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Depressive symptoms are associated with dietary intake but not physical activity among overweight and obese women from disadvantaged neighborhoods

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Abstract

Evidence suggests that depressive symptoms are associated with poorer dietary intake and inadequate physical activity; however, this association has not been examined in lower income overweight and obese African American women. The objective of this cross-sectional study was to examine the associations between depressive symptoms and diet and physical activity in 196 women (87% African American, ages 25–51). Higher depressive symptoms were hypothesized to predict poorer diet quality, greater emotional eating, lower physical activity levels, and greater sedentary time. Depressive symptoms were measured using the validated short form of the Center for Epidemiological Studies Depression Scale (CESD-10). Dietary intake and quality were assessed using three 24-hour dietary recalls. Emotional eating was evaluated using four items from the emotional eating subscale of the Eating Behavior Patterns Questionnaire. Physical activity and sedentary time were objectively measured using the ActiGraph accelerometer. Linear regression models tested the associations between depressive symptoms and each dietary and physical activity outcome variable. Symptoms of depression were positively associated with total daily caloric intake from saturated fat and total sugars, as well as emotional eating scores (p values < . 05). While not statistically significant, depressive symptoms were positively associated with sweetened beverage consumption (p=.06) and added sugars (p=.07). Depressive symptoms were not associated with total fat, sodium, fruit and vegetables, fast food consumption, the Alternate Healthy Eating Index score, moderate-to-vigorous physical activity or sedentary time. Future studies should explore the mechanisms linking the identified associations between depressive symptoms and dietary intake, such as the role of emotional eating.

Keywords

Depression; diet; physical activity; women; African Americans

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1. Introduction

Depression is a leading contributor to the global burden of disease, and disproportionately affects women, African Americans, and the financially disadvantaged [1–3]. Research suggests that depressive symptoms are associated with increased risk of relatively lower diet quality and physical activity (PA) [4–8]. However, no studies have examined this association in overweight and obese lower income African American women, a population at higher risk for depression, poor diet, and inadequate PA as compared to white women [2,9–12].

Research on depression and diet has typically focused on nutrients such as omega-3 fatty acids, zinc, magnesium, and B-vitamins [13,14]. More recently there has been a shift away from studying isolated nutrients and toward a more comprehensive view of dietary patterns. For example, Appelhans and colleagues found greater depression severity to be associated with poorer overall diet quality, as measured by the Alternative Healthy Eating Index (AHEI), in a sample of predominantly white obese women [4]. These associations were driven by greater intake of sugar, saturated fat and sodium. Other studies have found associations between greater depressive symptoms and more frequent fast-food intake [5], higher sweetened food consumption [6], and lower fruit and vegetable intake [7]. Similarly, emotional eating (the tendency to eat in response to negative emotions) is also associated with poorer diet quality, including high consumption of energy dense snack foods [15] and sweets [16,17]. Some evidence also suggests emotional eating is positively associated with depressive symptoms[18,19]; however, no studies were identified that examined this relationship in African American women.

An inverse association between depressive symptoms and physical activity is consistently reported [8]. Most of the existing research has examined self-reported leisure-time PA and depression [20]. However, studies examining total PA have also reported inverse associations with depression disorders [21,22]. Few studies have examined the associations of PA and depression using objective measures. Research using data from the National Health and Nutritional Examination Survey (NHANES) in the US found an inverse association between accelerometer measured PA and depressive symptoms in the general population and specific subgroups, including pregnant women and older adults [23–26]. For example, Song and colleagues found that adults with moderate to severe depression spend less time in light and moderate-intensity PA as measured by accelerometer data than non-depressed adults [23].

Research also suggests that higher levels of self reported sedentary behaviors (computer time, TV viewing and sitting time) are positively associated with depression symptoms [27,28]. Teychenne and colleagues examined self-reported sedentary behaviors and depressive symptoms among lower income women from Australia. Compared with women in the lowest tertiles of self-reported TV viewing time, screen time and sitting time, those in the highest tertiles had significantly greater odds of depression [28]. There is limited data on objectively measured sedentary time and depression. However, two studies were identified that examined accelerometer measured sedentary time in overweight and obese adults, both reporting greater odds of depressive symptoms in those with greater sedentary time [24,29].

Few studies have examined the association of depressive symptoms with *both* diet and PA, and results have been mixed. Two studies found that greater levels of depressive symptoms were associated with lower diet quality, but not with PA [4,30]. Data from the Reasons for Geographic and Racial Differences in Stroke (REGARDS) study found an association between depressive symptoms and both poor diet quality and low levels of PA in adults 45 years and older [31]. Only the REGARDS study included a large proportion of African Americans [31], and all studies examining both diet and PA used self-report measures of PA.

The objective of our study was to examine the associations between depressive symptoms and both dietary intake and PA in overweight and obese, predominantly African American women who were recruited from economically disadvantaged neighborhoods. We hypothesized that symptoms of depression would be positively and significantly associated with poorer diet quality, emotional eating, lower levels of moderate-to-vigorous physical activity (MVPA), and greater levels of sedentary time. To test this hypothesis, we estimated overall diet quality using the Alternate Healthy Eating Index (AHEI) and also collected information on percent of calories from total fat, saturated fat, added sugars and total sugars, sweetened beverages, sodium, fruit and vegetable intake, fast-food frequency, emotional eating score, as well as MVPA and sedentary time. These specific variables were selected to gain a more comprehensive view of health behaviors. Analyses examined associations between depressive symptoms and each of these dietary and physical activity variables.

2. Methods and Materials

The Sisters Taking Action for Real Success (STARS) study was a randomized controlled trial designed to test a culturally appropriate behavioral and social support intervention to reduce body weight, increase PA and improve dietary intake in women from economically disadvantaged neighborhoods. Complete details of the study's protocols and theoretical approach have been described previously [32]. This paper analyzed data from the baseline measurement period collected prior to random assignment to intervention and control groups.

2.1 Participants

Overweight and obese women were recruited in Columbia, SC using a community outreach approach. We engaged an advisory committee from the community to advise us on recruitment venues and assist with "word-of mouth" recruitment. In addition to leaving posters and sign-up sheets in recommended community settings, staff members and advisory committee members gave presentations, set up information tables and conducted face-to-face recruitment in various community settings. Inclusion criteria were: (1) body mass index $\geq 25 kg/m^2$ and waist circumference ≥ 88 centimeters; (2) 25 to 50 years of age at their last birthday; (3) able to read and speak English; not pregnant; (5) able to participate in some type of MVPA; (6) no affirmative responses on the Physical Activity Readiness Questionnaire (PAR-Q) or approval by a physician on the Physical Activity Readiness Medical Examination (PAR-MED-X) if an affirmative response was provided; (7) blood pressure <140/90 (unless approved by physician); (8) no impairments that would prohibit participation in data collection, group discussion, or learning activities even with

accommodations; and (9) did not have insulin-dependent diabetes. Further, women had to live in a setting that allowed them to select their own food (non-institutional residence). Of 746 initial telephone inquiries, 657 women were successfully reached and screened for eligibility; 307 met inclusion criteria. All eligible women who signed informed consent and had complete accelerometer and dietary recall data at baseline were included in these analyses. The University of South Carolina's Institutional Review Board approved the study protocol.

2.2 Measures

Depressive symptoms were measured using the validated short form of the Center for Epidemiological Studies Depression Scale (CESD-10) [33,34]. Participants were asked to rate how often they experienced symptoms of depression over the previous week. Scores can range from 0 to 30, and higher scores are indicative of more depressive symptoms. Scores of 10 or higher have been associated with clinically diagnosed depression [35].

Dietary intake was assessed via three 24-hour dietary recalls, a methodology with established validity and reliability [36]. During the baseline measurement session all participants went through a one-on-one, 20-minute training session to promote accurate portion size estimation. This training was based on an existing protocol using Food Portion Visual (The 2D Food Portion Visual, 1996, Nutrition Consulting Enterprises, Framingham, MA) [37], and was further enhanced to include food models, plates, bowls, cups and utensils. Immediately following this session, participants completed their first 24-hour dietary recall by telephone with a registered dietician trained in the interview protocol through the University's Dietary Assessment Research Unit. Dietary intake data were collected and analyzed using Nutrition Data System for Research (NDSR V2011), developed by the Nutrition Coordinating Center (NCC), University of Minnesota, Minneapolis, MN [38].

The dietary outcomes of interest for this study were percent of calories from total fat, saturated fat, added sugars and total sugars; sweetened beverages (servings/day); sodium (mg/day); fruits and vegetables (servings/day); and fast-food frequency (meals or snacks/week). Fruit and vegetable serving sizes are defined in the NDSR manual [38], and based on the 2005 Dietary Guidelines for Americans [39]. For example, fruit servings are defined as 1 medium apple, banana, orange or pear, ½ cup of chopped, cooked or canned fruit, ¼ cup of dried fruit, or ½ cup of fruit juice. Vegetable servings are defined as 1 cup of raw leafy vegetables, ½ cup of other cooked or raw vegetables, or ½ cup of vegetable juice.

We also estimated overall diet quality using an adaptation of the AHEI. The AHEI has a possible score range from 0 to 100 and has been shown to have stronger associations with health outcomes than other indices [40,41]. The original AHEI consists of nine components, including: vegetables, fruit, non-meat protein sources, ratio of white to red meat, cereal/grain fiber intake, trans fat, ratio of polyunsaturated to saturated fat, duration of multivitamin use, and alcohol use. Multivitamin use was not assessed; therefore eight of the nine original components were included in this study and the computation of the score adjusted accordingly to produce a possible range from 0 to 80, with a higher score indicating a higher quality diet.

Emotional eating practices (the tendency to eat in response to negative emotions) were also assessed using four items from the emotional eating subscale of the Eating Behavior Patterns Questionnaire [42]. The questions ask participants if they eat when they are upset, eat for comfort, eat when not hungry, or eat until the package of food is finished. This subscale has acceptable internal consistency (alpha=.77), and demonstrated construct validity in a sample of African American women [42].

PA was measured objectively using the ActiGraph accelerometer (GT1M model, ActiGraph, LLC, Fort Walton Beach, FL) with ActiLife Lifestyle Monitoring System software, version 3.2.11). Participants were asked to wear the monitor for seven consecutive days during all waking hours (except while bathing or swimming). This week began the day after the data collection session. The monitoring epoch length was 60 seconds. The participants' orientation and wear protocol have been described in detail previously [43].

The minimum amount of data required for inclusion in analyses was four days of at least 10 hours of continuous wear. The first seven consecutive days were used unless there were any days in which the Actigraph was worn fewer than 10 hours. If one or more days were eliminated due to insufficient wear time, and the Actigraph had been worn for a second week, corresponding days (matching weekdays for weekdays and weekend for weekend) from the second week were substituted for the insufficient-wear days. If this procedure yielded fewer than four days of sufficient wear the participants' data were not used. Data reduction identified "non-wear" time as 60 minutes or more of consecutive zero counts [44,45], and all remaining counts were categorized into sedentary, light, moderate or vigorous PA according to Lopes' et al. cut points, which have been validated in a sample of middle-aged to older obese adults with type 2 diabetes [46]. The following cut points were used for categorization: sedentary (<200 counts per minute (cpm); <1.5 METs), light (200–1239 cpm; 1.5 to 1.9 METs), moderate (1240–2399 cpm; 3.0–5.9 METs) or vigorous (≤ 2400; ≤ 6 METs). Total minutes per day of MVPA as well as minutes per day of MVPA from bouts lasting 10 minutes or longer were expressed in units of minutes per week by multiplying the respective average daily totals by 7 to get the MVPA minutes per week (total minutes per week of MVPA and minutes of MVPA per week in bouts of 10 or more minutes).

The public health recommendation for PA is to accumulate at least 150 minutes of moderate intensity activity per week or 75 minutes of vigorous intensity activity per week, or a combination of the two in bouts of at least 10 minutes [8]. We computed total minutes per day of MVPA, total minutes per day of MVPA from bouts lasting 10 minutes or longer, and total minutes per day of sedentary time. To account for variations among participants in total accelerometer wear time, we also calculated MVPA (total time and in bouts ≥ 10 minutes) and sedentary time as a percentage of total wear time.

2.3 Statistical analyses

Linear regression models tested the associations between depressive symptoms (independent variable) and percent calories from total fat and saturated fat, total sugars (grams/day), added sugars (grams/day), sweetened beverages (servings/day), total sodium (milligrams/day), fruits and vegetables (servings/day), the AHEI and emotional eating score (dependent

variables). Dietary models were adjusted for age, education, employment, marital status and average daily caloric intake. These potential confounders have been reported in previous research [5].

Linear regression models also tested associations between depressive symptoms and total minutes/week of MVPA in bouts ≥ 10 minutes and total minutes/week of sedentary time. Models were also run using MVPA in bouts ≥ 10 minutes and sedentary time as a percentage of total wear time (dependent variables). PA models adjusted for the same variables in the dietary models, with the exception of average daily caloric intake, as reported in prior research using accelerometer data [23]. Because of normality violations with the models examining MVPA, quantile and linear regression models were examined. As the models were very similar we chose to report the results using linear regression. SAS version 9.2 was used for all statistical analyses.

3. Results

Informed consent was obtained on 230 women, and 26 were excluded because of medical contraindications and other exclusion criteria. Of the remaining 204 women, one did not complete the 24-hour dietary recalls, six did not have accelerometer data, and one had neither, resulting in a sample of 196 for these analyses. The average time between the first and third dietary recall interviews was 9.5 days. Participant demographics are shown in Table 1. Participants averaged 38.3 ± 7.6 years. The sample was predominantly African American, not married, employed, and high school educated or beyond. Health-related characteristics are shown in Table 2. The most frequently reported health conditions were hypertension, arthritis, lung disease, diabetes and heart disease. The majority of participants were obese, with an average BMI of 40.6 ± 8.8 kg/m^2. The mean CESD-10 score was 9.4 ± 5.5 (range 2.0–29.0). Average caloric intake was 1,926.0 ± 767.5 calories/day with 35.0 ± 6.1% of calories from total fat. Fruit and vegetable intake was 3.3 ± 1.8 servings/day and AHEI total score averaged 29.9 ± 9.4. Mean total MVPA was 303.1 ± 174.2 minutes/week, and mean MVPA accumulated in bouts ≥ 10 minutes was 37.1 ± 71.7 minutes/week. Percent of total accelerometer wear time spent in MVPA, in MVPA bouts ≥ 10 minutes, and sedentary averaged 5.2 ± 2.9%, 0.6 ± 1.3% and 72.2 ± 7.7%, respectively.

As seen in Table 3, symptoms of depression were positively associated with percentage of total daily caloric intake from saturated fat (t = 2.21, p = .03), total sugars (t = 2.05, p = .04), and emotional eating score (t = 2.81, p = 01). While not statistically significant, depressive symptoms were positively associated with sweetened beverage consumption (p = .06), and added sugars (p = .07). Depressive symptoms were not associated with percent of calories from total fat, sodium, fruit and vegetable intake; fast food consumption; or AHEI total score. Depressive symptoms were not associated with MVPA or sedentary time.

Because depressive symptoms were positively associated with emotional eating scores, we conducted additional analyses to examine the associations between emotional eating (independent variable) and total fat, saturated fat, total sugars, added sugars, and sweetened beverages (dependent variables). Emotional eating was positively associated with total sugar

intake (t = 2.01, p = .05), but not with total fat (t = 0.65, p = .52), saturated fat (t= 0.25, p = .80), added sugars (t = 1.78, p = .08), or sweetened beverages (t = 0.41, p = .68).

4. Discussion

This study examined the associations between depressive symptoms, diet, emotional eating, MVPA, and sedentary time in an understudied population of predominantly obese African American women recruited from financially disadvantaged neighborhoods. While depressive symptoms were not associated with overall dietary quality (assessed with the AHEI index) as hypothesized, they were associated with greater saturated fat and total sugar intake, as well as greater emotional eating scores. Contrary to hypotheses, depressive symptoms were not associated with MVPA or sedentary time.

Previous studies have identified a positive association between depression and sugar intake [4,47,48]. Peet and Westover independently found that sugar consumption was associated with depression in different multinational samples [47,48]. Research examining the association between depression and fats has primarily focused on the protective effects of essential fatty acids [49,50]. However, two studies reported a positive association between depressive symptoms and saturated fat intake [4,51].

It remains unclear whether depressive symptoms lead to greater consumption of sugar and fat or if consumption of sugar and fat leads to greater symptoms of depression, or if the association is bi-directional. The majority of research examining the association between depressive symptoms and diet has been cross-sectional. However, several prospective studies were identified that examined the association between dietary intake and depression incidence [52–54]. The Seguimiento Universidad de Navarra (SUN) project reported positive associations between baseline trans-fat intake and subsequent depression in a cohort of Spanish adults followed for an average of 6 years [52]. The British Whitehall II study found that high consumption of processed food (sweetened desserts, chocolates, fried food, processed meat, pies, high-fat dairy products and condiments) was associated with increased odds of depression 5 years later [53].

Molteni and colleagues have identified a plausible mechanism to explain how poor dietary intake, specifically high sugar and fat consumption, may lead to an increased risk of depression. Ingestion of sugar and fat in rats led to a reduction in brain-derived neurotrophic factor (BDNF), a protein responsible for creation of new neurons [55]. This reduction in BDNF may lead to a reduction in synaptic function, neuronal growth, and cognitive function, and has implications for the development of depression.

No studies were identified that prospectively examined the association between depressive symptoms and subsequent dietary intake. However, one potential mechanism explaining how depression may alter eating behaviors, including an increased desire for sweet and higher fat foods, is linked to hypothalamic pituitary adrenal (HPA) axis activity. Evidence suggests that individuals with depression have increased activity of the HPA axis, which in turn increases the release of glucocorticoids in the blood [56]. Glucocorticoids stimulate food intake, particularly of palatable foods (i.e. foods high in fat and sugar) [57,58].

Additional prospective studies are needed to further examine the directionality of the association between depressive symptoms and dietary intake.

Consistent with our findings, other studies have reported an association between greater depressive symptoms and increased engagement in emotional eating [18,19]. Emotional eating may be an important factor that explains the association between depressive symptoms and unhealthy food choices, particularly high consumption of energy dense snack foods [15] and sweets [16,17]. To further explore this relationship we used linear regression models to examine the associations between emotional eating and total fat, saturated fat, added sugars, total sugars, and sweetened beverage intake; however, emotional eating was significantly associated with total sugar intake only. Our secondary analysis of cross-sectional data provides evidence of an association between depressive symptom level, saturated fat, and total sugar intake; however, further research is needed to examine the mechanisms behind these associations.

Our hypotheses regarding associations between depressive symptoms, lower MVPA and greater sedentary time were not supported. These findings contrast with other large cross-sectional [23] and longitudinal studies [59,60]. This study may not have found the same relationship due to the overall low levels of PA across all participants. Furthermore, the majority of existing studies examining depression and PA have relied on self-report measures of leisure-time PA [20]. Some evidence suggests that a stronger association exists between leisure time PA and depression than overall PA or PA in other domains (transport, work, domestic PA) [27,28]. Therefore, it is possible that we were unable to detect significant relationships because we were unable to specifically examine leisure-time PA in our analyses.

This study adds to and strengthens the literature in multiple ways. We focused on an understudied, high-risk population of predominantly obese African American women living in financially disadvantaged neighborhoods. Existing studies have primarily focused on the association between depression and dietary intake or depression and PA. This study examined both health behaviors. Further, this is the first study to our knowledge to examine the association of emotional eating and depressive symptoms in African American women. Participants completed three 24-hour dietary recalls, which is considered the gold standard for measuring dietary intake in population-based research. MVPA and sedentary time were measured objectively using Actigraph accelerometers.

While this study offers some unique insights into the relationship between depressive symptoms and health behaviors, the findings and implications of this study should be interpreted with a number of limitations in mind. This report uses cross-sectional data from baseline measurements; therefore we cannot determine the direction of the relationship between variables or infer causality. It is possible that depressive symptoms may be related to dietary misreporting; however, evidence examining this relationship is insufficient [61], and 24-hour dietary recalls have established validity and reliability [36, 62]. While objective measurement of PA is a strength of this study, we were unable to examine domain specific PA, which again may explain our non-significant findings. The study sample size was determined to provide adequate power to detect change over time as a result of a diet and

exercise intervention. However, this paper reports results from a secondary analysis of baseline data for which no a priori calculations were conducted. Therefore, given that our total sample was relatively small compared to other population-based studies examining depressive symptoms and health behaviors, it is possible that our study may not have been adequately powered to detect meaningful but modest differences. However, the rigorous measurement methodology and access to an underserved, predominantly African American sample of participants are strengths.

In summary, depressive symptoms were positively associated with saturated fat, total sugar, and emotional eating. However, depressive symptoms were not associated with the other hypothesized dietary variables, physical activity or sedentary time. In light of these findings, targeted interventions aimed at reducing depressive symptoms should also help women cope with negative affect in more positive ways than eating high fat, high sugar foods. Evidence from prospective studies is needed to further examine the directionality of the relationships found in this study. Our findings may also encourage future research to examine the role of emotional eating as a possible mechanism mediating the association between depressive symptoms and dietary intake. Finally, studies should further explore the association of depressive symptoms and PA using a combination of both objective and subjective measures to determine if this association is activity domain specific.

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Abbreviations

PA	physical activity
AHEI	Alternative Healthy Eating Index
NHANES	National Health and Nutritional Examination Survey
REGARDS	Reasons for Geographic and Racial Differences in Stroke
MVPA	moderate to vigorous physical activity
STARS	Sisters Taking Action for Real Success
PAR-Q	Physical Activity Readiness Questionnaire
PAR-QX	Physical Activity Readiness Medical Examination
CESD-10	Epidemiological Studies Depression Scale
NDSR	Nutrition Data System for Research
SUN	Seguimiento Universidad de Navarra
BDNF	Brain Derived Neurotropic Factor

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Table 1

Sociodemographic characteristics of study participants

Characteristic		Percentage
Race		
White		8.2
Black/African American		86.7
Other		4.6
Missing		0.5
Hispanic Ethnicity		
Yes		3.1
No		96.4
Missing		0.5
Education		
Grades 1–8		0.5
Grades 9–11		4.1
Grade 12 or GED		15.8
Some college		49.0
College grad		30.6
Employment status		
Employed or self-employed		74.0
Not employed		13.8
Student		4.6
Retired		1.0
Unable to work		3.1
Employed and student		3.6
Marital Status		
Married		20.9
Divorced		18.4
Widowed		1.5
Separated		8.7
Never married		41.3
Couple		9.2
	Mean ± SD	Range
Age (years)	38.3 ± 7.6	25–51
Number of children in household	1 ± 1.2	0–5

Values are percentages and means ± SD of n = 196

Table 2

Health-related characteristics of study participants

Characteristic		Percentage
Self-reported health conditions (past or present)		
Hypertension		30.1
Arthritis		14.3
Diabetes		10.7
Lung disease		12.2
Heart disease		9.7
Cancer		1.5
Stroke		0.51
Weight Status		
Overweight		5.6
Obese		94.4
	Mean ± SD	Range
Body Mass Index	40.6 ± 8.8	27.0–69.5
Depressive Symptoms Score [a]	9.4 ± 5.5	2.0–29.0

Values are percentages and means ± SD of n = 196

[a] Depressive symptoms score can range from 0–30, higher scores indicate more depressive symptoms

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Table 3

Association of depressive symptoms with dietary and physical activity behaviors: Results from linear regression models with selected covariates

Dependent Variable	Overall Model		Depressive Symptoms		Model R-Squared
	F statistic	p-value	t statistic	p-value	
Dietary Models					
% of total Kcals from fat	1.18	0.30	1.98	0.05	0.08
% of total Kcals from saturated fat	1.88	0.03	2.21	0.03*	0.12
Total Sugars (g/d)	34.49	<0.01	2.05	0.04*	0.71
Added Sugars (g/d)	25.99	<0.01	1.83	0.07	0.65
Sweetened Beverages (srv/d)	5.83	<0.01	1.93	0.06	0.29
Total Sodium (mg/d)	35.25	<0.01	0.43	0.66	0.72
Total Fruits/Vegetables (srv/d)	2.78	<0.01	1.06	0.29	0.17
AHEI Total Score[a]	1.80	0.05	0.30	0.76	0.11
Emotional Eating Score	2.20	0.01	2.81	0.01*	0.14
Fast Food frequency (meals or snacks/week)	2.85	<0.01	0.24	0.81	0.17
Physical Activity Models					
MVPA bouts ≥ 10 min (min/week)	2.68	<0.01	0.30	0.77	0.15
MVPA bouts ≥ 10 min (%)	2.75	<0.01	0.07	0.95	0.15
Sedentary time (min/week)	1.99	0.03	0.04	0.97	0.12
Sedentary time (%)	2.39	0.01	0.05	0.96	0.14

Each model (n=196) contained depressive symptoms (independent variable) and age, marital status, education, and employment (covariates). The dietary models also contained average daily total kcals (covariate).

The F statistic and its probability (p-value) refer to the overall model that contains depressive symptoms and all covariates.

The t statistic and its probability (p-value) refer to the association between depressive symptoms (independent variable) and the dependent variable, after adjustment for all covariates.

[a]Total score can range from 0 to 80. Higher scores indicate a more favorable diet.

*p-value <.05