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Mediterranean diet and emotion regulation

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Abstract

BACKGROUND: Mediterranean dietary patterns have been associated with cardiovascular and psychological health, including positive affect. Emotion regulation has not been linked to this pattern.

OBJECTIVE: The present study prospectively examined the relationship between Mediterranean diet and later emotion regulation and whether positive or negative affect mediated any such relationship.

METHODS: Data was derived from the Adventist Health Study-2 (2002–6), and Biopsychosocial Religion and Health Substudy (2006–7; 2010–11). We assessed adherence to Mediterranean diet using the Trichopoulou score at baseline, and responses to Positive and Negative Affect Schedule (2006–7) and Difficulties in Emotion Regulation Scale (2010–11) in 1,699 men and 3,293 women. Statistical analyses were performed using multiple linear regression and Hayes PROCESS SPSS macros.

RESULTS: Mediterranean dietary adherence scores were inversely related to difficulty with clarity of emotional responses (B =−0.013, $p = 0.006$, 95% CI [−0.23, −0.004]) but unrelated to difficulty with awareness of emotional responses or lack of access to strategies for regulating emotions. Positive and negative affect fully mediated the diet and clarity relationship by respectively decreasing and increasing difficulty with clarity (effect scores −0.007 [95% CI −0.009, −0.005] and −0.005 [95% CI −0.008, −0.003]).

CONCLUSIONS: Mediterranean diet adherence showed association with emotional clarity via increasing positive and decreasing negative affect.

Keywords

Affect; emotion regulation; Mediterranean diet

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1. Introduction

The Mediterranean diet boasts higher overall intakes of plant based foods and includes monounsaturated and omega-3 fatty acids, antioxidants, fiber, and micronutrients which synergistically promote health and longevity [1, 2]. It is widely accepted that dietary choices have significant influence on physical health and mortality, but the relationship between diet and psychological health is poorly understood.

Positive affective states promote the development of healthy social interactions and relationships, and are associated with improved health-related quality of life [3, 4]. Negative affect is characterized by feelings of distress, sadness and lethargy, with low negative affect being the absence of these feelings. Both dimensions of affect have been strongly linked to depression, and negative affect to anxiety [3]. Further, negative affect has been found to be a primary predictor of binge eating behaviors [5].

Emotion regulation is defined by Gross as “the processes by which individuals influence which emotions they have, when they have them, and how they experience and express them” [6]. According to Gross, emotions such as sadness or anger are managed and regulated in a variety of ways, some of which are helpful and some maladaptive. Different regulation strategies trigger different physiological and behavioral outcomes [7]. Gratz and Roemer defined emotion regulation in terms of (a) awareness, and understanding of emotions, (b) acceptance of emotions, (c) ability to control impulsive behaviors and behave in accordance with desired goals when experiencing negative emotions, and (d) ability to use situationally appropriate emotional regulation strategies flexibly to modulate emotional responses” [8]. Absence of these skills suggests difficulties with emotion regulation. The Difficulty with Emotional Regulation Scale (DERS) has been developed to measure major dimensions of emotional regulation including (a) lack of awareness of emotional responses, (b) lack of clarity of emotional responses, (c) non-acceptance of emotional responses, (d) limited access to emotion regulation strategies, (e) difficulties controlling impulses when experiencing negative emotions, and (f) difficulties engaging in goal-directed behaviors when experiencing negative emotions [8].

Difficulties in regulating emotions characterize many psychological conditions [6]. Three fourths of the diagnoses in the Diagnostic and Statistical Manual of Mental Disorders are characterized by difficulties with emotion regulation. Examples include major depression, borderline personality disorder [9], binge eating disorder, substance abuse, post-traumatic stress disorder and anxiety disorders [7]. Difficulties with emotional clarity and emotion regulation strategies, in particular, have been identified as most predictive of binge eating behaviors [5]. Use of adaptive emotion regulation strategies have been shown in meta-analyses to be inversely related to anxiety and depressive disorders [10]. The ability to modify or, at minimum, tolerate unpleasant emotions while continuing to respond adaptively has an important bearing on psychological health, development, and wellness [11–13].

In a recent study, intakes of fruit, vegetables, olive oil, nuts and legumes were significantly linked with positive affect, whereas soda, sweets and fast foods were inversely related to positive affect [14]. Intake of desserts and fast food correlated directly with increased

negative affect scores, whereas vegetable, fruit and nut consumption were inversely related. These observational results suggest that intakes of foods suggestive of a Mediterranean dietary pattern are protective in terms of reported well-being. Kinnunen and colleagues prospectively found that successful regulation of emotion was associated with lower prevalence of metabolic disease factors [15]. As such, maladaptive emotion regulation strategies may compound risk of chronic illness and mortality. These results, taken together, suggest an association of diet with psychological health which in turn may result in shifts in physical health-related outcomes.

Lafrance-Robinson and colleagues report that women had greater difficulty with emotion regulation strategies relative to men, and were also more prone to disordered eating patterns, which are thought to be a common means of soothing distressing emotions [16]. These authors suggest that future studies should include negative affect when examining the relationship between nutrition and emotion regulation [16]. Given these findings we examined the following questions:

1. Are Mediterranean dietary intake patterns associated with emotion regulation including difficulty with awareness of emotional responses, clarity of emotional responses and emotion regulation strategies?
2. Do positive and negative affect mediate the relationship between Mediterranean diet and these three domains of emotion regulation?

2. Methods

The present study used archived data from the 2002–6 Adventist Health Study-2 (AHS-2) [17] as well as wave 1 and 2 of a sub-study of the AHS-2, the 2006–11 Biopsychosocial Religion and Health Study (BRHS) [18]. The AHS-2 is a study of approximately 97,000 Seventh-day Adventists who completed a 52 page questionnaire on diet, lifestyle and health. Of these, 10,988 completed the 2006–7 BRHS survey on religion and health and of these 6,508 also completed the 2010–11 BRHS survey. Black and White participants were targeted in both studies. Of the 6,508 potential participants the following were excluded: (a) those whose reported daily energy intake was under 500 kilocalories ($n = 5$) or over 4500 kilocalories ($n = 41$), as this was most likely due to error; (b) BMI under 15 kg/m^2 or over 60 kg/m^2 ($n = 39$) as such BMIs are extreme outliers; (c) missing data on one or more study variables ($n = 1,423$) and (d) other ethnicity than Black or White ($n = 8$). As such, 4,992 participants were available for analysis.

All instruments and procedures were approved by the Loma Linda University Institutional Review Board in June 2001; approval was renewed annually thereafter. Personal identifiers were coded in the database to protect confidentiality and identifying information was stored separately from the data in a secure database.

2.1. Dietary measures

Dietary data was collected using a food frequency questionnaire (FFQ) from the AHS-2 survey. Participants were asked to identify how frequently they consumed food and beverage items on a 9-point scale: *never or rarely, 1 to 3 times monthly, once per week, 2 to 4 times*

weekly, 5 to 6 times weekly, once per day, 2 to 3 times daily, 4 to 5 times daily, and 6 or more times daily. Additionally, participants indicated the amount of each dietary item consumed on a three point scale: *standard serving size, half the standard size or less, or one and one half the standard serving or more with photos depicting these portions*. The Nutrition Data System for Research (NDS-R, Nutrition Coordinating Center, Minneapolis, MN, USA) was used to enter and analyze the dietary data. Previous analyses showed good validity for most foods among both Black and White participants [21, 22].

A Mediterranean diet score was calculated following the methods similar to that of Trichopoulou, Costacou, Bamia and Trichopoulos [23]. Included in the AHS-2 FFQ were nine dietary constituents which are either characteristic or not characteristic of a Mediterranean diet and used to create a Mediterranean diet score (Table 1). Each of the nine food groups were first regressed upon energy (kilocalorie) intake, allowing for control of energy intake for each participant with the residual method [24]. If a participant's intake of a food group characteristic of a Mediterranean diet (i.e., fruit, vegetables, olive oil, fish, legumes/beans, or nuts/seeds) was higher than the median value for all participants within the study sample, that participant was assigned a value of one for that category. If intake was equal to or less than the median, zero was assigned. Conversely, equal to or higher than median intakes for foods not characteristic of a Mediterranean diet (i.e., processed meats, red-meat/lamb or dairy) warranted a zero score, and lower than median intake a score of one. Thus, a nine-point total was possible with higher scores indicating greater adherence to the Mediterranean diet.

2.2. Measure of positive and negative affect

The 10-item Positive and Negative Affect Schedule (PANAS) [25] was completed by participants as part of the BRHS mailed survey in 2006–7. Participants rated their affect over the past year on a 5-point rating scale *(very slightly or not at all* to *extremely)* on the following adjectives: inspired, alert, enthusiastic, determined, excited, upset, nervous, distressed, scared and afraid. Taking a mean of the 5 positive ratings produced a positive affect rating and a mean of the 5 negative ratings produced a negative affect rating. If data were missing on one of the five then the mean of the remaining four was taken. If more than one item was missing then the case was dropped. Internal consistency analyses for PANAS have reported a Cronbach's alpha of 0.89 for positive affect and 0.85 for negative affect [3]. In the current study population Cronbach's alpha was 0.85 for positive affect and 0.87 for negative affect.

2.3. Measure of difficulty with emotional regulation

The subsequent BRHS 2010–11 survey assessed emotion regulation with three of the six scales from the DERS including those on emotional awareness (6 items), clarity of emotional responses (5 items) and access to emotion regulation strategies (8 items) [8, 26]. In order to lessen the burden on participants the other three scales were not queried. Participants described themselves on a 0–4 Likert scale: *almost never, sometimes, about half the time, most of the time* and *almost always* with higher scores indicating greater difficulty with emotion regulation. Cronbach's alphas were 0.81, 0.70 and 0.74 in the current study

population for each of the scales of difficulty with emotional awareness, clarity of emotional responses and regulation strategies, respectively.

2.4. Control variables

Control variables were assessed in the AHS-2 survey and included age, gender, self-reported weight and height to calculate BMI, education, ethnicity and exercise frequency. The variables were chosen as they represent likely confounders of the diet and emotion regulation relationship [27]. For measurement of exercise frequency, subjects were asked how frequently they engaged in vigorous exercise, with eight options ranging from *never* to *six or more times per week*.

2.5. Statistical analyses

Participants missing data for study variables were excluded listwise. Existing literature suggests that affect and emotion regulation responses may differ in regard to gender and ethnicity [19, 20]. Thus descriptive data were analyzed by gender and ethnicity and compared with Pillai's Trace test for significance which indicated that groups overall were different with $t = 0.175$, $F = 30.914$ ($p = 0.0001$, $df = 30$). Analysis of variance (ANOVA) was used to compare continuous variables, and Pearson's Chi Square for the categorical variable (education). For comparing means and percentages Bonferroni corrections were made for each of the six possible paired comparisons for each variable (see Table 2).

Gender and ethnicity were entered into least squares linear regression along with Mediterranean diet score and the product of the gender and ethnicity dummy variables and diet score. The latter were specified as the interaction term to examine potential differences across gender and ethnicity. Regression model results are not shown by gender and ethnicity, as gender and ethnicity did not modify the relationship between Mediterranean diet and DERS scores.

Statistical analyses were performed using SPSS version 21.0. Hayes PROCESS SPSS macros (2012) were used to examine the mediating role of affect in the diet and emotional regulation relationship [28]. The technique provides information about the proportion of an association between two variables that can be accounted for by mediator variable(s). In this case, both scales of the PANAS were treated as multiple mediators between diet and each emotion regulation subscale score. Total mediation effect sizes for each mediator (positive affect and negative affect) and the two mediators jointly were calculated and a 1,000 sample bias-adjusted bootstrap procedure performed to generate upper and lower 95% confidence intervals ($N = 4,992$).

3. Results

There were significant differences among the four groups (Black females, White females, Black males, White males) for all study variables (age, BMI, education, exercise, PANAS, DERS scores and Mediterranean diet scores). Pairwise comparisons revealed that Whites were older than Blacks, and Black females had the highest BMI (Table 2). The majority of participants had some college, with males being most educated. Blacks had higher positive affect than Whites. Females had higher negative affect than males. White males had more

difficulty with awareness of emotions than White females but both White males and females had more difficulty with awareness than Blacks. Whites had more difficulty with clarity of emotions than Blacks. For difficulty with strategies, White females scored higher than Black females or White males. Generally speaking, results suggest that Blacks had less difficulty with emotion regulation relative to Whites. Black females had the highest Mediterranean diet score, while White males had the lowest diet scores.

Pearson correlations indicated that all control variables were significantly associated with the Mediterranean diet score (Table 3). Better adherence to a Mediterranean diet was associated with older age as well as lower BMI. Participants with higher Mediterranean diet scores also had more education and higher exercise levels. Greater adherence to the diet was associated with higher positive affect scores, and lower negative affect scores. As anticipated, higher Mediterranean diet scores were inversely correlated with all DERS subscale scores—the greater the diet adherence, the fewer difficulties with emotion regulation.

In multiple regression models, higher Mediterranean diet scores predicted difficulty with clarity when affect scores were excluded in the model (Table 4). There was no relationship between Mediterranean diet score and difficulty with awareness and difficulty with strategies. The two affect domains were significantly related to Mediterranean diet score and DERS subscale scores in all six analyses.

Further testing for mediation effects using Hayes Process SPSS macros indicated that positive and negative affect mediated the relationship between Mediterranean diet adherence and difficulties with clarity of emotional responses (Table 5). The total effect of 1 unit change in Mediterranean diet was −0.0127 in relation to difficulty with clarity. A 1 unit change in Mediterranean diet score changed clarity by −0.007 when acting through positive affect and by −0.005 when acting through negative affect.

4. Discussion

We sought to understand any relation between diet and emotion regulation in this study. While adherence to the Mediterranean diet was not associated with the awareness and strategies components of emotion regulation, there was a relationship between adherence to the diet and fewer difficulties with clarity of emotional responses, and this relationship was mediated by positive and negative affect. That is, greater adherence to a Mediterranean diet appears to enhance positive affect and diminish negative affect, which in turn led to fewer difficulties with clarity. Adherence to a Mediterranean diet was associated with older age, lower BMI, more education and higher levels of exercise.

This study is the first, to our knowledge, to assess the association of Mediterranean diet adherence to emotion regulation. Emotion dysregulation is a known precursor to psychological disorders and is thought to have adverse implications in terms of physical health as well [15, 29]. While the finding that just one of three dimensions of emotion regulation studied was associated to diet may be due to chance, we observed that the association between diet and clarity of emotional responses was mediated by positive and

negative affect. Other studies have shown associations between diet and affect. A vegetarian diet appears to be associated with more favorable mood states [30]. In a pilot study, restriction of animal foods was associated with mood improvement [31]. We have reported an association between intake of Mediterranean diet-type foods and affect in an earlier study conducted in this population [14]. In the previous study, intake of foods typical of Mediterranean diets was associated with higher positive affect and lower negative affect while Western foods were associated with low positive affect. The current study extends the previous findings to the overall Mediterranean dietary score. Recent trends in measurement of diet favor adherence to the dietary components as a whole as opposed to looking at single nutrients due to the beneficial interactive effects [27]. The Trichopoulou score used in the current study to assess overall Mediterranean diet adherence has shown associations to longevity [23].

In adulthood, emotional complexity is paramount to healthy development and adjustment [32]. Adults must continuously regulate both positive and negative affect across situations to enhance intrapersonal and interpersonal functioning. Carl et al. [33] note for example that positive affect can be up-regulated by savoring a moment; it can be down-regulated by dampening. Negative affect is also continuously regulated and balanced with positive affect, and can be up-regulated with rumination or down-regulated with reappraisal or distraction [34]. At all times, dimensions of affect are balanced in complex ways to adapt to the environment. This research indicates one more avenue for adults to modulate emotion by changing their situation so there is less negative and more positive affect to regulate. Dietary modifications are “situational selections” that can improve affect and subsequently tax emotional regulation processes less over time [33]. We hypothesize that a possible mechanism for the relationship between diet and affect is that high intakes of plant-based nutrients such as monounsaturated and omega-3 fatty acids, antioxidants and fiber in the Mediterranean diet may promote anti-inflammatory processes which prevent oxidative stress. In contrast, arachidonic acid, an omega-6 fatty acid that is prevalent in animal-based foods, is a substrate for a number of proinflammatory cytokines which are possible disruptors of neuroendocrine signaling [20]—possibly influencing affective states.

Our study was consistent with previous findings showing that women reported greater difficulties with negative affect and with emotion regulation strategies than man [18]. White males reported greater difficulties with awareness relative to White females and Black participants. However, when gender × diet score and ethnicity × diet score were entered into the regression model as interaction terms, no significant differences were found across groups indicating that the group differences regarding emotional regulation and affect were not predicted by dietary patterns.

Several study limitations warrant discussion. First, this study is observational, and emotion regulation was only assessed at one time point. The population studied attended worship services regularly and may not be representative of Western society at large. The sample were primarily non-smoking, non-drinking, and with a high rate of vegetarian dietary patterns. The FFQ has been validated, and is considered one of the most accurate tools available for capturing dietary patterns. However, FFQ responses were self-reported, and subjects may under report intake of foods deemed unhealthy. A total of 1,423 subjects were

excluded due to missing data, and missing data tends not to be distributed evenly in regards to the study constructs.

5. Conclusion

The present study's findings suggested that adherence to an intake pattern characteristic of a Mediterranean diet may predict fewer difficulties with emotional clarity, by enhancement of positive affect and lowering negative affect. Future studies should examine the association of dietary patterns with additional domains of emotion regulation, and may strive to include clinical populations and outcomes.

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Table 1

Dietary variables used from food frequency questionnaire to create the Mediterranean diet score (ranging from 0–9 points possible)

Vegetables[a]	Dark green lettuce	Onions
	Iceberg lettuce	Avocados
	Tomatoes	Broccoli
	Peppers	Cauliflower
	Cabbage	Spinach
	Kale, collards, mustard greens	Peas
	Brussels sprouts	Carrots
Fruit[a]	Grapes	Persimmons
	Plums	Apples
	Apricots	Oranges
	Cantaloupe	Grapefruits
	Strawberries	Bananas
	Blueberries Cherries	Fresh fruit salad
Olive oil[a]	Added to breads, foods (aside from salads)	Salad dressing
Nuts and seeds[a]	Seeds (sunflower, pumpkin, sesame)	Walnuts
	Mixed nuts	Almonds
	Peanuts	Cashews
Fish (non-breaded/fried)[a]	White fish (cod, salt-fish, sole, haddock or halibut, snapper, catfish)	
	Salmon	Tuna salad
	Canned tuna	Tuna casserole
Legumes/beans[a]	Navy, red kidney, other red beans	Pinto, black
	Lentils, split peas Chick peas (garbanzos), black-eyed	Lima, white
Red meat and lamb[b]	Hamburger, ground beef (in casserole, meatballs) Beef or lamb as main dish (steak, roast, stew, pot pies)	
Processed meats[b]	Processed beef, lamb (sausage, salami, bologna) Processed chicken or turkey (turkey bologna, turkey, ham) Pork (bacon, sausage, ham, chops, ribs, lunch-meat)	
Dairy[b]	Low fat yogurt	Cottage cheese
	Regular yogurt	Low fat milk, 1%, skim

[a]Participants given one point for intakes above the median. Zero points given for intakes equal to or below the median.

[b]Participants given one point for intakes below the median. Zero points given for intakes equal to or above the median.

Table 2

Descriptive characteristics of participants by ethnicity and gender represented by mean (SD) or percentages. (*N*=4,992)

	Female		Male		*p* value[a]
	Black	**White**	**Black**	**White**	
	19.7%	46.3%	6.7%	27.3%	
	n=981	*n* = 2,312	*n* = 335	*n* = 1,364	
Age, years	57.7[b] (11.6)	62.1[a] (12.4)	59.3[b] (11.6)	63.0[a] (12.5)	<0.001
Body mass index, kg/m^2	28.5[b] (6.1)	26.5[a] (6.1)	26.9[a] (4.5)	26.2[a] (4.6)	<0.001
Education					<0.001
Grade school/Some high school	4.6%[a]	3.5%[a]	4.5%[a]	2.6%[a]	
High school or trade school diploma	13.6%[a,b]	17.2%[a]	12.2%[a,b]	13.0%[b]	
Associate's degree/Some college	35.6%[a]	36.6%[a]	25.1%[b]	23.8%[b]	
Bachelor's degree	22.7%[b]	28.0%[a]	25.1%[a,b]	23.0%[b]	
Master's or doctoral degree	23.5%[b]	14.7%[a]	33.1%[c]	37.6%[c]	
Exercise frequency score[b]	4.03[a] (2.14)	4.09[a] (2.27)	4.37[a,b] (2.17)	4.43[b] (2.17)	<0.001
Affect score[c]					
Positive affect	3.7[b] (0.7)	3.5[a] (0.7)	3.8[b] (0.7)	3.5[a] (0.7)	<0.001
Negative affect	1.77[a] (0.72)	1.77[a] (0.72)	1.53[b] (0.55)	1.57[b] (0.60)	<0.001
Difficulties with Emotion Regulation Subscales[d]					
Awareness	1.97[b] (0.84)	2.23[a] (0.83)	2.08[b] (0.82)	2.43[c] (0.85)	<0.001
Clarity	1.58[b] (0.61)	1.65[a] (0.61)	1.51[b] (0.57)	1.65[a] (0.63)	<0.001
Strategies	1.90[b] (0.49)	1.96[a] (0.48)	1.90[a,b] (0.46)	1.89[b] (0.45)	<0.001
Mediterranean diet score[e]	4.75[b] (1.83)	4.31[a,c] (1.79)	4.58[b,c] (1.76)	4.22[a] (1.87)	<0.001

Notes: Values in the same row not sharing the same subscript are significantly different ($p < .05$) in the two-sided test of equality for column means. Cells with no subscript are not included in the test. Tests are adjusted for all pairwise comparisons within a row of each innermost subtable using the Bonferroni correction.

[a]ANOVA used for continuous variables assuming equal variance in groups; Pearson's Chi Square used for categorical variable (education).

[b]Exercise frequency scores range from 1 *(never exercises)* to 8 *(exercises at least 6 times weekly).*

[c]Positive and Negative Affect Scales range from 1 *(very slightly or not at all)* to 5 *(extremely).*

[d]Difficulties in Emotion Regulation Subscale scores range from 1 *(almost never)* to 5 *(almost always)* with higher scores suggesting more difficulty with emotion regulation.

[e]Mediterranean Diet score ranges from 0 to 9 with higher scores suggesting greater compliance.

Table 3

Pearson correlation coefficients of Mediterranean diet Score[a] with study variables with 95% confidence intervals (*N*=4,992)

	R	Lower CI	Upper CI	*p* (2-tailed)
Age, years	0.053	0.025	0.081	<0.001
Body mass index, kg/m^2	−0.158	−0.182	−0.134	<0.001
Education [b]	0.066	0.039	0.093	<0.001
Exercise frequency [c]	0.147	0.120	0.175	<0.001
Affect score [d]				
Positive affect score	0.155	0.129	0.182	<0.001
Negative affect score	−0.085	−0.117	−0.060	<0.001
Difficulties with Emotion Regulation[e]				
Awareness	−0.057	−0.083	−0.029	<0.001
Clarity	−0.064	−0.092	−0.038	<0.001
Strategies	−0.040	−0.068	−0.013	0.005

[a] Mediterranean diet score ranges from 0 to 9 with higher scores suggesting greater compliance.

[b] Education score ranges from 1 (grade school) to 9 (doctoral degree).

[c] Exercise frequency scores range from 1 (never exercises) to 8 (exercises at least 6 times weekly).

[d] Positive and Negative Affect Scales range from 1 (very slightly or not at all) to 5 (extremely).

[e] Difficulties in Emotion Regulation Subscale scores range from 1 (almost never) to 5 (almost always) with higher scores suggesting more difficulty with emotion regulation.

Table 4

Association of emotion regulation scores[a] with Mediterranean diet scores[b] with and without controlling for affect[c] (*N*= 4,992)[d]

	Model 1 (without Affect)			Model 2 (with Affect)		
	B	**95% CI**	***p***	**B**	**95% CI**	***p***
Difficulty with awareness						
Age, years	0.002	[0.000, 0.004]	0.027	0.003	[0.001, 0.005]	0.001
Body mass index, kg/m^2	0.002	[−0.002, 0.006]	0.373	−0.001	[−0.005, 0.003]	0.658
Gender[e]	0.212	[0.159, 0.263]	0.001	0.22	[0.172, 0.269]	<0.001
Education	−0.052	[−0.72, −0.029]	0.001	−0.03	[−0.05, −0.009]	0.005
Exercise frequency[f]	−0.026	[−0.037, −0.016]	0.001	−0.012	[−0.022, −0.002]	0.023
Ethnicity[g]	−0.273	[−0.327, −0.218]	0.001	−0.179	[−0.232, −0.127]	<0.001
Positive affect				−0.345	[−0.38, −0.311]	<0.001
Negative affect				0.09	[0.055, 0.125]	<0.001
Mediterranean diet score	−0.011	[−0.024, 0.003]	0.099	0.005	[−0.008, 0.017]	0.451
Difficulty with clarity						
Age, years	−0.002	[−0.003, 0.000]	0.020	0.001	[−0.001, 0.002]	0.352
Body mass index, kg/m^2	0.003	[0.000, 0.006]	0.032	0.002	[−0.002, 0.003]	0.342
Gender	0.004	[−0.033, 0.041]	0.833	0.039	[0.004, 0.073]	0.020
Education	−0.036	[−0.0592, −0.021]	0.000	−0.016	[−0.032, −0.000]	0.049
Exercise frequency	−0.010	[−0.018, −0.003]	0.010	0.001	[−0.007, 0.008]	0.838
Ethnicity	−0.102	[−0.142, −0.062]	0.000	−0.042	[−0.080, −0.006]	0.026
Positive affect				−0.191	[−0.218, −0.164]	0.001
Negative affect				0.227	[0.200, 0.257]	0.001
Mediterranean diet score	−0.013	[−0.23, −0.004]	0.006	−0.001	[−0.010, 0.008]	0.872
Difficulty with strategies						
Age, years	−0.005	[−0.006, −0.004]	0.000	−0.003	[−0.004, −0.002]	0.001
Body mass index, kg/m^2	0.004	[0.001, 0.006]	0.003	0.003	[0.001, 0.005]	0.011
Gender	−0.037	[−0.066, −0.009]	0.009	0.001	[−0.025, 0.028]	0.908
Education	−0.020	[−0.032, −0.008]	0.001	−0.006	[−0.017, 0.005]	0.329
Exercise frequency	−0.007	[−0.013, −0.001]	0.017	−0.001	[−0.007, 0.005]	0.752
Ethnicity	−0.063	[−0.094, −0.033]	0.000	−0.035	[−0.064, 0.006]	0.017
Positive affect				−0.065	[−0.085, −0.043]	0.001
Negative affect				0.232	[0.209, 0.257]	0.001
Mediterranean diet score	−0.003	[−0.011, 0.004]	0.367	0.005	[−0.002, 0.011]	0.202

[a] Difficulties in Emotion Regulation Subscale scores range from 1 *(almost never)to* 5 *(almost always)* with higher scores suggesting more difficulty with emotion regulation.

[b] Mediterranean diet score ranges from 0 to 9 with higher scores suggesting greater compliance.

[c] Positive and Negative Affect Scales range from 1 *(very slightly or not at all)* to 5 *(extremely).*

[d] Emotion regulation subscales scores regressed upon Mediterranean Diet score.

[e] Gender was coded 1 = female and 2 = male.

[f] Exercise frequency scores range from 1 *(never exercises)* to 8 *(exercises at least 6 times weekly).*

[g] Ethnicity was coded as 1 = White and 2 = Black.

Table 5

Test for mediating effects of positive and negative affect scores on relationship between Mediterranean diet score[a] and emotion regulation[b] (*N* = 4,992)[c]

	Effect[e]	95% CI	SE	t	*p*
Direct effects of Mediterranean dieta on DERS subscale scores[b]					
Awareness	0.005	[−0.008, 0.017]	0.006	0.075	0.451
Clarity	−0.001	[−0.010, 0.008]	0.005	−0.161	0.872
Strategies	0.005	[−0.002, 0.012]	0.035	1.301	0.193
Indirect effects of Mediterranean diet on DERS Subscale Scores					
Awareness					
Total	−0.016	[−0.020, −0.011]	0.002		
Positive affect[d]	−0.013	[−0.018, −0.010]	0.002		
Negative affect[d]	−0.002	[−0.004, −0.001]	0.006		
Clarity					
Total	−0.013	[−0.017, −0.009]	0.020		
Positive affect	−0.007	[−0.009, −0.005]	0.001		
Negative affect	−0.005	[−0.008, −0.003]	0.001		
Strategies					
Total	−0.008	[−0.011, −0.005]	0.001		
Positive affect	−0.003	[−0.004, −0.002]	0.001		
Negative affect	−0.006	[−0.001, −0.000]	0.001		

[a] Mediterranean diet score ranges from 0 to 9 with higher scores suggesting greater compliance.

[b] Difficulties in Emotion Regulation Subscale scores range from 1 (almost never) to 5 (almost always) with higher scores suggesting more difficulty with emotion regulation.

[c] Hayes (2012) Process SPSS macros performed with 95% confidence intervals based on a 1,000 sample bias-corrected bootstrap.

[d] Positive and Negative Affect Scales range from 1 (very slightly or not at all) to 5 (extremely).

[e] Effects are change in difficulty with emotion for a 1 unit change in the Mediterranean diet score through the corresponding path. For example consider the indirect association of Mediterranean diet on awareness, a 1 unit increase in the Mediterranean diet score is associated with a .013 decrease in difficulty with awareness by the indirect path through positive affect.