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Is there a relationship between personality traits and fruit and vegetable intake among pregnant women?

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Abstract

Previous studies have shown that certain personality traits such as neuroticism and conscientiousness influence dietary choices. Pregnancy is a unique period in a woman's life during which most women are highly intrinsically and extrinsically motivated to start a diet rich in fruit and vegetables. Yet, an adequate consumption of fruits and vegetables remains a challenge for many women. The present study investigates the relationships between personality traits and fish, dairy, fruit, and vegetable intake. Data was collected from 602 pregnant women and analyzed using descriptive statistics and hierarchical regression analyses in order to examine predictive relationships between the variables of interest. The results demonstrated that high scores in openness to experience, older maternal age, higher income, and educational attainment were positively associated with increased fish, vegetable, and fruit intake. These findings have important implications for interventions that seek to improve eating behaviors of pregnant women, thereby increasing the health of their pregnancies.

Keywords

diet, health behaviors, personality traits, pregnancy, women's health

Introduction

Pregnancy is a unique window of opportunity to improve eating patterns. Pregnant women are encouraged by their health care professionals to have a healthy diet for the benefit of fetal development and the ability to carry a pregnancy to term without complications (McDermott et al., 2009; Wen et al., 2010). The 2015–2020 Dietary Guidelines from the U.S. Department of Agriculture recommends the general population, as well as women who are or would like to become pregnant, to consume 2½ cup-equivalents of vegetables, 2 cup-equivalents of fruit, and 3 cup-equivalents of dairy products every day, and at least 8 and up to 12 ounces of fish per week. In addition, the guidelines recommend limiting calories from saturated and trans fats, added sugar, and sodium (U.S. Department of Health and Human Services and U.S. Department of Agriculture, 2015). Recent estimates, however, show that about three-fourths of the population does not meet the recommendations and their daily intake of vegetables, fruits, and dairy is low (Krebs-Smith et al., 2010).

Despite the considerable health benefits of a healthy diet for the mother and fetus, pregnant women, like the general population, also do not meet recommendations for fruit and vegetable consumption. Although some women report increased fruit and vegetable intake during pregnancy compared to their pre-pregnancy state (Guelinckx et al., 2010; Miyake et al., 2010), on the whole, pregnant women do not consume the recommended amounts of various food groups (Crozier et al., 2009; Ramón et al., 2009). Little is known about the underlying mechanisms that account for such health behavior among pregnant women, but one of the

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plausible mechanisms is that personality traits influence dietary choices.

Research suggests that healthful diets are particularly important during pregnancy because decreased fruit, vegetable, dairy and fish intake is associated with an increased risk of gestational diabetes, significantly lower birth weight, small-for-gestational-age at birth, sporadic retinoblastoma in the infant, and pre-term birth (Herring and Oken, 2001; Mannion et al., 2006; Olsen and Secher, 2002; Orjuela et al., 2005; Ramón et al., 2009; Stube et al., 2009). An analysis of data from 19 studies showed that women who ate more than two servings of fish per week during pregnancy were at lower risk of having a small-for-gestational-age baby and a lower risk of preterm birth compared with those eating it less than once a month (Guldner et al., 2007; Leventakou et al., 2014; Meltzer et al., 2011). A moderate consumption of dairy products (2–3 servings per day) is positively associated with adequate fetal growth and birth weight (Brantsæter et al., 2012), whereas a low consumption of dairy (<2 servings) may negatively affect fetal bone development by limiting the amount of calcium provided to the fetus (Chang et al., 2003). Apart from providing essential nutrients during pregnancy, dietary habits are an important factor in maintaining an appropriate weight. A pre-pregnancy body mass index (BMI) is recognized as being one of the most important predictors of adverse maternal and infant outcomes (Vinturache et al., 2014), therefore, women who would like to get pregnant are encouraged to achieve and maintain a healthy weight (Groth and Kearney, 2009).

More recent evidence highlights the importance of an adequate maternal diet. Taking into account that dietary intervention can be conducted at a relatively low cost and provide significant health benefits during pregnancy, more and more researchers and health care professionals are interested in factors that can help achieve the recommended intake of fruit, vegetable, dairy, and fish among pregnant women. The determinants of eating behavior are complex and influenced by biological, developmental, social, cultural and economic factors (Chadwick et al., 2013; Furst at al., 1996). Most research examining predictors of health-promoting behaviors focus on demographic variables such as age, body mass index (BMI), gender, income, and educational attainment (Charlton et al., 2014; Emanuel et al., 2012; Goldberg and Strycker, 2002). The results show that increased age and higher levels of education are positively associated with fruit and vegetable consumption (Crozier et al., 2009; Guenther et al., 2006; Kimmons et al., 2009).

A more limited but a growing body of research indicates that personality traits (extraversion, neuroticism, agreeableness, conscientiousness, and openness to experience) play a significant role in dietary habits and may also be predictive of whether a person is more likely to engage in maladaptive health behaviors such as smoking, alcohol consumption, eating unhealthy foods, and physical inactivity (Conner et al., 2017; de Bruijn et al., 2005; Martin et al., 2007; Turiano et al., 2013). Of the five traits, higher neuroticism and lower conscientiousness have been consistently associated with unhealthy eating behaviors. For example, people scoring higher on neuroticism tend to consume more sweet and savory foods (Keller and Siegrist, 2015; Kikuchi and Watanabe, 2000; Meier et al., 2012; Mõttus et al., 2012). It has been proposed that such behavior helps them to regulate negative emotions and states such as loss of control, feelings of helplessness, and depression by raising the level of serotonin in the body (Hamburg et al., 2014). Research also demonstrated that women with higher levels of neuroticism eat less fish and vegetables (Tiainen et al., 2013) and are more reluctant to receiving health information and learning healthy dietary habits (Kikuchi and Watanabe, 2000). Individuals with lower levels of conscientiousness tend to engage in emotional and external eating, which is a tendency to overeat in response to food-related cues like the smell or taste of food, regardless of the individual's physical need for food (Evers et al., 2011; Heaven et al., 2001). Studies have also found that individuals with a lower score on conscientiousness indicated a stronger drive toward overeating, engaging in binge eating episodes, and struggling with controlling their impulses to choose unhealthy food (Elfhag and Morey, 2008; Koren et al., 2014). Higher neuroticism and lower conscientiousness are also associated with increased BMI (Sutin et al., 2011). Conversely, personality traits associated with health-promoting behaviors include extraversion, openness to experience, and conscientiousness. Individuals scoring high on these traits are more likely to consume healthy food like fish, fruits, and vegetables (Booth-Kewley and Vickers, 1994; Keller and Siegrist, 2015; Tiainen et al., 2013). Additionally, individuals high on conscientiousness, openness, and extraversion are likely to be more self-disciplined about their diet and meal schedule, are more persistent in monitoring their dietary intake, more likely to comply with health recommendations (Bogg and Roberts, 2004; Elfhag and Morey, 2008; Terracciano et al., 2009; van den Bree et al., 2006), and avoid various forms of high-fat foods (Goldberg and Strycker, 2002).

Existing evidence of the association between personality traits and health-related behaviors in general populations indicates that dietary choices during pregnancy may also be driven in part by personality traits (Kikuchi and Watanabe, 2000; Mõttus et al., 2012). This study is one of the first to examine the psychological predictors of fish, dairy, vegetable, and fruit intake in a representative group of pregnant women, which can help to extend our understanding of dietary patterns in this population and may inform the development of more effective interventions to improve diet quality during pregnancy. We hypothesized that openness to experience, extraversion, and conscientiousness would be positively associated with the intake of fruits, vegetables, fish and dairy during pregnancy, and neuroticism

would be negatively associated with appropriate consumption of these food groups during pregnancy.

Methods

Participants

The sample consisted of 744 pregnant women who participated in the Measures of Maternal Stress (MOMS) Study, a comprehensive study that aimed to systematically develop reliable measures of maternal stress and investigate the correlates of maternal stress during pregnancy. Women were enrolled from prenatal clinics as part of a multisite prospective cohort study that included four geographically and racially diverse regions (Pittsburgh PA, Chicago IL, Schuylkill County PA, and San Antonio TX) between June 2013 and May 2015. Eligible participants were 18 years of age or older, carrying a singleton pregnancy, English-speaking, and had no evidence of fetal congenital or genetic anomalies. Participants were excluded if they did not provide data on dietary pattern and personality traits. A final sample for analysis included 602 women.

Detailed information on the socio-economic, health, and demographic characteristics of the study population used in this analysis were collected via survey at 12–20 weeks gestation, and after delivery via postpartum medical chart review. Prior to data collection, IRB approval was obtained at each participating site. All participants received 40 U.S. dollars for their participation.

Measures

Personality traits. Personality was measured using the NEO Five-Factor Inventory (NEO-FFI; Costa and McCrae, 1992). The NEO-FFI is a self-report questionnaire consisting of 60 items answered on a five-point Likert scale ranging from 0 (strongly disagree) to 4 (strongly agree). The NEO-FFI is a shortened version of the NEO Personality Inventory (the NEO-PI-R) and assesses neuroticism, extraversion, conscientiousness, agreeableness, and openness to experience; each of the five subscales is comprised of 12 items. Respondents were given a list of statements such as "I like to have a lot of people around me" and "Too often, when things go wrong, I get discouraged and feel like giving up." The summary score for each domain ranges from 0 to 48. NEO-PI-R scales have shown longitudinal stability, cross-observer agreement, and convergent and discriminant validity in a large body of studies (Costa & McCrae, 1992).

Fruit, vegetable, dairy, and fish intake. Participants were asked to indicate how many servings of fruit, vegetables, and dairy they consumed in a typical day. A serving of fruit is equal to one small piece of fresh fruit about the size of a tennis ball, 1/2 cup of cut fruit, 1/4 cup of raisins, apricots, or other dried fruit, or 1/2 cup of 100% orange, apple, or grapefruit juice, and excludes fruit punch, lemonade, Gatorade, Sunny Delight, or fruit drinks. A serving of vegetables was defined as one medium carrot or other fresh vegetable, one cup of green salad, one cup of raw or 1/2 cup cooked vegetables, or 1/2 cup of vegetable juice, and did not include French fries, onion rings, potato chips, or fried okra. Dairy was defined as milk, cheese, soy, or yogurt products, with one serving equal to one cup of milk or soy milk, one slice of cheese, or one cup of yogurt. Finally, fish consumption was assessed on a monthly basis, with a single serving defined as 3 oz. of cooked fish. Participants could indicate that they did not know how many servings of these foods they typically consumed.

Covariates. Sociodemographic variables in this analysis included age, education, parity, pre-pregnancy body mass index (BMI) calculated as weight at first prenatal visit divided by the square of height, race/ethnicity, and income. Race/ethnicity was categorized as white, black, Hispanic, and other. Initially, educational attainment was categorized into three groups: "high school diploma or less", "some college but no degree", and "college and higher". Annual household income was reported in brackets: under $15 000; $15 000–$50 000; $50 000–$100 000; and more than $100 000.

Statistical analyses

Separate hierarchical and logistic regression analyses were conducted to predict pregnant women's fish, dairy, vegetable, and fruit consumption. Data were first screened for violations of univariate normality; none were detected. Potential covariates (education, income, age, and BMI) were entered together in the first block; personality traits were entered together in the second block to determine whether they explained a significant additional portion of variance in fruit, vegetable, dairy, and fish consumption. Taking into account consuming a diet poor in fruits, vegetables, and fish, may have detrimental effects on birth outcomes (Jarman et al., 2018), we also conducted additional exploratory analyses to see if fruit, vegetable, fish, and dairy consumption predicted birth outcomes. All significant differences or associations were based at $p < 0.05$ level. All analyses were conducted using SPSS 21.0 (SPSS, Inc., Chicago, IL).

Results

Characteristics of this sample are presented in Table 1. The mean age of the eligible 602 women was 29 years. The average pre-pregnancy BMI ($M = 27.6$) of participants in our sample was above the normal range (18.5–24.9 BMI). The majority of participants in the sample were non-Hispanic white (61.8%), 19.3% were Hispanic white and 13% were black. The average monthly fish consumption was 2.7

Table 1. Characteristics of the study sample ($n = 602$).

Variables	Pregnant women ($n = 602$)
	M (SD)
Age	29.4 (5.7)
Body Mass Index (BMI)	27.65 (7.2)
Educational level, n (%)	
Less than a high school diploma or GED	26 (5.6)
High school diploma or GED	53 (11.5)
Some college but no degree	82 (17.8)
Associate Degree	57 (12.4)
Bachelor's Degree (e.g., BA, BS)	111 (24.1)
Post Graduate Degree	131 (28.4)
Race/ethnicity, *n* (%)	
Non-Hispanic white	285 (61.8)
Black	61 (13.2)
Hispanic	89 (19.3)
Parity, n (%)	
Nulliparous	273 (45.3)
Multiparous	329 (54.7)
Personality traits, mean (SD)	
Neuroticism	18.1 (8.3)
Extraversion	29.2 (8.3)
Openness to experience	26.4 (6.1)
Conscientiousness	34.9 (8.7)
Agreeableness	30.09 (4.9)
Food Consumption[a]	
Fish	2.71 (1.5)
Dairy	3.42 (1.1)
Vegetables	3.13 (1.1)
Fruit	3.32 (1.0)

SD = standard deviation.
[a]Food consumption variables expressed in standard serving sizes.

servings (ranging from 1 to 5). Participants consumed on average 3.42 daily servings of dairy, 3.13 daily servings of vegetables, and 3.32 daily servings of fruit. These values meet the recommendations of the Dietary Guidelines for daily vegetable and fruit servings and exceed the recommendations for dairy servings. The numbers of servings reported for all of these foods ranged from one to five with no woman reporting eating less than one serving.

Results of hierarchical regression analyses predicting women's fish, dairy, vegetable and fruit consumption

In the first step of hierarchical multiple regression, four predictors were entered: age, pre-pregnancy BMI, education attainment, and income. The model was statistically significant $F(4,518) = 8.662$, $p < 0.000$) and explained 6.3% of variance in fruit intake. Education attainment emerged as a significant predictor of fruit intake and remained a significant predictor, though partially reduced, after entering personality traits in the second block ($\beta = .16$, $p < 0.01$). The model predicting vegetable intake was significant $F(4,518) = 8.302$, $p < 0.000$) and explained 5.3% of the variance in vegetable intake. Income was a significant predictor of vegetable intake and remained significant even after controlling for other variables entered in the second block ($\beta = 0.18$, $p < 0.01$). For dairy intake, the model including covariates was not significant, $F(4,518) = 1.7$; $p = 0.15$]. There was no relationship between the demographic variables and dairy consumption. In the model predicting fish consumption, the covariates significantly predicted the number of servings consumed monthly, accounting for 7.7% of variance, $F(4,515) = 10.75$, $p < 0.001$. Higher education, age, and income were associated with increased fish consumption but only income and education attainment remained significant predictors after controlling for personality traits ($\beta = 0.17$, $p < 0.05$; $\beta = 0.21$, $p = 0.05$ respectively). Higher income was also associated with an increased likelihood of exercising during pregnancy (OR = 1.40, 95% CI 1.09–1.78, $p = 0.007$).

The personality traits, entered in the second step, significantly predicted fruit intake, above and beyond the demographic factors, $F(9, 513) = 5.502$, $p < 0.000$. However, the addition of personality traits only slightly improved prediction of fruit intake [R^2 change = 0.025]. As shown in Table 2, only openness to experience emerged as a significant predictor of fruit intake ($\beta = 0.10$, $p = 0.02$). Openness to experience was also a significant predictor of vegetable intake ($\beta = 0.18$, $p < 0.000$). After personality traits have been included in a model predicting vegetable intake, the model remained significant, $F(9,513) = 6.740$, $p < 0.001$, and explained 10.6% of variance (see Table 3). In the model predicting dairy intake, neither the covariates nor personality traits were significant predictors, $F(9, 513) = 1.00$, $p = 0.436$ (see Table 4). Including personality traits significantly predicted fish consumption above and beyond the covariates [$F(9, 510) = 6.28$, $p = 0.026$], but accounted only for an additional 2.5% of variance. Lower scores on agreeableness ($\beta = –0.11$, $p < 0.05$) and higher scores on openness to experience ($\beta = 0.12$, $p < 0.01$) emerged as significant predictors of fish consumption, even after controlling for demographic variables (see Table 5). High levels on extraversion were associated with an increased likelihood of exercising during pregnancy (OR 1.05, 95% CI: 1.01–1.08, $p = 0.02$).

Diet, personality traits and birth outcomes

Additional exploratory analyses were performed to identify which variables might account for birth outcomes such as child's birth weight, preterm delivery (defined as giving birth between 22 and 37 weeks of pregnancy), postpartum hemorrhage (defined as a blood loss of 500 ml or more within 24 hours after birth), and small for gestational age

Table 2. Summary of Hierarchical Regression analysis for variables predicting Fruit Intake.

Model		β	B	Beta	t	Sig	Tolerance	VIF
1	(Constant)	2.933	0.332		8.842	0.000		
	Age	−0.013	0.010	−0.065	−1.321	0.187	0.743	1.345
	Education	0.266	0.076	0.198	3.499	0.001	0.565	1.769
	Income	0.101	0.060	0.096	1.680	0.094	0.558	1.791
	BMI	−0.003	0.007	−0.019	−0.423	0.673	0.893	1.120
2	(Constant)	1.883	0.723		2.603	0.010		
	Age	−0.013	0.010	−0.069	−1.394	0.164	0.722	1.386
	Education	0.218	0.077	0.162	2.835	0.005	0.545	1.836
	Income	0.075	0.060	0.072	1.252	0.211	0.543	1.843
	BMI	−0.002	0.007	−0.010	−0.228	0.820	0.886	1.129
	Neuroticism	−0.006	0.007	−0.040	−0.795	0.427	0.714	1.400
	Extraversion	0.008	0.009	0.045	0.924	0.356	0.733	1.363
	Openness	0.018	0.008	0.101	2.320	0.021	0.939	1.065
	Agreeableness	0.014	0.009	0.076	1.487	0.138	0.684	1.462
	Conscientiousness	0.006	0.015	0.018	0.379	0.705	0.833	1.200

Dependent variable: Fruit Intake.

Table 3. Summary of hierarchical regression analysis for variables predicting vegetable intake.

Model		β	B	Beta	t	Sig	Tolerance	VIF
1	(Constant)	2.284	0.336		6.802	0.000		
	Education group	0.037	0.077	0.027	0.484	0.629	0.565	1.769
	Age	0.010	0.010	0.051	1.029	0.304	0.743	1.345
	Income	0.209	0.061	0.196	3.445	0.001	0.558	1.791
	BMI	−0.002	0.007	−0.009	−0.208	0.835	0.893	1.120
2	(Constant)	1.252	0.724		1.729	0.084		
	Education	−0.016	0.077	−0.012	−0.206	0.837	0.545	1.836
	Age	0.011	0.010	0.056	1.143	0.254	0.722	1.386
	Income	0.178	0.060	0.167	2.953	0.003	0.543	1.843
	BMI	0.000	0.007	−0.003	−0.059	0.953	0.886	1.129
	Openness	0.032	0.008	0.178	4.121	0.000	0.939	1.065
	Neuroticism	−0.008	0.007	−0.057	−1.155	0.249	0.714	1.400
	Extraversion	0.016	0.009	0.085	1.747	0.081	0.733	1.363
	Agreeableness	−0.005	0.009	−0.027	−0.526	0.599	0.684	1.462
	Conscientiousness	0.008	0.016	0.022	0.485	0.628	0.833	1.200

Dependent variable: Vegetable Intake.

birth (SGA, defined as birthweight less than the 10th percentile for the gestational age at birth according to gender-specific national norms). Hierarchical or logistic regression analyses were used to determine the association of birth outcomes and fruit, vegetable, dairy, and fish intake, controlling for demographic variables, prenatal smoking and alcohol consumption, and indication for delivery (spontaneous term labor, induced term labor, spontaneous preterm labor, medically indicated/induced preterm labor, scheduled term cesarean section, medically indicated scheduled preterm cesarean section). As shown in Table 6, smoking during pregnancy ($\beta = -0.12$, $p = 0.02$) and dairy intake ($\beta = 0.12$, $p < 0.02$) were significant predictors of birth weight. None of the other variables were associated with birth outcomes, therefore, results for these outcomes are not presented.

Discussion

There is growing evidence that personality also plays a significant role in dietary habits but previous work has focused on general populations and has not addressed the relationship between personality and diet among pregnant women. This study sought to extend previous research by examining the link between personality traits and a healthy diet as well as the relationship between diet and birth outcomes.

Table 4. Summary of hierarchical regression analysis for variables predicting dairy intake.

Model		β	B	Beta	t	Sig	Tolerance	VIF
1	(Constant)	3.948	0.366		10.781	0.000		
	Education group	0.016	0.084	0.011	0.191	0.849	0.565	1.769
	Age	−0.012	0.010	−0.056	−1.110	0.268	0.743	1.345
	Income	0.069	0.066	0.061	1.047	0.296	0.558	1.791
	BMI	−0.014	0.008	−0.079	−1.720	0.086	0.893	1.120
2	(Constant)	3.564	0.808		4.413	0.000		
	Education	−2.685	0.086	0.000	0.000	1.000	0.545	1.836
	Age	−0.011	0.011	−0.052	−1.015	0.310	0.722	1.386
	Income	0.053	0.067	0.047	0.791	0.429	0.543	1.843
	BMI	−0.013	0.008	−0.075	−1.618	0.106	0.886	1.129
	Openness	0.003	0.009	0.014	0.304	0.761	0.939	1.065
	Neuroticism	−0.006	0.008	−0.038	−0.740	0.459	0.714	1.400
	Extraversion	0.006	0.010	0.028	0.549	0.583	0.733	1.363
	Agreeableness	0.004	0.010	0.020	0.384	0.701	0.684	1.462
	Conscientiousness	0.007	0.017	0.019	0.403	0.687	0.833	1.200

Dependent variable: Dairy Intake.

Table 5. Summary of hierarchical regression analysis for variables predicting fish intake.

Model		β	B	Beta	t	Sig	Tolerance	VIF
1	(Constant)	0.565	0.465		1.213	0.226		
	Education group	0.251	0.107	0.132	2.340	0.020	0.564	1.774
	Age	0.026	0.013	0.097	1.962	0.050	0.734	1.362
	Income	0.176	0.084	0.119	2.098	0.036	0.558	1.792
	BMI	0.014	0.010	0.061	1.349	0.178	0.890	1.123
2	(Constant)	1.668	1.014		1.645	0.101		
	Education group	0.214	0.108	0.113	1.978	0.048	0.544	1.837
	Age	0.025	0.014	0.092	1.850	0.065	0.714	1.400
	Income	0.173	0.085	0.116	2.039	0.042	0.543	1.841
	BMI	0.012	0.010	0.055	1.226	0.221	0.883	1.133
	Openness	0.030	0.011	0.121	2.781	0.006	0.940	1.064
	Neuroticism	−0.009	0.010	−0.045	−0.917	0.360	0.717	1.395
	Extraversion	0.005	0.013	0.020	0.407	0.684	0.737	1.357
	Agreeableness	−0.027	0.013	−0.106	−2.082	0.038	0.684	1.461
	Conscientiousness	−0.033	0.022	−0.069	−1.502	0.134	0.833	1.200

Dependent variable: Fish Intake.

As hypothesized, our study demonstrated that openness to experience is associated with increased consumption of fruits, vegetables, and fish during pregnancy.

Our findings are consistent with previous studies identifying a relationship between sociodemographic variables and a healthy diet in general population. The positive associations between educational attainment, age, and vegetable and fruit consumption demonstrated here are consistent with previous studies (Darmon and Drewnowski, 2008; Mõttus et al., 2012; Tryggvadottir et al., 2016), and we also found that more educated and older women consumed more fish than younger and less educated women. Additionally, we found that women with lower income consumed significantly less vegetables. These findings are in line with previous results showing that vegetable consumption is related to household income, wherein the increased cost of vegetables compared to processed foods can be a significant barrier for low-income households (Erber et al., 2010; Prelip et al., 2011).

Our results indicate that personality traits are significant predictors of fish, vegetable, and fruit consumption during pregnancy. Women who identified as more open to experience consumed more fish, vegetables, and fruit. Openness is a consistent predictor of healthy diet in the literature (Conner et al., 2017; Tiainen et al., 2013). These results confirm previous findings in the general population that openness to experience is a key predictor of fruit and vegetable consumption (Tiainen et al., 2013). Individuals high

Table 6. Predictors of birth weigh.

Model		β	B	Beta	t	Sig	Tolerance	VIF
1	(Constant)	3282.69	189.52		17.321	0.000		
	Age	3.388	4.937	0.035	0.686	0.493	0.906	1.104
	Smoking	−176.68*	78.700	−0.110	−2.245	0.025	0.966	1.036
	Alcohol	−5.578	86.576	−0.003	−0.064	0.949	0.978	1.023
	BMI	7.533	4.037	0.093	1.866	0.063	0.941	1.063
	Parity	29.833	26.296	0.058	1.135	0.257	0.892	1.121
	Delivery reason	−169.6**	52.503	−0.159	−3.230	0.001	0.959	1.043
2	(Constant)	3080.986	226.642		13.594	0.000		
	Age	3.414	5.118	0.035	0.667	0.505	0.838	1.193
	Smoking	−194.93*	80.165	−0.121	−2.432	0.015*	0.926	1.080
	Alcohol	−9.829	86.642	−0.006	−0.113	0.910	0.971	1.030
	BMI	7.695	4.037	0.095	1.906	0.057	0.936	1.069
	Parity	31.248	26.306	0.061	1.188	0.236	0.886	1.128
	Delivery reason	−160.49*	52.780	−0.150	−3.041	0.003	0.944	1.059
	Fruit	−14.644	28.411	−0.029	−0.515	0.607	0.749	1.335
	Vegetables	10.992	28.433	0.022	0.387	0.699	0.734	1.362
	Diary	56.388*	23.583	0.117	2.391	0.017	0.962	1.040
	Fish	1.795	19.131	0.005	0.094	0.925	0.816	1.225

Delivery reason (spontaneous term labor or term rupture of membranes; induced term labor; spontaneous preterm labor or prom; medically indicated preterm labor; scheduled term cesarean section; medically indicated scheduled preterm cesarean section).
*$p < 0.05$; **$p < 0.01$.

on openness tend to be curious, flexible, open-minded, and willing to explore the environment. In contrast, individuals with low openness to experience tend to have little interest in unfamiliar environments and have a more conventional attitude toward values (Costa and McCrae, 1992). It may be that pregnant women who scored high in openness were more likely to change their diet and try new or different products to improve their nutrition during pregnancy, while women who scored low on this trait may have been more likely to keep with their typical diet and avoid novel products.

The 6.3% of variance in vegetable, and fruit consumption attributable to differences in personality traits in this study is similar to that reported by de Bruijn et al. (2005) who found that openness to experience explained 6% of variance in fruit intake and 3% in vegetable intake among adolescents. The results are also supported by other studies that demonstrated the association between openness and increased fruit and vegetable intake in different age groups ranging from schoolchildren to older adults (Kikuchi and Watanabe, 2000; Mõttus et al., 2012, 2013; Myrdal et al., 2016).

Although pregnant women are highly motivated to improve their diets and tend to reduce the amount of fast food and artificially sweetened beverages they consume after learning about their pregnancy (Verbeke and Bourdeaudhuij, 2007), pregnant women, similar to the general population, not consume the recommended amounts of fruit, vegetable, fish and dairy (Guelinckx et al., 2010; Miyake et al., 2010). In light of research demonstrating the adverse consequences of low fruit, vegetable, fish, and dairy intake, it is important to identify factors that can help with adherence to a healthy diet. Our findings have important implications and may aid health care practitioners in encouraging the compliance to dietary recommendations. Maternal diet is thought to be a modifiable factor for adverse pregnancy and birth outcomes (Abu-Saad and Fraser, 2010; Bandoli et al., 2010). Adherence to a healthy and well-balanced diet have the potential not only to reduce a broad range of adverse health effects such as malnutrition or obesity (Mytton et al., 2014), but also offers opportunities for chronic disease prevention and establishing healthy behaviors that could continue into post-pregnancy period. More importantly, research demonstrates a strong parental influence on food consumption and preference in children (Vollrath et al., 2012). If a woman seeks out new, nutrient-dense foods to incorporate into her diet, her child can gain exposure to different tastes and a variety of healthy products. Therefore, interventions among pregnant women could subsequently and indirectly promote healthier eating behavior for her offspring. Further examination of this association is needed in the future work.

Our results show that different factors contributed to the variation in fruit, vegetable, and fish consumption by pregnant women. The results also illustrate the potential benefits of incorporating personality traits into interventions promoting positive health behavior during pregnancy. For example, an intervention conducted by Magidson et al. (2014) demonstrated that it is possible to modify personality traits associated with healthy lifestyle habits by engaging in conscientious-like activities and

thus creating healthier patterns of behavior. Taking into account that women who have high levels of openness tend to eat more vegetables and fruit, health care professionals might encourage all pregnant women to try new, nutritious products which may be especially motivational for these individuals. Exposure to novel and healthful products may result in increased consumption of said healthful products, which may in turn increase liking of the products and facilitate adherence to dietary recommendations over time (Cooke, 2007).

The strength of our study is that we employed a large, demographically diverse sample size. However, some limitations should be also noted. One issue that arises from using the secondary data is that we relied on self-report measures, therefore, there is a possibility that pregnant women were subject to social desirability bias (Hebert et al., 1995). The second limitation is that fruit, vegetable, fish, and dairy consumption was measured by asking participants to indicate a number for servings per day using cup equivalent values. It may be hard to judge for some participants what a serving size is and it can therefore cause errors in estimation. In order to help participants recall how much food they consumed, future research should use visual cues providing examples of one cup equivalents. Such solution has proven to be effective (Almiron-Roig et al., 2013). Another limitation is that we do not know pre-pregnancy dietary patterns of women who participated in this study. Finally, these were cross-sectional; the participants were interviewed only once. Thus we are unable to make interferences about dietary changes. Future work needs to include measures that capture multiple time points (prior, during and post-pregnancy) to gain deeper insights into the process linking personality traits and dietary habits.

Our findings demonstrating that one of the personality traits, openness to experience, is associated with an increased consumption of fruit, vegetable, and fish intake may have implications for promoting a healthy diet among pregnant women. Given that personality traits can explain some of the variance in the dietary patterns of pregnant women, it may be useful to assess personality traits as part of prenatal care and encourage women to try new fruits and vegetables in order to increase intake of healthful foods during pregnancy and in turn improve their health.

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