean diet has several beneficial impacts on health. Self-efficacy may be crucial for adhering to the diet. This study set out to develop a reliable and valid instrument that would enable measurement of the extent to which people are confident about their ability to adhere to the Mediterranean diet: the Self-Efficacy Scale for Adherence to the Mediterranean Diet (SESAMeD). The study was carried out in two stages. In Stage 1, a pilot questionnaire was administrated to 170 students to reduce and refine items. In Stage 2, the validity and reliability of the scale were evaluated among a sample of 348 patients who have suffered from cardiovascular disease. After items reduction, the scale consisted of 22 items. The factor structure of SESAMeD was tested across exploratory factorial analysis and confirmatory factorial analysis, with both analyses confirming a robust adjustment for the bi-factorial structure. The two factors identified were (a) self-efficacy for the avoidance of determined unhealthy foods not recommended in the Mediterranean diet and (b) self-efficacy for the consumption of determined healthy foods recommended in this diet. The pattern of relations between the SESAMeD and the SESAMeD subscales and other different psychological variables (outcome expectancies, motivation, affective balance, and life satisfaction) supported the validity of the bi-factorial structure and provided strong evidence of construct validity. The instrument can help health professionals and researchers to assess patients' confidence of their ability to adhere to the Mediterranean diet, a psychological variable that may affect adherence to this healthy food consumption pattern.


**Keywords:** Self-efficacy; Diet Adherence; Mediterranean Diet; Health; Scale Construction and Validation.

## Introduction

The traditional Mediterranean diet (MeD) is a healthy dietary pattern coming from the culinary culture of the population bordering the Mediterranean Sea. This diet, which has been accepted as one of the healthiest food consumption patterns (Maiz & Balluerka, 2016), is a highly varied diet characterized by a high consumption of vegetables, fruits, legumes, cereals, and nuts; a contribution of culinary fat mainly in the form of olive oil; moderate consumption of fish and dairy; and a low intake of red wine and meats. The MeD presents an optimum balance among the different foods and dietetic components (Carbajal & Ortega, 2001), and it is characterized by low saturated fat intake, high intake of unsaturated fatty acids (with olive oil, nuts, or bluefish for example), and high antioxidant intake, improving the cellular health (Maiz & Balluerka, 2016). Accordingly, the variety of foods intake of the MeD, represented by an adequate balance between the different foods, has several beneficial impacts on mental and physical health (Muñoz, Fíto, Marrugat, Covas, & Schröder, 2009; Sánchez-Villegas, Henríquez, Bes-Rastrollo, & Doreste, 2006) and on chronic diseases and mortality (Estruch et al., 2006; Salas-Salvadó et al., 2010; Sofi, Abbate, Gensini, & Casini, 2015; Sofi, Cesari, Abbate, Gensini, & Casini, 2008). An inverse association has been shown between adherence to the Mediterranean diet and overall mortality (Trichopoulou, Bamia, & Trichopoulos, 2009), neurodegenerative diseases (Féart et al., 2009; Lourida et al., 2013; Scarmeas et al., 2009), cardiovascular risks (Buckland et al., 2009; Estruch et al., 2006; Martínez-González et al., 2009; Mente, de Koning, Shannon, & Anand, 2009), metabolic syndromes (Kastorini et al., 2011), and type 2 diabetes (Salas-Salvadó et al., 2010), among afflictions.

Nevertheless, it is necessary to differentiate the traditional MeD from the current MeD. The dietary intakes of populations bordering the Mediterranean Sea have changed

over the last several decades, with the adopting of a pattern of ingestion more typical of northern European society. Those modern Mediterranean patterns of consumption, contrary to the traditional MeD, include high consumption of meat and animal fat, to the detriment of vegetables, legumes and fruits; moreover, the consumption of processed and precooked foods (with high levels of saturated and trans fats) at the expense of of fresh ones has also increased in the current diet of Mediterranean populations (Márquez-Sandoval, Bulló, Vizmanos, Casas-Agustench, Salas-Salvadó, 2008). This dietary change from the traditional and healthy MeD to a less healthy and modern pattern of consumption among populations bordering the Mediterranean Sea shows the importance of increased adherence to the MeD.

For dietary intervention to succeed, strong adherence to the diet is required by patients and participants (Downer et al., 2016). Nevertheless, the food preferences of individuals often make changes in dietary patterns difficult, and dietary interventions often have low adherence (Douketis, Macie, Thabane, & Williamson, 2005; Downer et al., 2016). Food choices of individuals are usually determined by taste and preference rather than by considerations of which foods are healthy (Food Marketing Institute, 1997; Nestle et al., 1998). And this statement is even truer for children, who reject foods they do not like more consistently than adults (Nestle et al., 1998). Nevertheless, food preference and food consumption in adults may have a not-so-direct link (Nestle et al., 1998). Self-efficacy may have a relevant influence on food consumption, by mediating and moderating the relation that food preferences have with food consumption. Research about self-efficacy has demonstrated that, when people lack confidence about their own ability to perform a particular behavior, they are very unlikely to carry out that behavior (Bandura, 2006). In this sense, the confidence people have in their ability to adhere to the MeD (self-efficacy for adherence to the MeD) may be crucial for

adhering and being faithful to the MeD and thereby improving their health. Accordingly, it has been demonstrated that healthy nutrition behavior is predicted by self-efficacy beliefs regarding adherence to the diet (Renner & Schwarzer, 2005): the more individuals perceive that they are able to adhere to the diet, the healthier their nutritional behavior is. In the same way, Warziski, Sereika, Styn, Music, and Burke (2008) have demonstrated that self-efficacy regarding the ability to change eating habits has a positive impact on adherence to the diet and weight loss. Moreover, individuals' high self-efficacy levels on making healthier choices have a direct effect on nutrition (Anderson, Winett, & Wojcik, 2007). Savoca and Miller (2001) have found that dietary self-efficacy acts as a mediator between favorite foods and food selection and eating patterns. Nevertheless, although there are different instruments to measure adherence to the MeD (Bach et al., 2006; Schröder et al., 2011), to our knowledge, there is no instrument to measure self-efficacy on adherence to the MeD.

This study set out to develop a reliable and valid instrument that would enable measurement of the extent to which people are confident about their ability to adhere to the MeD. The construct reliability and validity of the developed scale—called the Self-Efficacy Scale for Adherence to the Mediterranean Diet (SESAMeD)—will be tested, and the relationship between the SESAMeD and other variables will be evaluated in order to test the external validity of the scale. The instrument is aimed at informing health professionals and researchers about patients' confidence of their ability to adhere to the MeD, a psychological variable that may affect such adherence.

**Self-efficacy to adhere to the Mediterranean Diet: Concept, measurement, and related variables**

Adherence to the MeD can be defined as the conformity of individuals to the traditional Mediterranean dietary pattern (Sofi et al., 2008). This dietary pattern is

represented by (a) the consumption of specific healthy components considered to be part of this diet, such as olive oil, fruits, vegetables and legumes, fish, nuts, and seeds, and a moderate intake of red wine during meals on the one hand; and, on the other hand, (b) the avoidance of specific foods presumed not to be part of the MeD, such as red and processed meats and dairy products (Sahyoun & Sankavaram, 2016; Sofi et al., 2008). We expected that the confidence individuals have about their ability to adhere to the MeD would be composed of two different types of self-efficacy, which correspond to those two different aspects of the adherence to the MeD. As such, we expected self-efficacy for adherence to the MeD to be a bidimensional construct. In accordance with this presumption, we elaborated our SESAMeD instrument with two different subscales: one related to the self-efficacy individuals have for their ability to avoid specific foods considered not to be part of the traditional MeD (subscale entitled SESAMeD Part 1), and the other related to the self-efficacy individuals have for their ability to consume different specific healthy foods presumed to be part of the MeD (SESAMeD Part 2).

As we have pointed out before, health beliefs, such as self-efficacy to adhere to a healthy diet and outcome expectancies, predict healthy nutrition behaviors (Anderson et al., 2007; Renner & Schwarzer, 2005). Several researchers have found that self-efficacy regarding healthy nutrition correlates with outcome expectancies and that both variables predict nutrition behaviors (Anderson et al., 2007; Renner & Schwarzer, 2005). In this sense, Anderson et al. (2007) have found self-efficacy on nutrition to be positively related with positive outcome expectations, and negatively with negative outcome expectations. Accordingly, we expected to find a positive correlation between the SESAMeD (and the two subscales of the SESAMeD) and positive outcome expectancies, such as weight loss, as well as a negative correlation between the

SESAMeD (and the two subscales) and negative expectancies, such as being bored with eating foods imposed by the diet.

Another variable potentially connected to adherence to the diet is framed in self-determination theory (SDT). According to SDT, people need to adopt a sense of autonomy and competence in order to internalize, integrate and, subsequently, self-regulate and sustain healthy behaviors (Deci & Ryan, 2000; Ryan & Deci, 2000). As such, as has been pointed out (Ryan, Patrick, Deci, & Williams, 2008), a great adherence to the diet, which would be maintained in the long term, is promoted by autonomous, intrinsic motivation (when patients are inherently motivated by the diet and endorse the values of the healthier dietary pattern), but not by controlled motivation, such as introjected regulation (when individuals act in order to receive approval or praise or to avoid disapproval or feeling guilty) or external motivation (in which people are moved to get external rewards). Moreover, autonomy produces a gain in the sense of competence or self-efficacy (Ryan et al., 2008); and, as such, intrinsic motivation and self-efficacy would be positively correlated. In this sense, self-efficacy has been positively related to intrinsic motivation, but not to extrinsic motivation (Walker, Greene, & Mansell, 2005). As a result, we expected intrinsic motivation to be positively correlated with the SESAMeD, and controlled motivation not to be related with the SESAMeD.

It should be noted that adherence to the Mediterranean diet can also be related to the broader well-being of individuals. Several studies have found the Mediterranean diet to be inversely associated with depression in individuals (Psaltopoulou et al., 2013; Sanchez-Villegas, Henriquez, Bes-Rastrollo, & Doreste, 2006). Furthermore, adherence to the Mediterranean diet has been associated with high levels of mental health perceptions, health-related perceptions of quality of life, and, in general, to higher

scoring for self-perceived health and life satisfaction (Costarelli, Koretsi, & Georgitsogianni, 2013; Muñoz et al., 2009). In this sense, the MeD has also been related to mood fluctuation, and it has been shown that changing dietary habits to the MeD has a positive and consistent impact on mood as a result of short-term interventions (McMillan, Owen, Kras, & Scholey, 2011). In line with these findings, we postulated that our SESAMeD would be positively associated with affective balance and global life satisfaction.

## Method

We carried out the study in two different stages. Stage 1 aimed to administer the pilot questionnaire in order to reduce and refine items. Stage 2 aimed to evaluate the validity and reliability of the scale among a sample of patients who have suffered from cardiovascular disease. In both stages, informed written consent was obtained, and the University of Cordoba's Research Ethics Committee approved the Study.

### Participants

In Stage 1, the participants were 170 students (35.3% men, 64.7% women; age range: 17–48 years, $M$ = 19.19, $SD$ = 3.54) randomly selected from the University of Córdoba (Spain).

In Stage 2, the participants were 348 cardiovascular disease patients (85.3% men, 14.7% women; age range: 37–81 years, $M$ = 64.29, $SD$ = 9.33) collaborating with the IMIBIC Cordioprev Project (http://www.cordioprev.es/index.php/en/) of the Reina Sofía University Hospital of Córdoba (Spain).

### Procedure

In Stage 1, students individually completed an online questionnaire, created with the Global Park survey program (Questback Inc, New York, United States), in

our laboratory, in which they responded to some socio-demographic questions (gender and age) and to the initial 24 items of the SESAMeD.

In Stage 2, patients completed an online questionnaire in the hospital, using tablets from our laboratory, in which they individually responded to the same socio-demographic questions, to the SESAMeD, and to other psychosocial scales. A research collaborator was always available in each session at the hospital to resolve any doubts or questions related to the questionnaire.

**Measurements**

***Self-Efficacy Scale for Adherence to the Mediterranean Diet***

A short questionnaire was created to analyze patients' perceptions of their own capability of adhering to the MeD. In order to create this instrument, we cooperated with the Maimonides Institute of Biomedical Research of Cordoba (IMIBIC). Within the framework of the CORonary Diet Intervention with Olive oil and cardiovascular PREVention study (Cordioprev) (Delgado-Lista et al., 2016), researchers have created a list of foods that patients who follow the MeD should consume, and others that they should avoid. To create our SESAMeD, we followed this list and the instructions given by the guide for the creation of self-efficacy scales by Bandura (2006). Then, items were divided into two pools: (a) 14 items relating to foods of which patients should reduce their consumption (SESAMeD Part 1; see Appendix 1) and (b) 10 items directly relating to foods that patients should consume (SESAMeD Part 2; see Appendix 2). Participants identified their level of confidence about their ability to avoid or consume food using a seven-point Likert scale, where 1 was "Cannot do at all," 4 was "Moderately can do," and 7 was " Highly certain can do."

***Outcome expectations***

In order to measure negative and positive nutrition outcome expectations, we used a healthier foods outcome expectation scale (Anderson, Winett, & Wojcik, 2000). This scale has been used in mixed samples, with both healthy individuals and individuals with some disease that could limit physical activity such as a cardiovascular disease (Anderson, Wojcik, Winett, & Williams, 2006). Participants responded to 22 items regarding what they expect from eating healthier foods every day (e.g., "I will have more energy" for positive outcome expectations or "I will be hungrier" for negative outcome expectations) on a seven-point Likert scale (1 = "Strongly disagree"; 7 = "Totally agree"). The Cronbach's alpha coefficient for this measure was .83 for positive outcome expectancies and .87 for negative outcome expectancies.

***Autonomous and controlled motivation***

Three different types of motivation (autonomous motivation, introjected regulation, and external regulation) to adhere to the diet were assessed using the three factors of the Treatment Self-Regulation Questionnaire (TSRQ) (Levesque et al., 2007) that referred to those three types of motivation. This scale has been previously used and validated in samples of individuals with chest pain suggestive of coronary artery disease (Williams, Gagné, Mushlin, & Deci, 2005) and of individuals with cardiac event history (Sher, Bellg, Braun, Domas, Rosenson, & Canar, 2002). Participants responded to the 12 items (e.g., "Because I personally believe it is the best thing for my health" for the autonomous motivation; "Because I would feel guilty or ashamed of myself if I do not adhere to the diet" for the introjected regulation; or "Because others would be upset with me if I do not adhere to the diet" for external regulation) on a seven-point Likert scale (1 = "Strongly disagree"; 7 = "Totally agree"). The Cronbach's alpha coefficient of the TSRQ was .78.

### *Affective balance*

An affective balance score was obtained from a short version of the Positive Affect and Negative Affect Scale (PANAS) (Watson, Clark, & Tellegen, 1988). The PANAS was previously used with individuals with cardiovascular disease (Hu & Gruber, 2008). Participants responded to 12 items, using a seven-point Likert scale (1 = "Strongly disagree"; 7 = "Strongly agree") to indicate the extent to which each item represented how they felt at that moment. Their affective balance was obtained by subtracting (Fernández-Berrocal, 2006) the score for the six negative items (e.g. nervous; $\alpha = .78$) from the score for the six positive items (e.g. enthusiastic; $\alpha = .90$).

### *Global life satisfaction*

Global life satisfaction was measured with the Satisfaction with Life Scale (Diener, Emmons, Larsen, & Griffin, 1985), an instrument psychometrically sound for its use with patients with cardiovascular disease (Apers et al., 2016; Moons, Van Deyk, De Geest, Gewillig, & Budts, 2005). Participants responded to five items (e.g. "In most ways life is close to my ideal") on a seven-point Likert scale (1 = "Strongly disagree"; 7 = "Totally agree"). The Cronbach's alpha coefficient for this measure was .86.

## Statistical analyses

Statistical analyses were performed by using SPSS.21 and Amos.19. In Stage 1, where the main aim was to reduce and refine the SESAMed, analyses for the SESAMed Part 1 and SESAMed Part 2 were carried out independently. Items were subjected to preliminary data checks to explore their suitability for inclusion in further analysis. Items with high floor and ceiling effects (more than 40% of respondents selecting one of the extreme response options) and items with large amounts of missing data (more than 10% of non-response) were removed. Another decision rule for item removal included items displaying a high number of poor correlations with other items and items

that considerably reduced the Cronbach's alpha value. A correlation matrix identified items demonstrating poor correlations ($r < .20$) with a large number of items (half of the items present in each part, or more), and reliability analysis was carried out to identify items with low item-to-total correlations ($r < .25$) or items that considerably decreased the internal consistency (Cronbach's alpha value).

In accordance with previous literature (Cabrera-Nguyen, 2010; Costello & Osborne, 2009) regarding how to validate new measures rigorously, we first performed an exploratory factor analysis (EFA); then, with a different sample, we followed with a confirmatory factor analysis (CFA).

In Stage 1, with the students' sample, we carried out an EFA with varimax rotation in order to identify subscales within the item pools and to exclude items that did not group in conceptually sound subscales. The suitability of using factor analysis was assessed using Bartlett's Test of Sphericity (BTS) and the Kaiser-Meyer-Olkin (*KMO*) statistic. A *KMO* value of .50 or higher is considered acceptable for a satisfactory factor analysis to proceed (Williams, Onsman, & Brown, 2010). For the *BTS*, a *p* value of .05 or smaller serves as the criterion for indicating that implementation of factor analysis is possible (Bartlett, 1954).

Afterward, in Stage 2, we performed a confirmatory factorial analysis (CFA) with the patients' sample, using Amos.20. We tested the chi-square ($\chi^2$), the goodness-of-fit index (*GFI*), the adjusted goodness-of-fit index (*AGFI*), the comparative fit index (*CFI*), the root-mean-square error of approximation (*RMSEA*), and the Tucker-Lewis index (*TLI*). For interpreting the goodness of fit of the different indices, we used the rules of thumb recommended by Schermelleh-Engel, Moosbrugger, and Müller (2003).

Then, in order to explore the external validity of the final scale, correlations between the SESAMeD (and its subscales) and other variables were investigated.

## Results

### Stage 1: Reducing and refining the items

#### *Floor and ceiling effects*

Results revealed that no items had more than 10% of missing data. Two items of the SESAMeD Part 1 (item 1—butterfat and item 3—margarine) and two items of SESAMeD Part 2 (item 3—"no more than two glasses of wine a day if you are male, or no more than one glass of wine a day if you are female" and item 9—"blue fish, at least once a week") had more than 40% of respondents selecting the most extreme response option. As a result, items 1 and 3 of the SESAMeD Part 1 were removed.

Regarding items of SESAMeD Part 2, both items are especially relevant in the MeD. We chose to keep item 3 (about the consumption of only a small quantity of red wine) in accordance with evidence found in the literature review that young people and students generally do not drink red wine (Centers for Disease Control and Prevention, 2007; Cremeens, Miller, Nelson, & Brewer, 2009; García del Castillo, López-Sánchez, & Quiles, 2006). The types of alcohol typically consumed by students are liquors and beer. As such, the 50.6% of responses allocated in the most extreme item option do not reflect ceiling effect but a reality regarding students' patterns of red wine consumption and thus their high level of confidence for drinking less than two glasses of red wine per day for men and one glass of red wine per day for women.

For item 9, about the consumption of blue fish, we also chose to keep it. Taking into account that Spain is one of the top seafood consumers in Europe and in the world (Food and Agriculture Organization of the United Nations, 2011; Welch et al., 2002) and that fish, especially blue fish, are highly traditional food in Spain (Medina, 2005), the 47.5% of responses allocated in the most extreme item option do not reflect ceiling

effects but a reality regarding the students' patterns of consumption of blue fish and thus their high level of confidence for high consumption of blue fish.

***Correlation between items***

After reducing SESAMeD Part 1 because of ceiling effects, correlation analyses were computed. No items of the resulting 12 items of the SESAMed Part 1 or of the 10 items of the SESAMed Part 2 displayed poor correlation ($r < .20$) with half (or more) of their items. Following this, no items were removed due to poor correlation with other items.

***Reliability analyses***

When entering the 22 items after reduction, the SESAMeD reliability level was .89. For SESAMed Part 1, the reliability level was .89. For SESAMed Part 2, the reliability level was .80. For the global SESAMeD and for each one of the two subscales no items showed low item-to-total correlation or decreased the Cronbach's alpha if removed. As a result, no items were removed due to a decrease of internal consistency.

***Exploratory factor analysis***

For the resulting 22 items of SESAMeD, the *KMO* index (.85) and *BTS* ($\chi^2 = 1471.89$; $df = 210$; $p < .001$) supported the use of EFA. The EFA, conducted with Varimax rotation with the 22 items, showed five factors with a balanced factorial structure. These factors explained 60.64% of the variance (see Table 1). Factor 1, defined as "sugars and fats," and Factor 2, defined as "meat," explained, conjunctly, 31.03% of the variance and were composed of all of the items of the SESAMeD Part 1 (self-efficacy for avoidance of food not presumed to be part of the Mediterranean diet). Factor 3, defined as "fruits and vegetables," Factor 4, defined as "fish and seafood," and Factor 5, defined as "antioxidants," explained, conjunctly, 29.61% of the variance and were composed of all of the items of the SESAMeD Part 2 (self-efficacy for the consumption of the characteristic foods of the Mediterranean diet). Thus, since the five

factors could be grouped into two different dimensions that corresponded with the two different parts of the SESAMeD, we concluded that the scale could probably be composed of two higher factors (the two parts of the scale), each with different subfactors (the five factors found in this CFA).

Table 1. Results of the Exploratory Factor Analysis of the SESAMeD (22 items): factor loading and reliability estimates

| | Highest loading for each one of the five factors | | | | |
|---|---|---|---|---|---|
| Items | F1 | F2 | F3 | F4 | F5 |
| 1. Butter | .458 | | | | |
| 2. Mayonnaise | .557 | | | | |
| 3. Sugary drinks (soft drinks) | .632 | | | | |
| 4. sugary commercial juices | .759 | | | | |
| 5. Cake shop | .784 | | | | |
| 6. Bakery products | .747 | | | | |
| 7. Chips or similar | .578 | | | | |
| 8. Food or pre-cooked dishes | .572 | | | | |
| 9. Whole milk of any kind (milk, cheese, yogurt, etc.) | .446 | | | | |
| 10. Red meat (beef, pork, lamb, etc.) | | .796 | | | |
| 11. Sausages (chorizo, black pudding, sausage or salami, etc.) | | .752 | | | |
| 12. Processed meats (burgers, sausages, meatballs) | | .806 | | | |
| 13. At least five tablespoons of olive oil a day, distributed among the different foods | | | | | .502 |
| 14. Nuts and / or seeds at least three times a week | | | | | .663 |
| 15. No more than two cup of red wine a day if male, or no more than one cup of red wine if female | | | | | .716 |
| 16. Two or more servings a day of green vegetables | | | .818 | | |
| 17. At least one serving of raw vegetables (e.g. Salad) | | | .802 | | |
| 18. Three or more pieces of fruit a day (including natural juices, without adding sugar) | | | .659 | | |
| 19. A serving of legumes / pulses at least three times a week | | | .556 | | |
| 20. Fish and seafood at least three times a week | | | | .826 | |
| 21. Bluefish (tuna, salmon, trout, mackerel, swordfish, anchovies, sardines...) at least once a week | | | | .787 | |
| 22. Only shellfish (clams, mussels, etc.), avoiding other kind of seafood | | | | .717 | |
| Scale reliability estimates | F1 | F2 | F3 | F4 | F5 |
| Cronbach's alpha values | .87 | .81 | .78 | .77 | .50 |
| Percentage of explained variance | 17.23 | 13.80 | 11.45 | 10.60 | 7.56 |

Therefore, in order to confirm the two parts of the SESAMeD, we conducted another EFA; however, this time we fixed two factors for extraction. Again, the *KMO* index (.84) and *BTS* ($\chi^2$ = 1553.64; *df* = 231; $p < .001$) supported the use of EFA. The two extracted factors explained 42.52% of the variance. All items were properly loaded on their proposed dimensions (See Table 2). The first factor was defined as SESAMeD Part 1; and the second factor was defined as SESAMeD Part 2.

Table 2. Results of the Exploratory Factor Analysis of the SESAMeD extracting two factors

| | Highest loading for each one of the two factors | |
|---|---|---|
| Items | Factor 1 (*SESAMeD Part 1*) | Factor 2 (*SESAMeD Part 2*) |
| 1. Butter | .495 | |
| 2. Mayonnaise | .651 | |
| 3. Sugary drinks (soft drinks) | .721 | |
| 4. sugary commercial juices | .648 | |
| 5. Cake shop | .566 | |
| 6. Bakery products | .636 | |
| 7. Chips or similar | .799 | |
| 8. Food or pre-cooked dishes | .743 | |
| 9. Whole milk of any kind (milk, cheese, yogurt, etc.) | .554 | |
| 10. Red meat (beef, pork, lamb, etc.) | .693 | |
| 11. Sausages (chorizo, black pudding, sausage or salami, etc.) | .616 | |
| 12. Processed meats (burgers, sausages, meatballs) | .709 | |
| 13. At least five tablespoons of olive oil a day, distributed among the different foods | | .470 |
| 14. Nuts and / or seeds at least three times a week | | .466 |
| 15. No more than two cup of red wine a day if male, or no more than one cup of red wine if female | | .351 |
| 16. Two or more servings a day of green vegetables | | .610 |
| 17. At least one serving of raw vegetables (e.g. Salad) | | .585 |
| 18. Three or more pieces of fruit a day (including natural juices, without adding sugar) | | .518 |
| 19. A serving of legumes / pulses at least three times a week | | .619 |
| 20. Fish and seafood at least three times a week | | .688 |
| 21. Bluefish (tuna, salmon, trout, mackerel, swordfish, anchovies, sardines...) at least once a week | | .742 |
| 22. Only shellfish (clams, mussels, etc.), avoiding other kind of seafood | | .684 |
| Scale reliability estimates | | |
| Cronbach's alpha values | .89 | .80 |
| Percentage of explained variance | 31.03 | 11.49 |

## Stage 2: Validity and reliability of the SESAMeD

### *Confirmatory factor analysis*

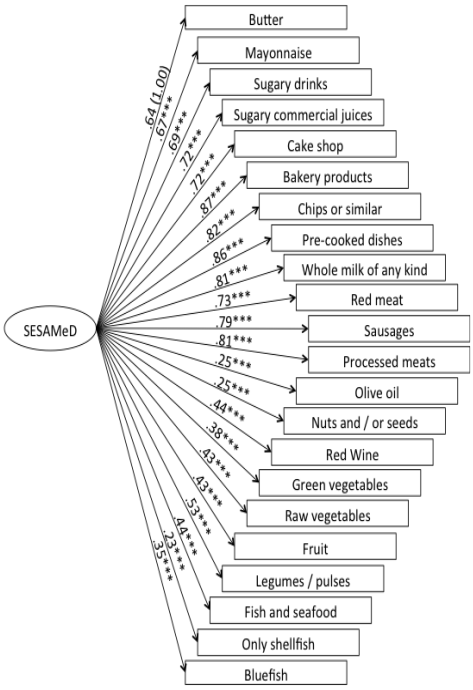
In order to test the unidimensionality or multidimensionality of the scale, we compared four competing models (see Figure 1) by performing a single-factor CFA, a two-factor CFA, a five-factor CFA, and a higher-order CFA. The first model (Model 1) evaluated (a single-factor model, the most parsimonious of all possible models, which we titled "Self-efficacy for MeD adherence") expressed the hypothesis that the variance of the SESAMeD can be partitioned into one general factor.

Following this, we tested a bidimensional model (Model 2) that expressed the hypothesis that the variance of the SESAMeD can be partitioned into two different factors, each corresponding to the two parts that composed the scale (SESAMeD part 1 and SESAMeD Part 2).

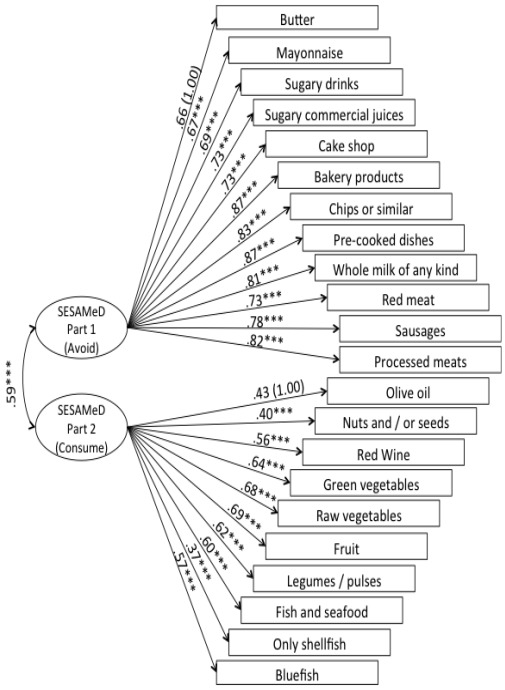
Then, the fit values of a five-factor model (Model 3) were tested. This model expressed the hypothesis that the variance of the SESAMeD can be partitioned into the five-factors found in the EFA conducted with the sample of students.

Finally, we tested a higher-order model (Model 4) in which the SESAMeD can be partitioned into two different first-order factors (SESAMeD Part 1 and SESAMeD Part 2), each with different second-order factors (two second-order factors for the SESAMeD Part 1, and three second-order factors for the SESAMeD Part 2).

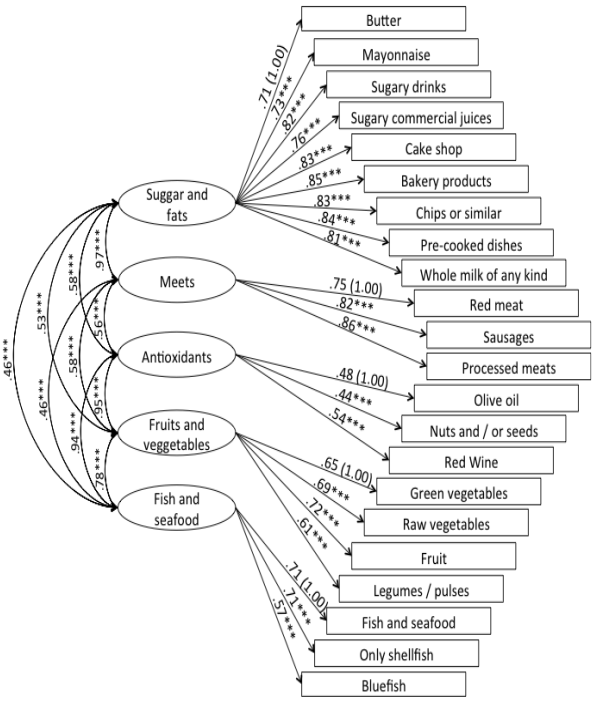
As shown in Figure 1 the four models had good or acceptable fits. The model with the worst fit was the single-factor model; however, despite this, it had acceptable fit indices. The bidimensional model was the best one, with excellent fit indices. Finally, the five-factor model and the higher-order factor model had acceptable fits.



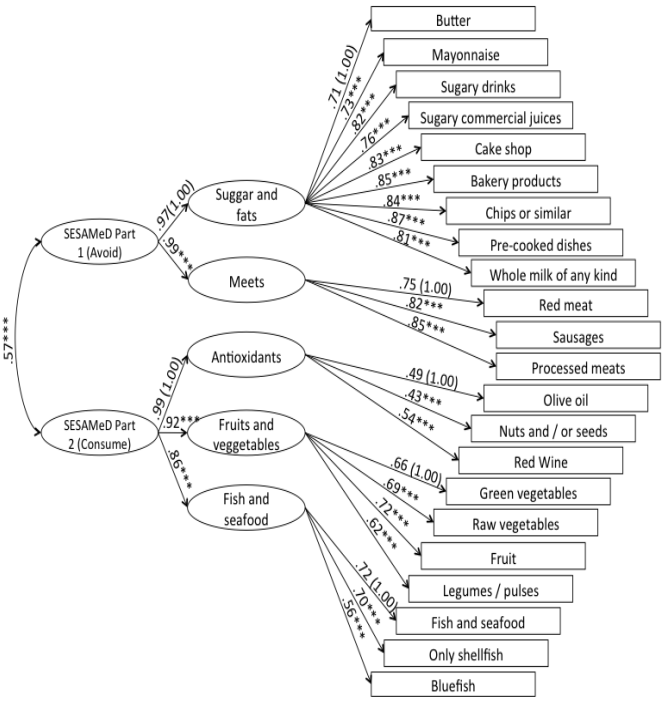

Model 1. Unidimensional model of SESAMeD
Fit indices:
$X^2$(gl = 155) = 265.970
RMSEA (95% CI) = 05 (04; 06)
CFI = .98; GFI = .93; AGFI = .87; TLI = .97




Model 2. Bidimensional model of SESAMeD
Fit indices:
$X^2$(gl = 174) = 178.163
RMSEA (95% CI) = 01 (001; 03)
CFI = 1.00; GFI = .96; AGFI = .94; TLI = 1.00




Model 3. Five-factors model of SESAMeD
Fit indices:
$X^2$(gl = 165) = 235.763
RMSEA (95% CI) = 04 (02; 05)
CFI = .99; GFI = .94; AGFI = .91; TLI = .98




Model 4. Two higher-order factor model of SESAMeD
Fit indices:
$X^2$(gl = 169) = 242.499
RMSEA (95% CI) = 04 (03; 05)
CFI = .99; GFI = .94; AGFI = .91; TLI = .98

Figure 1. Comparison between the four models of Self-Efficacy Scale For Adherence to de Mediterranean Diet (SESAMeD) tested

***External validity***

When performing correlational analyses to obtain additional evidence of the instrument's validity in relation to other variables of interest, the expected correlations were found (Table 3).

Regarding outcome expectancies, as expected, the global scale (SESAMeD), as well as the two subscales, correlated positively with positive outcome expectancies and negatively with negative outcome expectancies.

SESAMeD, SESAMeD Part 1, and SESAMeD Part 2 correlated positively with autonomous motivation. SESAMeD and SESAMeD Part 1 correlated positively with introjected motivation, but SESAMeD Part 2 did not. Neither the SESAMeD nor either of the two subscales correlated with external regulation.

SESAMeD, as well as SESAMeD Part 2, correlated positively with affective balance and with well-being. Nevertheless, SESAMeD Part 1 did not correlate with affective balance or well-being.

Table 3. Correlation between the global SESAMeD, the SESAMeD Part 1 and Part 2 and the different variables of the Study

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| SESAMeD | - | | | | | | | | |
| SESAMeD Part 1 | .92*** | - | | | | | | | |
| SESAMeD Part 2 | .81*** | .52*** | - | | | | | | |
| Positive expectancies | .42*** | .37*** | .38*** | - | | | | | |
| Negative expectancies | -.17** | -.12* | -.19*** | .02 | - | | | | |
| Autonomous motivation | .33*** | .29*** | .28*** | .50*** | -.20*** | - | | | |
| Introjected motivation | .13* | .14* | .09 | .29*** | -.04 | .46*** | - | | |
| External motivation | -.07 | -.05 | -.06 | .13* | .19** | .10# | .37*** | - | |
| Affective Balance | .11* | .05 | .17** | .21*** | -.17** | .14* | .01 | -.04 | - |
| Well-being | .15** | .10# | .18** | .30*** | -.08 | .29*** | .18** | .16** | .50*** |

#$p < .09$. *$p < .05$. **$p < .01$ *$p < .001$.

## Discussion

In this study, we have documented the steps taken to psychometrically develop, refine, and validate the Self-Efficacy Scale for Adherence to the Mediterranean Diet (SESAMeD). The main aim was to provide a comprehensive and psychometrically sound scale that assesses the level of confidence individuals have in their ability to follow the dietary pattern of the MeD, (a) by avoiding some foods that do not form part of this diet, and (b) by consuming healthy foods that are typical of this diet. Since it has previously been demonstrated that the MeD has several positive impacts on health and well-being (Muñoz et al., 2009), improving adherence to the MeD can be relevant. Although successful dietary interventions are promoted for adherence to the diet (Downer et al., 2016), this adherence may often be difficult (Douketis et al., 2005; Downer et al., 2016). As Bandura (2006) explained, level of self-efficacy is very important for people to engage in behaviors. Thus, to promote adherence to the diet in people, a first step may be to increase the confidence they have in their own ability to adhere to it. Professionals, therefore, must initially evaluate patients' levels of self-efficacy. Given that self-efficacy is relevant for people to engage in desired behaviors (Bandura, 2006) and that self-efficacy for adherence to the diet determines nutrition behavior (Anderson et al., 2007), the lack of scales to measure self-efficacy for adherence to the MeD justifies the relevance of this study. The proposed scale provides professionals with a tool for assessing self-efficacy for adherence to MeD, which will then help them in their prediction of the real adherence of patients and the need of complementary programs in order to motivate them to adhere to the MeD.

### The SESAMeD, a bi-factorial, reliable, and valid scale

This study has shown that self-efficacy for adherence to MeD is a multidimensional construct. Both CFA and EFA analyses confirmed a robust

adjustment for the bi-factorial structure. In contrast, the one-factor, five-factor, and higher-order factor solutions presented correct but poorer fit indices in comparison to the bi-factorial solution. Moreover, one component factor of the five-factor and higher-order factor solutions showed a low reliability level, while the two factors of the bi-factorial structure have a high reliability level. The two dimensions identified correspond to the two parts of our scale: (a) self-efficacy for the decrease of consumption of determined unhealthy foods not recommended in the MeD and (b) self-efficacy for the consumption of determined healthy foods recommended in the MeD. This bidimensional structure responds to the understanding of the MeD as a healthy dietary pattern in which some aliments are unhealthy and have to be avoided, and others healthy and have to be consumed (Sahyoun & Sankavaram, 2016; Sofi et al., 2008). After refining the scale, 12 items composed the first factor, and 10 items composed the second, all referring to specific foods and/or to specific quantities of food to be decreased in their consumption (for the SESAMeD Part 1) or consumed (for the SESAMeD Part 2). The final SESAMeD Part 1 and SESAMeD Part 2 can be found in Appendices A and B, respectively.

The external validity of the scale was tested across the relation of the scale with different measures. The pattern of relations among the SESAMeD subscales and between the SESAMeD subscales and other psychological variables supported the validity of the bi-factorial structure and provided strong construct validity evidence. As we expected based on the previous literature, we found the SESAMeD and both of its two parts to be correlated with positive and negative outcome expectancies. In accordance with previous studies (Anderson et al., 2007; Renner & Schwarzer, 2005), the results have shown that the more individuals are confident in their ability to adhere to the MeD, to avoid prohibited foods, and to consume the recommended ones, the more

they expect the diet to provide positive outcomes (such as weight loss), and the less they expect the diet to provide negative outcomes (such as being hungry).

The expected relations also emerged between the SESAMeD and motivation. In accordance with the SDT (Deci & Ryan, 2000; Ryan & Deci, 2000), the SESAMeD and the two subscales positively correlated with autonomous motivation, but were not correlated with external motivation. Thus, the results show that the more intrinsically motivated patients are by the MeD, the higher their self-efficacy to adhere to the diet will be. Nevertheless, external motivation of individuals has no influence on their self-efficacy levels. In relation to motivation, the most interesting result is the relation maintained between the two subscales of the SESAMeD and introjected motivation. The results show that (a) self-efficacy for the avoidance of foods not recommended in the Mediterranean dietary pattern is correlated with introjected motivation, but (b) self-efficacy for the consumption of foods recommended in the Mediterranean dietary pattern is not correlated with introjected motivation. Thus, self-efficacy is only associated with the motivation to avoid feelings of culpability or shame, or to receive approval (introjected motivation), when it is referred to the self-restraint that individuals have to adopt in their nutritional behavior (self-efficacy for the avoidance of not recommended foods).

Finally, the relation between the two subscales of the SESAMeD and well-being and affective balance were also coherent and interesting. The results have shown that the global SESAMeD (in accordance with previous studies: Costarelli et al., 2013; McMillan et al., 2011; Psaltopoulou et al., 2013) and the SESAMeD Part 2, but not the SESAMeD Part 1, correlate with affective balance and well-being. Thus, in the same way that self-efficacy is only related to introjected motivation with regards to the avoidance of prohibited unhealthy foods, it is, also, only related to well-being and

positive moods with regards to the consumption of healthy foods, but not to the avoidance of prohibited foods. This means that the sense of ability to adhere to the MeD by consuming healthy foods is related with well-being and positive moods. However, the sense of ability to adhere to the MeD by decreasing the consumption of foods that may be unhealthy—but appreciated—is not related to well-being and moods.

**Limitations and future research**

Some limitations can be identified. Although the sample size was adequate and allowed for the development of a valid and psychometrically sound scale, and although the results of this study are encouraging, the data are cross-sectional in nature. In future research, investigators should conduct cross-cultural studies, paying particular attention to the different nutritional patterns of different countries or cultures. In this sense, the decision to keep or eliminate items due to floor or ceiling effect may be questionable depending on the culinary culture where the scale is used. Note that this study was developed in Córdoba, an area where the MeD is typical. Thus, we can wonder if the decision to eliminate butterfat from the SESAMeD Part 2 would have the same validity in an area where the consumption of butter is not abundant (as in Córdoba, an area where the MeD is typical) as in an area where the consumption of butter is part of the culinary culture (e.g., in some parts of France).

As scholars have observed, food preference is usually related to adherence to a diet (Nestle et al., 1998) and to food selection and eating patterns (Savoca & Miller, 2001). But this relation is not always observed, and some individuals may disassociate their food preferences from their food consumption (Nestle et al., 1998), for example basing their choice on the healthiness of food. In this sense, we think that self-efficacy for the diet may mediate and moderate the link between food preference and food consumption. Then, future research could explore the links among those three variables

by analyzing whether SESAMeD can (a) be influenced by the food preferences of individuals, (b) influence adherence to the MeD, and (c) moderate the food preferences–food consumption link.

**Conclusion**

In summary, analyses have provided reasonable evidence for the reliability and validity of the SESAMeD. Health researchers and practitioners now have a valid and reliable short scale to assess the confidence individuals have in their ability to adhere to the Mediterranean diet. The development of instruments related to healthy behaviors and their change is pertinent in order to determine how interventions can improve health (Levesque et al., 2007). As self-efficacy for the adherence to the—healthy—MeD may improve the faithfulness of patients to the prescribed MeD and, subsequently, their health, using the SESAMeD has potential implications for professionals and researchers, in order to improve interventions and subsequently adherence to the MeD and the health of patients. Specifically, the SESAMeD may be a useful instrument for helping practitioners to develop better strategies for nutritional interventions.

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Appendix A. Self-Efficacy Scale for Adherence to the Mediterranean Diet. SESAMeD Part 1 (self-efficacy for the decrease of consumption of food not presumed to be part of the Mediterranean diet)

| To what extent do you feel confident in your ability to avoid the foods on the following list? | 1 = "Cannot do at all" | 2 | 3 | 4 = "Moderately can do" | 5 | 6 | 7 = "Highly certain can do" |
|---|---|---|---|---|---|---|---|
| 1, Butterfat* | | | | | | | |
| 2. Butter | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. Margarine* | | | | | | | |
| 4. Mayonnaise | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5. Sugary drinks (soft drinks) | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6. sugary commercial juices | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7. Cake shop | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8. Bakery products | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 9. Chips or similar | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 10. Food or pre-cooked dishes | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 11. Whole milk of any kind (milk, cheese, yogurt, etc.) | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 12. Red meat (beef, pork, lamb, etc.) | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 13. Sausages (chorizo, black pudding, sausage or salami, etc.) | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 14. Processed meats (burgers, sausages, meatballs) | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

* items removed from the final scale for ceiling effects

Appendix B. Self-Efficacy Scale for Adherence to the Mediterranean Diet. SESAMeD Part 2 (Self-efficacy for the consumption of the characteristic foods of the Mediterranean Diet)

| To what extent do you feel confident in your ability to consume the foods on the following list or to consume them in the quantity suggested? | 1 = "Cannot do at all" | 2 | 3 | 4 = "Moderately can do" | 5 | 6 | 7 = "Highly certain can do" |
|---|---|---|---|---|---|---|---|
| 1. At least five tablespoons of olive oil a day, distributed among the different foods | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. Nuts and/or seeds at least three times a week | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. No more than two glasses of red wine a day if male, or no more than one glass of red wine if female | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. Two or more servings a day of green vegetables | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5. At least one serving of raw vegetables (e.g., salad) | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6. Three or more pieces of fruit a day (including natural juices, without adding sugar) | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7. A serving of legumes/pulses at least three times a week | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8. Fish and seafood at least three times a week | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 9. Bluefish (tuna, salmon, trout, mackerel, swordfish, anchovies, sardines...) at least once a week | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 10. Only shellfish (clams, mussels, etc.), avoiding other kinds of seafood | 1 | 2 | 3 | 4 | 5 | 6 | 7 |