Current Research

Food Preference Questionnaire as a Screening Tool for Assessing Dietary Risk of Cardiovascular Disease within Health Risk Appraisals

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ABSTRACT

Objective Nutrition components of health risk appraisals (HRAs) aim to rapidly and accurately assess dietary behaviors that increase disease risk. Because cognitive research suggests that recalling food likes/dislikes may be simpler and more accurate than recalling intake, we tested whether a preference measure was predictive of cardiovascular disease risk factors within an HRA.

Methods HRA participants (422 primarily non-Hispanic white men, mean age 46±10 years) from a manufacturing company completed surveys to assess fat and sweet food/beverage preference; frequency of consuming fat and sweet foods/beverages, alcoholic beverages, fiber-rich foods (whole grains, fruits, and vegetables); and physical activity. Per measured risk factors, 34% had central obesity (waist circumference ≥102 cm), 32% had hypertension (≥140 and/or ≥90 mm Hg), 52% had prehypertension (≥120 to 139 and/or ≥80 to 89 mm Hg), and 52% had an elevated total cholesterol level (≥200 mg/dL [5.2 mmol/L]).

Statistical analyses Multiple linear regression models explaining variability in waist circumference, blood pressure, and serum lipids were tested.

Results Although preference and intake pairs for fat and sweets were significantly correlated, intake of fat and sweets failed to associate significantly with any risk factor. Significant variance in waist circumference was explained by age, fat preference, fiber intake, and physical activity. Those with greater circumferences liked fat more, consumed less fiber, and exercised less. Waist circumference in turn contributed significantly to models predicting serum lipid levels and blood pressure. Alcohol intake explained variability in serum lipid levels—higher intakes were associated with higher high-density lipoprotein cholesterol levels. The models predicting risk were generally more explanatory in younger (<50 years) than in older men.

Conclusions Including a preference measure within an HRA appears to enhance cardiovascular disease risk factor assessment. Fat preference, intake of fiber-rich foods, and alcohol proved the best dietary determinants of cardiovascular disease risk factors.

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Through *Healthy People 2010*, the Centers for Disease Control and Prevention advocates increasing the numbers of, and participation in, worksite health promotion programs (1). Health risk appraisals (HRAs), a component of most worksite health promotion programs, involve assessing biometric and behavioral parameters for predicting risk of mortality from chronic diseases like cardiovascular disease (CVD) (2). They typically include questionnaires, risk calculations, and an educational report (3) that focuses on changing modifiable risks (2). As part of a comprehensive health promotion process, measuring risk factors may motivate workers to change behaviors (4) and provide organizations a way to target and monitor effectiveness of interventions to reduce health care costs or increase productivity (5). The utility of HRAs hinges on how well they measure mortality risk factors (ie, face validity) and predict mortality risk (ie, predictive validity) (2), which in part depends on how well participants can communicate their health behaviors.

The dietary component of HRAs typically includes a short frequency questionnaire to assess intake of saturated fat, fruits, vegetables, whole grains (6), and alcohol (7,8). Participants are asked to recall usual intake of listed foods during a specified time frame, a task requiring access to factual memories of past experiences. In comparison, preference assessments tap affective memories (9,10), which can be accessed even when factual memories cannot (10). This suggests the possibility that methods focusing more on affective and less on factual memory may increase the accuracy of dietary assessment. Preference questionnaires have provided reasonable estimates of dietary intake of fat, fiber, vitamin C, fruits, and vegetables in college-aged women (11) and children who varied in age and ancestry (11-15). Preference for fat has been shown to associate with level of adiposity in primarily normal weight adults as assessed through sampling of high-fat foods (16) and reported by simple questionnaire (17). Level of dietary restraint (18) and/or disinhibition (19) can challenge the accuracy of reporting intake of and possibly preference for high-fat and sweet foods, especially for adults who are trying to modify their weight or health behaviors (19).

The objective of our study was to assess the ability of a measure of preference for fat and sweet foods to explain variability in adiposity, as an intermediary step in explaining variability in serum lipids and blood pressure within a sample of men who participated in worksite HRAs. The study aim required that ratings of preference be obtained with scales that provide valid comparisons across individuals/groups. Because conventional labeled scales (eg, 9-point scale) do not allow valid comparisons across individuals/groups (20-22), the men reported the degree of liking/disliking for foods on the hedonic version of the general Labeled Magnitude Scale, a preference scale devised to minimize the errors of conventional scales (23).

METHODS

Participants

The objective was tested in a cross-sectional study with a convenience sample of 422 males (mean age 46±10 years) from a large manufacturing company who participated in worksite HRAs. The men were primarily salaried and of European ancestry. The demographics of this sample are similar to those of the larger workforce (24). Data from women were not included in the present analyses as many fewer participated in the HRAs, reflecting the demographics of a manufacturing company; women show different modifiable risk factors related to CVD, for example (25), and may have different patterns of relationship between preference and weight (17,19). The study was conducted in accordance with the University of Connecticut Institutional Review Board; participants provided informed written consent.

Preference Measure

The preference measure was part of a two-sided document. The first side provided orientation to the general Labeled Magnitude Scale by having subjects report the intensities of six remembered nonoral sensations (eg, brightest light you have seen, loudness of a conversation). They were instructed to determine which adjective described what they experienced or remembered and that top of the scale, "strongest imaginable sensation," referred to any kind of experience even those that may be painful. The second side asked participants to use the general Labeled Magnitude Scale to rate how much they liked or disliked 19 items including fats (eg, mayonnaise), fats with sweet (eg, milk chocolate) or salty (eg, sausage) tastes, and bitter beverages and foods (eg, coffee, grapefruit, cooked broccoli). The ends of the scale (strongest imaginable like or strongest imaginable dislike) were intended to refer to all hedonic experiences not just within the context of food.

The 12 fat foods (cheddar cheese, mayonnaise, beef steak or prime rib, gravy, butter, milk chocolate, sausage, sweets, fried chicken, sour cream, whole milk, and whipped cream) formed a conceptual grouping that was statistically reliable (α=.80). Similarly, a sweet group was formed from four foods (sugar, whipped cream, sweets, and milk chocolate; α=.74). Other foods were included on the survey to avoid focusing solely on fat and sweet foods. Mean preference ratings across the fat and sweet groups were used in the analyses.

Screeners for Dietary Intake and Exercise

Participants completed the Insight questionnaire (J&J Health Care Systems, Piscataway, NJ), an HRA that includes self-reported lifestyle factors (eg, smoking, diet, alcohol use, and physical activity) and medical information (26). The men reported how often they consumed high-saturated-fat and fiber-rich foods or beverages using a categorical frequency scale (Table 1). The six high-saturated-fat foods or food types formed a statistically reliable group (α=.66), referred to as fat intake. Food items that were whole grains, fruits, and vegetables also formed a reliable group (α=.70), referred to as fiber intake. The distribution of categorical responses to each food/food type is shown in Table 1. For regression analyses, each categorical response was expressed as intake per week and summed across the fat and fiber intake groups. Reasonable validity for screening fat and fiber intake with these groups is expected according to data from similar instruments (27) and significant correlations between food items and nutrient intakes from nonconsecutive food records (unpublished data, November 2005).

In a separate section of the Insight questionnaire, participants also reported number of alcoholic beverages consumed during a typical week (one beverage=5 oz glass of wine, 12 oz beer, or 1.5 oz hard liquor) with the request to provide a two-digit response (eg, "enter '7' as 07"). Under the heading physical activity, the men were asked how many days of the week they engaged in at least 30 minutes of physical activity, including exercise, yard work, housework, and stair climbing according to the following categories: 6 to 7 days/week, 4 to 5 days/week, 2 to 3 days/week, 1 day or less per week, or never. They were instructed that they could sum up the activity periods and that the 30 minutes did not have to occur at one time. For the analyses, the responses were reverse coded (ie, higher number, more physical activity) and labeled as exercise frequency.

Chronic Disease Risk Factors

According to established protocols (24), trained health professionals measured weight, height, waist circumference, blood pressure, and serum lipid levels for all par-

Table 1. Distribution of reported frequency of consuming food groups[a] across frequency categories on a brief frequency questionnaire among adult men (n=422) aged 46±10 years participating in a worksite health risk appraisal

Food group	Never-1 times/wk	1-4 times/wk	5-7 times/wk	2 times/d	>3 times/d
Fried foods	37.3	57.3	5.0	0.5	
Red meat (steak, hamburger, pork, or lamb)	14.0	68.4	16.5	0.9	0.2
Processed meat (hot dogs, bologna, salami, pepperoni, sausage, or bacon)	42.2	49.7	8.1		
Cream- or oil-based salad dressings, cream sauces, or mayonnaise[b]	34.3	52.7	12.1	0.9	
Whole milk dairy products (whole milk, yogurt, cream ice cream, cheese, or butter)[b]	24.0	43.3	25.2	7.0	0.5
Cookies, pastries, cakes, or chocolate candy[b]	23.5	47.6	26.7	2.1	0.2
Whole grain cereals, breads, and pasta	5.3	37.2	39.0	15.8	2.8
Fresh, frozen, or canned fruits or fruit juices	11.9	30.1	38.3	13.7	6.2
Fresh, frozen, or canned vegetables or vegetable juices	5.5	28.4	47.0	14.9	4.1

[a]Shown as percent of men across each food group.
[b]Participants were instructed not to include low- or no-fat varieties of the foods.

ticipants. After the men removed shoes and excess materials (eg, layered clothing and contents of pockets), weight and height were measured to the nearest 0.10 kg or quarter inch (0.64 cm), respectively, using a Waist High Balance Beam Scale (Sunbeam/Health-o-Meter, Bridgeview, IL), for calculation of body mass index (BMI) (calculated as kg/m^2). Waist circumference was taken at the height of the iliac crest with a Gulick tape measure (Sammons Preston, Chicago, IL) to the nearest quarter inch (0.64 cm).

Blood pressure was measured after 5 minutes of seated rest in both arms using a regularly calibrated Baumanometer Komompak model aneroid sphygmomanometer (W.A. Baum Co, Inc, NY, NY) and Signature stethoscope (Mabis Healthcare Inc, Lake Forest IL). If within 5 mm Hg, the two measures were averaged and recorded. If greater than 5 mm Hg difference, the arm with the higher blood pressure was repeated until two measures were within 5 mm Hg, and the average recorded. Capillary blood was drawn for lipid-lipoprotein analysis using Cholestech LDX (Cholestech Corp, Hayward, CA) for total and high-density lipoprotein (HDL) cholesterol. The HDL ratio was calculated (total cholesterol/HDL) as was low-density lipoprotein, from the Freidwald equation (28). Although participants were encouraged but not required to fast for >8 hours before the capillary blood draws, most indicated that they were not fasting.

Statistical Analysis

Using bivariate and multiple linear regression analyses, dietary behaviors (ie, preference, intake), exercise, and age were treated as continuous variables to predict adiposity (ie, BMI, waist circumference), which in turn was used to predict blood pressure and serum lipid levels. Because previous research has shown stronger associations between adiposity and serum lipid levels in younger men (29), multiple regression models are shown in men younger than 50 years (n=252, mean age 40±7 years) and ≥50 years (n=170, mean age 56±6 years). Data were analyzed with Statistica (Macintosh version 4.1, StatSoft, Tulsa, OK), with a significance criterion of $P \leq 0.05$. Univariate and multivariate outliers were removed using standardized residuals (≥2.5) and Mahalanobis distance criteria ($P<0.001$) (30). Regression coefficients (r) or semipartial correlations (sr) of significant contributors are presented as appropriate. The nonparametric correlation (Spearman rank-order) tested the association between intake of sweets (a categorical variable) and preference for sweet foods.

In addition, preference and intake responses were dichotomized for examining differences in adiposity according to BMI classification (31) among groups where fat behaviors were concordant (ie, liking and consuming fat) vs discordant (ie, liking high-fat foods but reporting low consumption of fat foods). Preference across the 12 fat foods was dichotomized near the median value (between moderate and strong like) and intake of fat across the six foods near the median, falling between consuming these foods 1 to 4 times/week and 5 to 7 times/week. The χ^2 statistic tested for differences in distribution of normal and overweight/obese men between concordant and discordant groups.

RESULTS

According to the National Institutes of Health (31) and Centers for Disease Control and Prevention (32) guidelines the sample showed increased risk factors associated with CVD, including elevated adiposity, abnormal lipid profile, elevated blood pressure, and low levels of physical activity (Table 2). Participants were predominately overweight to obese (BMI ≥25), had elevated total cholesterol levels, and had either prehypertension or hypertension. Based on BMI and waist circumference classifications (31), 59 men were at high risk, 101 at very high risk, and eight at extremely high risk for developing chronic disease. Related to physical activity, nearly one in two men did not meet Centers for

Table 2. Prevalence of cardiovascular disease risk factors among men aged 46±10 years participating in a worksite health risk appraisal (n=422)	
Risk factor	**%**
Body mass index	
18.5-24.9	22
25-29.9[a]	47
≥30.0[a]	31
Waist circumference	
<102 cm	66
≥102 cm[a]	34
Total cholesterol[bc]	
<200 mg/dL	48
200-239 mg/dL	33
≥240 mg/dL[a]	19
High-density lipoprotein cholesterol[bc]	
<40 mg/dL[a]	36
40-60 mg/dL	52
>60 mg/dL	12
Low-density lipoprotein cholesterol[bc]	
<100 mg/dL	48
130-159 mg/dL	32
≥160 mg/dL[a]	20
Blood pressure	
<120/80 mm Hg	14
120-139/80-89 mm Hg[d]	56
≥140/90 mm Hg[a]	30
Exercise frequency (30 min/d)[e]	
6-7 d/wk	28
4-5 d/wk	29
2-3 d/wk	30
1 day or less/wk	10
Never	3

[a]Elevated risk for chronic disease (31,32).
[b]Serum lipid levels from capillary blood samples; the majority of men were not fasting (>8 hours after a meal).
[c]To convert mg/dL cholesterol to mmol/L, multiply mg/dL by 0.026. To convert mmol/L cholesterol to mg/dL, multiply mmol/L by 38.6. Cholesterol of 200 mg/dL=5.2 mmol/L.
[d]Prehypertension.
[e]The Centers for Disease Control and Prevention recommend 30 min on 5 or more days a week (33).

Disease Control and Prevention current recommendations for physical activity of 30 minutes on 5 or more days a week (33). For alcoholic beverages, 114 said they never drank, 112 were "light drinkers" (a couple of drinks per year but less than three per week), 171 "moderate drinkers" (three to <14 drinks per week), and 25 "heavy drinkers" (two or more drinks per day).

Mean preference ratings for the fat and sweet groups ranged from strongly dislike to very strongly like with the majority of men (64% and 61%, respectively) falling between moderately like and very strongly like. Table 1 shows the distribution of frequency of consuming the individual food groups. Most of the men reported consuming fat foods one to four times per week, with a total intake averaging between two to three servings per day. Based on this average total intake and usual portion sizes (34), we estimated that daily intake of saturated fat exceeded the current recommendations (10% of energy

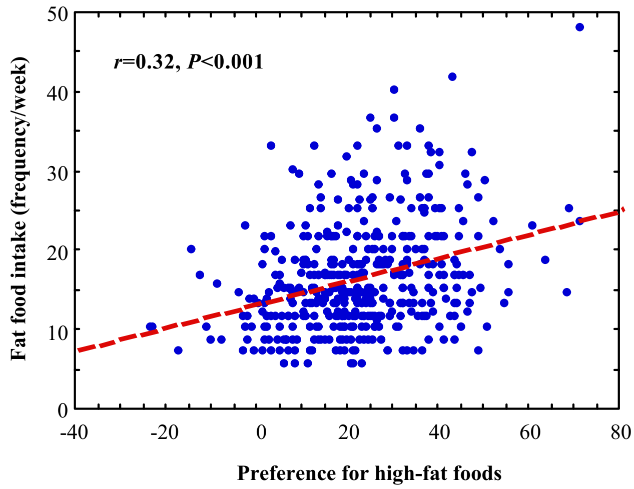

Figure. Relationship between fat preference and fat intake among adult men (n=422) aged 46±10 years participating in a worksite health risk appraisal. Fat preference is the average liking/disliking rating (general Labeled Magnitude Scale [23]) of 12 high-fat survey foods/groups (0=neutral, ±6=weakly, ±17=moderately, ±35=strongly, ±53=very strongly). Fat intake is the total weekly intake of six high-fat foods/groups reported on a brief food frequency questionnaire.

[35]). Only 3% of participants reported intakes that met current recommendations for whole grains (three servings per day), 6% for fruit (two servings per day), and 4% for vegetables (three servings per day) (1). There was a positive relationship between fat preference and fat food intake (see the Figure) and sweet preference and intake (rho=0.32, P<0.001). Although significant, the relationship between fiber intake and fat preference was minimal (r=−0.11, P<0.05) and there were no relationships between fiber intake and fat intake (r=0.04, P=0.47) or sweet preference (r=0.01, P=0.89).

Predicting Adiposity from Diet and Exercise Behaviors

Table 3 shows significant bivariate relationships between measures of adiposity and dietary behaviors, exercise, and age. In general, a greater adiposity was seen in those who reported greater fat preference, less frequent intakes of fiber-rich foods, and less physical activity. Greater waist circumference was seen in older men. Sweet preference, alcohol intake, or intake of fat foods were not significant predictors of either measure of adiposity. Interestingly, BMI differed between men who reported liking fat and had either higher (≥5 to 7 times per week) or lower (≤1 to 4 times/week) intakes of fat foods. Those who liked fat but reported lower intakes were significantly more likely to be overweight/obese (BMI >25; n=115) than those who liked fat and reported higher fat intakes (BMI ≤25; n=49) (χ^2=3.773, P=0.05). These groups did not differ significantly in level of physical activity or age.

Because waist circumference and BMI had similar patterns of association with the dietary behaviors and waist circumference showed stronger relationships with CVD risk factors in men in our study and that reported in the literature (29), waist circumference was

Table 3. Significant associations between measured cardiovascular disease risk factors and age, dietary behaviors, and exercise frequency[a] for men (n=422) aged 46±10 years participating in a worksite health risk appraisal

Risk factor	BMI[b]	Waist circumference	Systolic blood pressure	Diastolic blood pressure	Total cholesterol[c]	High-density lipoprotein cholesterol (HDL)[c]	Total cholesterol/HDL[c]
Age		0.21	0.24	0.18			
Fat intake							
Fiber intake	−0.18	−0.20					
Alcohol use					0.16	0.19	
Fat preference	0.11	0.15				−0.17	0.12
Exercise frequency	−0.15	−0.22			0.12	0.16	−0.21
Waist circumference	0.85		0.25	0.25	0.12	0.23	0.21

[a]Coefficients generated via linear regression, shown when $P \leq 0.05$.
[b]BMI=body mass index; calculated as kg/m^2.
[c]Based on measures of serum lipids from capillary blood.

Table 4. Multiple regression models for predicting measures of chronic disease risk (dependent variables) among men participating in a worksite health risk appraisal

		26 to 50 y (n=252)			50 to 70 y (n=170)		
Dependent variable	Explanatory variables	Semipartial correlation	*P* value	R^2	Semipartial correlation	*P* value	R^2
Waist circumference	Age	0.31	<0.001	0.24	0.04	0.64	0.11
	Fiber intake	−0.11	<0.05		−0.18	<0.05	
	Fat preference	0.12	<0.05		0.16	<0.05	
	Exercise frequency	−0.26	<0.001		−0.15	0.06	
Total cholesterol	Age	0.09	0.15	0.07	−0.08	0.30	0.02
	Waist circumference	0.13	0.04		0.04	0.58	
	Alcohol intake	0.17	<0.01		0.09	0.27	
High-density lipoprotein cholesterol	Age	0	1.0	0.16	−0.07	0.36	0.10
	Waist circumference	−0.25	<0.001		−0.24	<0.005	
	Alcohol intake	0.32	<0.001		0.19	<0.05	
Diastolic blood pressure	Age	0.09	0.13	0.15	−0.02	0.79	0.02
	Waist circumference	0.32	<0.001		0.10	0.20	
	Alcohol intake	0.03	0.61		0.07	0.37	
Systolic blood pressure	Age	−0.06	0.40	0.07	0.20	<0.01	0.10
	Waist circumference	0.25	<0.001		0.19	0.01	
	Alcohol intake	0.03	0.61		0.17	<0.05	

used in the models to predict CVD risk factors. Across the entire sample, age, intake of fiber-rich foods, fat preference, and exercise frequency explained 16% of the variance in waist circumference ($P<0.001$). The variance explained was larger in the younger vs older age groups (Table 4) related to larger contributions from age and exercise frequency. Fat preference and fiber intake were significant contributors to waist circumference in both age groups.

Predicting Serum Lipid Levels and Blood Pressure from Waist Circumference

Greater waist circumference was associated with higher total cholesterol level, blood pressure (systolic, diastolic), and lower HDL cholesterol level across the entire sample in bivariate relationships (Table 3) as well as in the younger age group in multivariate analyses (Table 4). The multiple regression models explained minimal variance in total cholesterol level and systolic blood pressure in both age groups and for all risk factors in the older age group. In both age groups, higher HDL cholesterol levels were seen in those with lower waist circumference and higher alcohol intake (24 men reported having a history of alcohol addiction problems; removing them did not affect the analyses).

DISCUSSION

This study revealed a positive association between preference for fat foods and adiposity measured by BMI and waist circumference in a sample of men, 78% of whom were overweight or obese. In multiple linear regression models, fat preferences joined other modifiable (intake of fiber-rich foods and exercise frequency) and nonmodifiable (age) factors as independent predictors of central adiposity. Although preference for fat foods showed significant correlation with reported intake of foods and beverages high in saturated fat, the measure of fat intake neither showed significant associations with central adiposity nor other CVD risk factors. Neither preference for nor reported intake of sweet foods associated with either measure of adiposity.

The food preference ratings in our study were collected with the hedonic general Labeled Magnitude Scale, a scale in which subjects are asked to consider their preference ratings within the context of all hedonic experiences not just those for food. This broader context aims to minimize errors made when assuming that scale labels (eg, strongly like) have the same meaning to all individuals when applied to food preferences. For example, suppose the aim was to compare the liking for sweetness across normal weight individuals and individuals with obesity with a traditional visual analogue scale labeled "zero" at one end and "maximum liking for sweetness" at the other end. Members of each group could be given an especially desirable dessert that both groups would rate at the top of the scale. This does not mean that both groups are experiencing the same level of pleasure. In fact, the individuals with obesity could be experiencing twice as much pleasure. There is no way to know what absolute level of pleasure is denoted by "maximum liking for sweetness." However, if the top label were changed to "maximum liking of any kind," the subjects can compare the pleasure they experience from sweet with all other pleasures (eg, pleasure experienced from driving a fast car). If the maximum of all pleasures is not systematically related to the pleasure from sweet, then any variation in maximum pleasure of any kind will be roughly the same in the obese and thinner groups. Thus, maximum pleasure of any kind serves as a standard. Suppose the obese subjects, on average, rate the pleasure from the dessert at 90% of the maximum pleasure of any kind while the thinner subjects rate it at 45%. If the maximum pleasure of any kind was considered to equal 100, then the thinner rating (45%) would be half that of the obese rating (90%); the conclusion could be that thinner subjects experience half the liking for the dessert as that experienced by the obese subjects. In our study neither sweet preference nor reported intake of sweet foods was a significant predictor of central adiposity. Although most studies also do not support that individuals with obesity have a greater preference for sweet foods (36-40), new advances in scaling food preferences should increase understanding of preference differences across individuals who vary in body weight (23), even if intake of sweets, specifically added sugars, are unlikely by themselves to have caused increases in obesity risk (41).

The observed associations between fat preference and adiposity agree with those from individuals with normal weight (16,17) and obesity (37). In fact, preference measures might be more able than other dietary measures at identifying diet and body composition relationships. They are less cognitively demanding and maybe less biased by cognitive control on reporting dietary intakes (ie, dietary restraint). Basic research in cognition shows that simple affective responses require less cognitive function (10,42) (eg, answering the question "how much do you like it" is much easier than recalling "how often and how much do you eat?"). This basic research is supported by the observation that children (43) and neurologically impaired adults (44) can complete preference tasks. Food preference assessment appears to match the goals for health screening of relating dietary patterns to health while requiring minimal concentration and cognitive processing.

One issue is whether or not dietary fat contributes to obesity, particularly central obesity. Although debate exists on macronutrient composition and adiposity, generally accepted scientific evidence supports that diets between 20% and 35% total fat and low in saturated fats (<10%) and cholesterol (<300 mg/day) promote optimal health and weight (35). High-fat diets are associated with greater adiposity in epidemiologic and clinical studies (45) as well as model animal systems (46). Fat is energy dense and compelling evidence shows that low-energy-dense diets (eg, high in fruits and vegetables) associate with lower body weights (47). Although a lack of association between fat intake and central adiposity has been seen (48,49), intakes of *trans* (50) and saturated fats (51,52) appear to bestow greatest risk of abdominal obesity.

Underreporting of intake can affect observed relationships between diet and abdominal obesity (53) and metabolic syndrome (54) and conclusions drawn from our results. In two separate studies using doubly labeled water to measure total energy expenditure, both women and men of European ancestry underreport energy intake using a food frequency questionnaire (55,56). The reasons for underreporting dietary intake are complex with rates highest in those who are obese and those reporting recent weight loss, having highest dietary restraint, and lowest fat intakes (56). Men who perceived their energy expenditure as low also show greater underreporting (56). Although men report lower levels of dietary restraint than do women (57), the men in our study were HRA participants who are more likely to be health-seeking and attempting to change their diet and lifestyle behaviors, and thus may be exerting restraint over what they eat (58-60). A high level of dietary restraint and disinhibition in men associates with greater adiposity (61).

Our study did not include a specific measure of dietary restraint or disinhibition, yet the relationship between preference and intake could provide an indirect measure of these constructs. Men who liked fat but reported low intakes were more likely to be overweight and obese than those who liked fat and reported that they consumed fat foods more frequently. Thus, those who did not fulfill their preference for fat foods could have been restraining their intakes of these foods until exposed to a disinhibitor, an environmental factor or stressor that produces loss of control over eating. High level of disinhibition associates with higher preference for sweet and "fattening" foods as shown in women who are dieting (19) and those with greater adiposity (61-63). Discordance between liking and intake of fat (ie, high preference and low intake) could reflect greater underreporting among people with higher preference for fat, or could indicate individuals who are actively trying to modify their diets. Counseling on strategies to incorporate fat and fat modified foods into dietary plans could help individuals resolve some of the discordance between preference and intake.

Intakes of high-fiber foods (eg, whole grains, vegetables, and fruits) as well as alcoholic beverages predicted lower adiposity and/or more favorable serum lipid levels. Reported intakes of fiber foods may be more accurate than intakes of fat to detect effects on body composition—there may be less motivation and/or social demands to distort reported intake of fiber foods. Alternatively, the male HRA participants who were more overweight could have underreported intakes of fiber foods, since underreporters tend to do so across most food groups (64), which could have inflated the apparent negative relationship between fiber intake and adiposity. Nonetheless, scientific evidence support that diets high in fiber associate with lower body weight and body fat, possibly due to affects on satiety and absorption (65). Higher intakes of fruits and vegetables promote control of energy intake because they are less energy dense, supporting satiety and controlling hunger (66). Reports of alcohol intake from HRAs can be valid and reliable enough to link with health and occupational outcomes (8). The positive relationship between a moderate intake of alcoholic beverages and serum lipid levels in our study is supported by previous research of inverse relationships between alcohol consumption and HDL cholesterol, triglycerides (67-69), insulin resistance, and glycosylated hemoglobin (69). Yet high alcohol intakes are also linked with higher blood pressures (70), as seen among our HRA participants over 50 years of age.

The limitations of our study should be noted. These are cross-sectional data and, thus, do not imply causality. The preference measure did not include all foods or food groups assessed by the intake measure, specifically lacking questions about preference for whole grains, fruits, and vegetables. Thus, the study could not assess the utility of preference for examining diet–body composition relationships across a range of foods, some of which are generally perceived as more healthful and socially desirable. The measure of fat intake may not have been sensitive enough to detect a relationship with overall or central adiposity. The study group was primarily composed of men of European ancestry who were salaried, suggesting higher incomes and educational levels. Thus, the results may generalize less well to women (17) and those of diverse ancestry or socioeconomic status. The multiple regression models predicted less variance in risk factors among the older age group (≥50 years) as shown previously (29). The models did not also include family history, which contributes a significant source of risk for CVD (eg, reference 71).

CONCLUSIONS

The dietary component of HRAs should screen for dietary behaviors that associate with risk of obesity and other chronic diseases. Cognitive issues such as memory and dietary restraint threaten the utility of recall-based intake measures, especially in screening situations with health-seeking individuals. Our study found that although reported preference and intake for fat foods were correlated, only preference for these foods was associated with adiposity. Men who reported greater preference for fat foods and beverages as well as lower intakes of fiber-rich foods (eg, whole grains, fruits, and vegetables) were more likely to have higher BMIs or waist circumferences. Greater waist circumference in turn was predictive of higher blood pressure and less favorable serum lipid levels. Based on previous research, the ability to reveal relationships between dietary intake and adiposity is challenged by underreporters, who are likely to be obese as well as estimate low intakes of socially undesirable foods. Research in cognition supports that assessing food/beverage preference may minimize cognitive factors associated with under- or overreporting intake. Thus, we believe that including the measure of preference for fat foods in the HRA enhanced the assessment of dietary risk of CVD. In addition, comparing preference and intake responses identified individuals for whom intakes of fat foods fell below preference for these foods. Dietary counseling may assist these individuals in incorporating fats into their diets that promote cardiovascular health while supporting their preference for fat.

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