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The Use of Food Frequency Questionnaires in Minority Populations

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Food frequency questionnaires (FFQs) are selected by investigators to assess the usual food or nutrient intakes of groups or individuals because they are relatively easy to administer, less expensive than other dietary assessment methods, and can be adapted to all racial and ethnic populations in the United States.[1] Investigators can also modify these dietary instruments for telephone interviews or self-administered mailed surveys. FFQs are commonly used in epidemiological studies on diet and disease, but are also chosen by investigators as the dietary assessment instrument in clinical intervention studies. The use of these questionnaires in minority populations in the U.S. is increasing for several reasons: the country is becoming more racially and ethnically diverse,[2] government agencies have placed emphasis on including minority population in health-related research,[3] and variations in disease incidence and dietary practices within and across ethnic minorities offer important opportunities for examining the role of diet in relation to risk for chronic disease.[4]

This section reviews 12 published studies evaluating the validity and/or reliability of FFQs used in measuring dietary intakes in adult minority populations in the U.S. over the last 20 years. Also included are selected samples of FFQs and information on obtaining copies. Recommendations on the use of these FFQs are discussed.

A search of the National Library of Medicine's (Bethesda, MD) MEDLINE system was conducted using various terms such as *validity, reliability, reproducibility, diet, food frequency questionnaire, minority, Hispanic, black, Asian, Pacific-islander* and *native America* to identify articles published between 1980 and 2000. These searches were supplemented by cross-referencing from author reference lists. Articles were selected that described the evaluation of any FFQ that assessed the usual daily diet and provided data on the validity and/or reliability of the instrument in a specific U.S. ethnic minority population or a diverse population representing at least 40% minority persons. The degree of reliability or validity of the instrument reported was not considered an inclusion factor. Validity and reliability studies that were reported in the same article were considered separately and are referenced in different tables. The measures of performance chosen were reliability, comparison of means (when available), and validity, because these are usually reported to describe the results of the evaluation of the FFQ. Correlation coefficients were selected as indicators of reliability and validity because they are commonly used and are more easily summarized. Factors that can influence correlation coefficients are the number of days between the times the questionnaire is administered (reliability coefficients) and the number of

days of food records or 24-hour recalls used for the referent period (validity coefficients). Unadjusted correlation coefficients if available are reported in the tables because of the considerable variation in the kinds of adjustment procedures that were used in these studies and the lack of standardization across studies for methods used.

Terms used to describe FFQs in the tables:

- *Quantitative* — Quantity of food consumed was estimated using weights, measures, or food models. Responses were open-ended.
- *Semi-quantitative* — Quantity of food consumed was estimated using a standard portion size, serving, or a predetermined amount and the respondent was asked about the number of portions consumed.
- *Nonquantitative* — Quantity of food was not assessed.
- *Self-administered* — An adult completed the dietary assessment without assistance.
- *Interviewer-administered* — A trained interviewer collected the dietary information from the adult in a one-on-one setting.
- *Diverse studies* — Publications that include various combinations of racial or ethnic groups
- *Minority studies* — Publications that include only one racial or ethnic group

The twelve studies reviewed for this section were divided into two groups based on ethnic participation. Within the group labeled Minority studies, two consisted of only black subjects,[5,6] one of Asian,[7] and one of Hispanic subjects.[8] In the group labeled Diverse, two studies included black and white subjects,[9,10] three studies black, Hispanic, and white subjects,[11,12,13] one study Hispanic and white,[14] one study Asian and white,[15] and one recruited Asian, black, Hispanic, and white subjects.[16]

The review of the validation studies on FFQs was not conclusive. The median correlations (Table 22.1) between questionnaire–based estimates of nutrient intakes and estimates derived from referent methods were not consistent for ethnic groups, but trends were suggested. The median correlations for black males and females across validation studies were in the range of 0.23 to 0.46; for Hispanic females, 0.32 to 0.49 except for one study conducted in Starr County, Texas which reported a median correlation of 0.75; for white males and females, 0.53, and for Asian males and females, 0.53. If you consider a measure of ≥0.05 as satisfactory or good, 0.30 to 0.49 as fair, and <0.30 as poor,[15] then these median correlations suggest that black and Hispanic groups do not perform extremely well on FFQs.

The validation correlations for total energy, total fat, and vitamin A were inconsistent and in some cases very low across studies. In Table 22.2 the correlation coefficients for total fat ranged from 0.23 to 0.65, with the higher correlations usually found in the Asian or white populations. A similar trend was found for energy among the various groups. The correlation coefficients for Hispanic and black populations were commonly in the range of 0.24 to 0.43, but in the white and Asian groups the coefficients ranged from 0.41 to 0.61. Values for vitamin A were more inconsistent, ranging from 0.15 to 0.67 across all groups. The number of days of food records and recalls that are compared against FFQs can explain some of these low correlations, especially for vitamin A. Many days are required to provide a precise estimate of vitamin A intake, and in these studies the greatest number of daily recalls or records collected over one year was 28. Even in this study, certain subgroup correlations for vitamin A were still 0.23 and 0.29.

The study[5] that reported serum nutrient concentrations of carotenoids, vitamin E, lycopene, and lutein as a referent reported correlations that were much lower for smokers

TABLE 22.1

Median and Reported Range of Correlation Coefficients

Study	Median and Reported Range Validity Coefficients	Reliability Coefficients
Diverse Groups		
Baumgartner et al.[14]	0.50 (0.21–0.57) HF+WF (adjusted value)	0.62 (0.40–0.71) Unadjusted
Hankin et al.[15]	0.63 (0.58–0.67) Chinese females	
	0.46 (0.38–0.64) White females	
	0.56 (0.49–0.60) Filipino females	
	0.38 (0.29–0.41) Hawaiian females	
	0.60 (0.23–0.68) Japanese females	
	0.58 (0.38–0.68) Chinese males	
	0.45 (0.34–0.64) White males	
	0.57 (0.21–0.84) Filipino males	
	0.36 (0.26–0.62) Hawaiian males	
	0.55 (0.46–0.77) Japanese males	
Kristal et al.[11]	Baseline	
	0.31 (0.26–0.46) Black females	0.51(0.37–0.60) Black females
	0.35 (0.25–0.48) Hispanic females	0.51(0.19–0.75) Hispanic females
	Six months (control group)	
	0.40 (0.29–0.49) Black females	
	0.37 (–0.01–0.48) Hispanic females	
Larkin et al.[9]	0.43 (0.26–0.62) White males	
	0.23 (0.09–0.41) Black males	
	0.44 (0.27–0.57) White females	
	0.32 (0.24–0.43) Black females	
Liu et al.[10]	0.64 (0.50–0.86) White males	0.70 (0.60–0.91) White M+F
	0.53 (0.13–0.68) White females	0.58 (0.45–0.85) Black M+F
	0.42 (0.23–0.67) Black males	
	0.27 (0.04–0.53) Black females	
Mayer-Davis et al.[12]	0.58 (0.30–0.77) White females, urban	0.71 (0.43–0.82) White females
	0.38 (0.22–0.62) Black females, urban	0.62 (0.26–0.69) Black females
	0.57 (0.24–0.68) White females, rural	0.64 (0.25–0.88) White females, rural
	0.32 (0.21–0.44) Hispanic females, rural	0.58 (0.33–0.66) Hispanic females, rural
Stram et al.[16]	Average correlation for amount	
	0.30 (0.16–0.41) Black M+F	
	0.48 (0.27–0.62) Hispanic M+F	
	0.57 (0.48–0.64) White M+F	
Suitor et al.[13]	0.32 (0.12–0.52) All females combined	0.88 (0.80–0.94) All females
Minority Groups		
Coates et al.[5]	0.34 (–0.02–0.45) Nonsmokers	
	0.08 (–0.02–0.20) Smokers	
Forsythe et al.[6]		0.88 (0.69–0.98) Black females
Lee et al.[7]	0.46 (0.21–0.66) Chinese females	
McPherson et al.[8]	0.75 (0.53–0.77) Hispanic M+F	0.85 (0.84–0.90) Hispanic M+F

(≤0.02) than for nonsmokers (<0.40). The investigators summarize that their FFQ is reasonably valid for use in a Southern, urban, low-income black population, except for the analysis of lutein and lycopene.

In most of the studies reviewed, the FFQ overestimated the mean of the referent recall or records, and in some cases by nontrivial amounts. One explanation for this difference was, again, the number of days of recalls or records collected for comparison to the FFQ. Depending on which nutrient is of interest in the study and the time period the participant

TABLE 22.2

Food Frequency Questionnaire (FFQ) Validity Studies among Diverse Adult Populations in the U.S.

Reference	Sample	Instrument	Response Categories	Validation Standard	Design	Results
Baumgartner et al.[14]	43 HF (Hispanic) 89 NHF	140 Items; interviewer-administered; open-ended; referent period was previous 4 weeks	Included per month, week or day	4-Day food records	Compared subject's report of past month's food intake against 4 randomly selected nonconsecutive day food records; third FFQ taken 6 months after 1st FFQ to recall original month, then compared against subject's 4 day FR	Pearson correlation coefficients (log transformed and energy adjusted); nutrients which differed significantly by ethnicity between FFQ2 + FFQ3 and food records: Protein(g) HF 0.40 NHF 0.35 Vitamin A (RE) HF 0.67 NHF 0.38 Vitamin C (mg) HF 0.34 NHF 0.64 Calcium (mg) HF 0.49 NHF 0.58
Hankin et al.[15]	Japanese 29M + 29F Chinese 29M + 26 F Filipino 22 M + 25 F Hawaiian 19 M + 28 F Caucasian 29 M + 26 F	Hawaiian Cancer Research Center 47 items, semi-quantitative; administered; covers past twelve months; color photographs showing S, M, L portion sizes were used by subjects to estimate intake on FFQ and FR	8 (Never or hardly ever to 2 or more times/day)	Four 1-week food records at approximately 3-month intervals	Compared subject's report of nutrient intake (FFQ) against average of 4, 1 week FR collected at 3 month intervals during a 1-year period. FFQ collected at end of 12 month period	Intraclass correlations (log transformed) between the subjects' reports on FFQs and average 7 day FR Total fat: JapM 0.55, WM 0.34, ChinM 0.39, FilM 0.60 HawM 0.26 JapF 0.68, WF 0.58, ChinF 0.67, FilF 0.55, HawF 0.40. Vitamin A: JapM 0.74, WM 0.38, ChinM 0.65, FilM 0.53, HawM 0.35, JapF 0.23, WF 0.40, ChinF 0.64, FilF 0.53, HawF 0.29 Intraclass correlation for total fat for all males was 0.48 and for all females 0.60. FFQ overestimated means of FR by large amounts but results on the agreement of the FFQ with FR were generally satisfactory

Kristal et al [11]	555 White F, 271 black F, 159 Hispanic F recruited at three clinical centers. Because Hispanics recruited at Miami clinic only, their data were compared with WF from same clinic; data for WF and BF at two other centers were collapsed and compared	100 Items, self-administered, semi-quantitative; covering last three months; portion sizes were S, M, L. FFQ collected at screening, baseline and six months. Printed in both English and Spanish	9 (Never or <once/mo to 2 or more times/day for foods and 6+/day for beverages)	4-Day food records collected at baseline and 6 months	Compared subjects; recall of baseline FFQs with the baseline food records and at six months, the 6-month FFQ with the 6-month food records	FFQ overestimated % of energy from fat compared with FR. Pearson correlations (log transformed) between FFQ and 4 day FR: Baseline: Fat (% energy, adjusted) BF — 0.26 WF — 0.49 HF — 0.35 WF — 0.35 Saturated fat (% energy adjusted) BF — 0.32 WF — 0.50 HF — 0.37 WF — 0.56 Beta-carotene (unadjusted) BF — 0.42 WF — 0.32 HF — 0.26 WF — 0.30 Correlations at baseline were significantly larger among whites than blacks and tended to be larger for whites than Hispanics. Six Months — Control group Fat (% energy) BF — 0.49 WF — 0.52 HF — 0.48 WF — 0.61 Saturated fat (% energy) BF — 0.47 WF — 0.53 HF — 0.48 WF — 0.68 Beta-carotene (unadjusted) BF — 0.34 WF — 0.23 HF — 0.27 WF — 0.57 Educational level associated with poor validity of FFQ and/or FR measures.

TABLE 22.2 *(Continued)*

Food Frequency Questionnaire (FFQ) Validity Studies among Diverse Adult Populations in the U.S.

Reference	Sample	Instrument	Response Categories	Validation Standard	Design	Results
Larkin et al. [9]	43 BM 48 BF 64 WM 73 WF (40% subjects black)	In Michigan FFQ-113 food items based on data from NFCS 77-78; semiquantitative; collected food intake over past 12 months	9 (Not in past year to more than once a day)	One 24-hr recall + 3-day food record collected 4 times/yr about 3 months apart. FR's administered and reviewed in subject's home. FFQ administered in subject's home about 3 months after 4th set of records had been completed	Compared by sex and ethnic group (BM, BF, WM, WF) report of food intake (4 sets of food record) against the FFQ	Pearson correlation (nonadjusted) values between FFQ and 16 days of FR: Energy: BM — 0.23 BF — 0.26 WM — 0.41 WF — 0.43 Protein (gm): BM — 0.30 BF — 0.40 WM — 0.41 WF — 0.36 Total fat (gm): BM — 0.23 BF — 0.35 WM — 0.44 WF — 0.39 Vitamin A(IU): BM — 0.15 BF — 0.28 WM — 0.26 WF — 0.27 FFQ showed larger mean nutrient intakes compared to FR. Black M+F had lower coefficients between FFQ and FR than white M+F

Liu et al. [10]	33 BM 32 BF 30 WM 33 WF	About 300 items in 20 categories; Interviewer-administered quantitative FF based on the Western Electric dietary history; referent period is past month.	Open-ended	Seven 24-hr food recalls collected by phone	Compared subject's recall of last 30 days against seven 24-hr food recalls	Mean nutrient values for WM are similar between 2 methods; for WF values from FFQ are generally higher than recalls (VitA significantly different); for BM + BF values from history are much higher than recalls (VitA+ Kcal significantly different); Pearson correlations (log transformed) Total Calories: WM — 0.64 WF — 0.47 BM — 0.43 BF — 0.21 Total Fat: (g) WM — 0.65 WF — 0.37 BM — 0.36 BF — 0.23 Vitamin A: (IU) WM — 0.67 WF — 0.62 BM — 0.62 BF — 0.32

TABLE 22.2 *(Continued)*

Food Frequency Questionnaire (FFQ) Validity Studies among Diverse Adult Populations in the U.S.

Reference	Sample	Instrument	Response Categories	Validation Standard	Design	Results
Mayer-Davis et al.[12]	32 WF (urban) 63 BF (urban) 30 WF (rural) 61 HF (rural)	114-Item, interviewer-administered FFQ; modified from NCI-HHHQ to include regional and ethnic food choices; past year	9 (Never or <1/month to 2 or more times/day)	Eight 24-hr recalls over course of 1 year (randomly selected days, about every 6 weeks)	Compared subject's report of frequency of intake from FFQ2 to average of eight 24-hr recalls;	Pearson correlations (log-transformed) between FFQ2 and food recalls were: Energy: WF (urban) — 0.61 BF (urban) — 0.37 WF (rural) — 0.56 HF (rural) — 0.27 Total fat: (g) WF (urban) — 0.66 BF (urban) — 0.59 WF (rural) — 0.58 HF (rural) — 0.40 Vitamin A: (IU) WF (urban) — 0.38 BF (urban) — 0.28 WF (rural) — 0.24 HF (rural) — 0.28 Correlations by educational status: Total fat: (g) <12 grade — 0.05 12 grade — 0.59 Total CHO: (g) <12 grade — 0.19 12 grade — 0.53 Saturated fat: (g) <12 grade — 0.07 12 grade — 0.63 Vitamin A: (IU) <12 grade — 0.31 12 grade — 0.21

Stram et al.[16]	African-Am 151BM, 186 BF Japanese 224 JM, 222 JF Hispanics 136 HM, 123 HF Caucasians 264 WM, 264 WF	Based on Hawaiian Cancer Research Center FFQ; quantitative by placing serving size photos beside the amount category; 8 frequency categories for food and 9 for beverages	Unknown; highest response for food is >2 times/day; for beverages, 4 times/day	Three random 24-hr recalls conducted by phone	An initial FFQ was mailed to random sample of prospective subjects; 3-24 hr recalls were collected by phone after the initial contact; a second FFQ was sent 4-6 weeks after the recalls were completed; the subjects' responses on the 2nd FFQ were compared against the 24-hr recall values	Corrected correlations for the regression of mean 24-hr recalls on the 2nd FFQ by ethnic sex/group for following nutrients: Total kcals: BM — 0.16 BF — 0.17 JM — 0.34 JF — 0.19 HM — 0.33 HF — 0.40 WM — 0.48 WF — 0.28 Total Protein: (g) BM — 0.17 BF — 0.22 JM — 0.31 JF — 0.25 HM — 0.27 HF — 0.35 WM — 0.51 WF — 0.38 Total Fat: (g) BM — 0.29 BF — 0.24 JM — 0.41 JF — 0.32 HM — 0.33 HF — 0.57 WM — 0.57 WF — 0.39 Vitamin A: (IU) BM — 0.30 BF — 0.22 JM — 0.45 JF — 0.49 HM — 0.62 HF — 0.52 WM — 0.59 WF — 0.58
Suitor et al.[13]	Initially who provided 3 diet recalls: WF — 54 BF — 20 HF — 18 Subjects who provided FFQ2 and FR = 62 but no ethnic breakdown	Willett (Harvard Un.) 111 items, self-administered (edited foods, portion size information deleted); developed as a prenatal FFQ	Unknown (recall of past 2 weeks)	Three 24-hr recalls conducted by phone	Compared female's report of food intake between food recalls and FFQ2 which were mailed	Pearson correlation (unadjusted, log transformed values) between FFQ2's and recalls Energy — 0.41 Protein — 0.33 Vitamin A — 0.12 Calcium — 0.52

TABLE 22.2 *(Continued)*

Food Frequency Questionnaire (FFQ) Validity Studies among Diverse Adult Populations in the U.S.

Reference	Sample	Instrument	Response Categories	Validation Standard	Design	Results
Coates et al.[5]	91 BF	HHHQ-original 98 item FFQ revised to include 19 ethnic/regional foods resulting in 117 item FFQ; past year	4 (Times/day, week, month or year)	Serum carotenoids, alpha-tocopherol, lycopene, crytoxanthin, lutein/xeaxanthin	Compared female's FFQ responses to 15-ml nonfasting venous blood sample	Pearson correlations (log transformed, unadjusted) between FFQ and serum for nonsmokers: Alpha-tocopherol (food only) — 0.19 Provitamin A carotenoids — 0.37 Beta-carotene — 0.34 Cryptoxanthin — 0.37 Lycopene — (-0.02) Lutein — 0.12 Person correlations (log transformed, unadjusted) for smokers were: Alpha-tocopherol — (–0.12) Provitamin A carotenoids — 0.07 Beta-carotene — 0.11 Cryptoxanthin — 0.18 Lycopene — (–0.02) Lutein — 0.11 Results suggest that FFQ was reasonably valid for black females. Analysis of lycopene and lutein may not reflect validity of the assessment of these nutrients

Forsythe et al.[6]	80 BF ethnic mix of African blacks, Asian Indians, Caribbean whites, Guyanese Amerindians, and Caribbean Chinese	FFQ-82 items compiled from Caribbean food tables, Willett FFQ, Stower prenatal food guide, and regional recipes	Unknown (weekly intake patterns)	Three 24-hr recalls	Compared female's report of intake against 3, 24-hr recalls, one recall at prenatal visit and two others by phone during next 7 days. 2nd FFQ administered 3 weeks later	Paired t-tests examined differences between the food recall means and the means of the FFQ at time 1. Most of the 14 nutrients were significantly different using the two instruments, with the exception of saturated fat, vitamin A and caffeine. The percentage of energy from protein, CHO, and fat showed no significant differences on either method of assessment. Mean difference scores were computed between food recalls and time 2 FFQ responses in the subsample. Significant differences were found for energy , CHO and vitamin C and the percentage of energy from CHO. The 24-hr recalls did not fully support the responses provided on the FFQ's.
Lee et al.[7]	74 Chin W	84 Items; interviewer administered; past year; portion size asked for foods eaten >1/ week; 3-dimensional actual size food models used; type of fat used in cooking asked	5 (Day, week, month, year or not at all)	One 24-hr recall (typical day during past month)	Compared female's report of frequency of intake against the 1-24 recall;	Pearson correlations between the FFQ and the food recall: Total kcal — 0.05 Total fat — 0.21 Protein — 0.56 Vitamin A — 0.46. Nutrient intakes by FFQ that were significantly higher than 24-hr recall were total kcal, total fat, vitamin A, saturated fat, cholesterol and beta carotene. Use of only 1-24 hr recall could explain the modest correlations.
McPherson et al.[8]	33 HM+F	38 Mutually exclusive food types; interviewer administered; referent period last 4 weeks	Unknown	Three random nonconsecutive food records	Compared subject's report of past month's food intake against 3-24 hr food records	Pearson correlation coefficients (unadjusted) between FFQ and records Energy — 0.77 Total fat — 0.76 Cholesterol — 0.61 None of the differences between nutrients on FFQ1 and FR were significant.

is asked to recall on the FFQ, more than four to seven days may be required to capture the actual intake of the individual.

The reliability coefficients across all diverse and minority studies were much higher than the validity coefficients (Table 22.3). The median correlations for black males and females across studies were in the range of 0.51 to 0.88; for Hispanic females, 0.51 to 0.58 except for one study conducted in Starr County, Texas which reported a median correlation of 0.85; for white males and females, 0.64 to 0.71. These coefficients would suggest that within minority and diverse populations, the FFQ can usually describe with some consistency the food or nutrient intakes of individuals when administered at two points in time.

In most of the studies reviewed, the investigators made suggestions and recommendations for improving the performance of the FFQ in minority populations. It was repeatedly mentioned that a "gold standard" referent method was not available, so collecting valid dietary intake data remains challenging. The need to identify a complete food list on the FFQ that captures all of the foods in the usual diet of the study population was highly recommended. Depending on the study, the food list should include foods that will contribute substantially to the nutrients under investigation. This importance of a food list capturing the usual intake of study participants was demonstrated in the study conducted in Starr County, Texas. Because of the limited number of overall foods that the participants consumed, the food list of the FFQ was able to reflect the major sources of food and nutrient intake of these individuals. Because of this unique situation, the nutrient values from the FFQ were more likely to agree with the values from the food records.

Several suggestions were made regarding administration of the dietary assessment forms in minority populations. It is recommended that any staff person who is responsible for interviewing a subject for any dietary assessment measure, whether the conversation takes place in person, or over the phone should be of the same ethnic background as the subject.

Educational attainment of participants appeared to be a major determinant of the validity of the dietary assessment measures in several studies. Agreement between the food frequency and the criterion measure of 24-hour dietary recalls was substantially compromised among individuals with less than a high school education. This was particularly true within a Hispanic group of one study. In another study, it was found that increasing validity with increased education suggested that poor education is a barrier to accurate completion of the FFQ, the food record, or both. In this same study, low educational levels did not affect reliability measures. These findings would suggest that special efforts are needed when using dietary assessment tools with participants of low educational status or culturally diverse dietary habits. Small group instruction and practice in using the dietary tools could improve the dietary information collected. Instructing participants by videotape on completing dietary forms is another method to help improve the accuracy of information.

This section includes examples of the food frequency questionnaires that have been used or adapted for studies of minority populations. This is not intended to be a complete list of all the questionnaires that were used in the 12 studies reviewed, nor is inclusion in this set of examples an implied endorsement of one instrument. The FFQs included are those that are widely available. The FFQs in this set were originally selected by an investigator for modification to his/her population, or the FFQ is the actual instrument used to assess dietary intake. Readers who are interested in using or adapting these dietary assessment tools should contact the resource people listed with each tool.

In selecting a food frequency questionnaire, the reader should consider several points:

1. What is the primary purpose of the project or study you are planning to conduct and how does the food intake data relate to the outcome?

TABLE 22.3

Food Frequency Questionnaire (FFQ) Reliability Studies among Adult Minority Populations in the U.S.

References	Sample	Instrument	Response Categories (range)	Design	Results
Baumgartner et al.[14]	43 HF (Hispanic) 89 WF	140-items; interviewer administered; semi-quantitative; referent period was previous 4 weeks	Included per month, week or day	Compared 6-month test-retest reproducibility of nutrient estimates from FFQ2 and FFQ3. Reproducibility coefficients were not reported by ethnic group except for 2 nutrients	Pearson coefficients (log transformed, adjusted) by ethnic group between the 2 FFQ's for 2 nutrients: Saturated fat: HF — 0.57 WF — 0.77 Retinol: HF — 0.50 WF — 0.80
Forsythe et al.[5]	80 BF ethnic mix of African blacks, Asian Indians, Caribbean whites, Guyanese Amerindians, and Caribbean Chinese	FFQ- 82 items compiled from Caribbean food tables, Willett FFQ, Stower prenatal food guide, and regional recipes	Unknown (weekly intake patterns)	Compared 3 wk test-retest reproducibility of nutrient estimates from FFQs and food recalls	Paired t-tests examined differences between the food recall means and the means of the FFQ at time 1. Most of the 14 nutrients were significantly different using the two instruments, with the exception of saturated fat, Vitamin A and caffeine. The percentage of energy from protein, CHO, and fat showed no significant differences on either method of assessment. Mean difference scores were computed between food recalls and time 2 FFQ responses in the subsample. Significant differences were found for energy, CHO and Vitamin C and the percentage of energy from CHO Pearson correlations between the 2 FFQs were: Energy — 0.91 Protein — 0.97 Total fat — 0.89 Vitamin A — 0.73
Kristal et al.[11]	555 WF 271BF 159 H F recruited at three clinical centers. Because Hispanics recruited at Miami clinic only, their data was compared with WF from same clinic; data for WF and BF at two other centers were collapsed and compared	100 items, self-administered, semi-quantitative; last three months; portion sizes were S, M, L. FFQ collected at screening, baseline and six months	9 (never or <once/ month to 2 or more times/day)	Compared 6-month test-retest reproducibility of selected nutrient estimates from baseline and 6 month FFQ's in the control group only Analyses were also stratified on level of education	Pearson coefficients (log transformed) between the 2 FFQ's were: Fat (% energy): BF — 0.37 WF — 0.51 HF — 0.45 WF — 0.34 Vitamin C (unadjusted): BF — 0.60 WF — 0.67 HF — 0.75 WF — 0.44 Beta-carotene (unadjusted): BF — 0.54 WF — 0.61 HF — 0.62 WF — 0.46 Little evidence that reliability was affected by poor education

TABLE 22.3 *(Continued)*

Food Frequency Questionnaire (FFQ) Reliability Studies among Adult Minority Populations in the U.S.

References	Sample	Instrument	Response Categories (range)	Design	Results
Liu et al.[10]	33 black M 32 black F 30 white M 33 white F	About 300 items in 20 categories; interviewer-administered; quantitative history based on the Western Electric dietary history; referent period is past month	Open-ended	Compared subject's history of last 30 days against baseline history	Sex-adjusted partial correlation coefficients (log transformed, not calorie adjusted) between the first and last histories Energy: W M+F — 0.76 B M+F — 0.50 Total fat: (g) W M+F — 0.73 B M+F — 0.56 Protein: (g) W M+F — 0.70 B M+F — 0.57 Vitamin A: (IU) W M+F — 0.77 B M+F — 0.74
McPherson et al.[8]	20 H M+F	38 mutually exclusive food types; interviewer administered; referent period last 4 weeks	Unknown	Compared 1 month test-retest reproducibility of nutrient estimates between FFQ2 and 3 and FFQ 2 and 4	Absolute nutrient intake from FFQ2 was greater than those of FFQ3 and FFQ4. Pearson coefficients (unadjusted) between FFQ2 and FFQ3: Energy: 0.90 Total fat: 0.85 Cholesterol: 0.85 Coefficients (unadjusted) between FFQ2 and FFQ4 were Energy: 0.84 Total fat: 0.70 Cholesterol: 0.79

Mayer-Davis et al.[12]	32 WF (Urban) 63 BF (Urban) 30 WF (Rural) 61 HF (Rural)	114-item, 1st FFQ interviewer-administered and 2nd was conducted over phone; modified from NCI-HHHQ to include regional and ethnic food choices; past year	9 (never or <1/month to 2 or more times/day)	Compared 2-4 year test-retest reproducibility of baseline FFQ1 with FFQ2	Pearson coefficients (log transformed, unadjusted) between 2 FFQ's were: Energy: WF (urban) — 0.81 BF (urban) — 0.64 HF (rural) — 0.83 WF (rural) — 0.61 Total fat: (g) WF (urban) — 0.81 BF (urban) — 0.69 HF (rural) — 0.87 WF (rural) — 0.63 Vitamin A: (IU) WF (urban) — 0.67 BF (urban) — 0.26 HF (rural) — 0.63 WF (rural) — 0.53 Reproducibility of FFQ's was similar across all subgroups evaluated including educational attainment
Suitor et al.[13]	Initially who provided 3 diet recalls: WF 54 BF 20 HF 18 Subjects who provided FFQ1 and FFQ2 = 43 but no ethnic breakdown	Willett (Harvard Un.) 111 items, self-administered (edited foods, portion size information deleted); developed as a prenatal FFQ	Unknown (recall of past 2 weeks)	Compared female's report of food intake between baseline FFQ1 which was completed in the clinic and FFQ2 which was mailed. Those returning FFQ2 were unrepresentative of the original sample	Pearson correlation (unadjusted, log transformed values) between FFQ1 and FFQ2: Energy — 0.92 Protein — 0.87 Vitamin A — 0.89 Calcium — 0.80

2. What length of time are you interested in assessing food intake? 12 months, 3 months?
3. How current is the food list? Does it reflect the current food supply?
4. Does the food list contain foods that contribute significantly to the nutrients you are interested in assessing?
5. Does the food list reflect the traditional or cultural foods eaten by your population?
6. Is the nutrient software analysis program updated on a regular basis to reflect the changing composition of our food supply?
7. Can you individualize the food list of the FFQ to your specific population? How much latitude do you have to modify the existing questionnaire? Can the existing software be modified to reflect the changes you wish to make?
8. Request a list of the validity and reliability studies that investigators have conducted using the FFQ you are considering. Were these studies conducted with populations similar to the groups of persons you wish to recruit into your study?

Diet History Questionnaire

Investigators at the National Cancer Institute have developed a new self-administered, scannable food frequency questionnaire, the Diet History Questionnaire (DHQ). The instrument was designed with particular attention to cognitive ease, and has been updated with respect to the food list and nutrient database using national dietary data (USDA's 1994-96 Continuing Survey of Food II). This instrument is available on the internet and can be downloaded from the site http://www-dccps.ims.nci.nih.gov/arp. The data analysis program that accompanies this questionnaire will become available for downloading from this site in 2001. Validity studies are in progress, but not within minority populations.

At this internet site, information is provided regarding the original Health Habits and History Questionnaire (HHHQ) developed by Gladys Block and updated in 1987 and 1992. Recommendations are provided for the continued use of this questionnaire and the software analysis program that accompanies it. Both the questionnaire and the software can be downloaded from the site.

Harvard University Food Frequency Questionnaire (Willett Questionnaire)

Several food frequency questionnaires are available from the Harvard School of Public Health including this current version designed for use in African American populations. This is a scannable, self-administered FFQ referred to as the "green version." Validity studies of this FFQ among black male prostate cancer survivors will be completed very soon. This questionnaire contains a section on the assessment of vitamin and mineral intake followed by approximately 174 food items. The assessment period of the FFQ is the past 12 months, and respondents are asked to average seasonal use of foods over the entire year. This tool is designed to enhance an individual's ability to respond more appropriately to the food items. For example, the response categories are individualized for each item ranging from never to six or more times per day, and probing questions are

asked regarding specific characteristics of foods consumed. (Resource: Laura Sampson, M.S., R.D. Harvard School of Public Health — Nutrition, Bldg. #2, Room 335, 665 Huntington Ave., Boston, MA 02115.)

Fred Hutchinson Cancer Research Center Food Frequency Questionnaire (Kristal Questionnaire)

This questionnaire links answers from an extensive list of food questions to specific food frequency items to derive more precise nutrient estimates for those items. The FFQ is machine-readable and is accompanied by a software system to process the questionnaire. The format has nine frequency categories and small, medium, and large portion sizes. The food list is composed of 122 foods and is preceded by 19 behavioral questions related to preparation techniques and types of food selected. Answers to these questions are used directly in the program to choose more appropriate nutrient composition values for certain foods in the food list. This questionnaire is available in Spanish. (Resource: Alan R. Kristal, Dr. P.H., Cancer Prevention Research Unit, Fred Hutchinson Cancer Research Center, 1124 Columbia St. MP 702, Seattle, WA 98104.)

Cancer Research Center of Hawaii's Dietary Questionnaire (The Hawaii Cancer Research Survey)

The Cancer Research Center of Hawaii, part of the University of Hawaii, has developed a variety of quantitative FFQs for use with the multiethnic population of Hawaii. A questionnaire was recently developed to assess the diets of the five main ethnic groups in the Hawaii-Los Angeles Multiethnic Cohort Study: Hispanics, African-Americans, Japanese, Hawaiians, and Caucasians. Unlike previous questionnaires, the cohort questionnaire was designed to be self administered. Three-day measured food items were collected from all ethnic groups in advance and were used to identify food items for inclusion in the questionnaire. To ensure more accurate specifications of amounts usually consumed, photographs showing three portion sizes were printed on the questionnaire. A customized, an in part ethnic-specific, food composition table was developed for the cohort questionnaire. A calibration study comparing questionnaire responses to the three 24-hour recalls for the same subjects showed highly satisfactory correlations, particularly after the energy adjustment. For more information about the The Cancer Research Center of Hawaii questionnaires, please contact Suzanne P. Murphy, Ph.D., R.D., Cancer Research Center of Hawaii, University of Hawaii, 1236 Lauhala St., Suite 407, Honolulu, HI 96813. Phone: 808-586-2987. Fax: 909-586-2982. Email: Suzanne@crch.hawaii.edu.

New Mexico Women's Health Study, Epidemiology and Cancer Control Program, University of New Mexico Health Sciences Center

This FFQ was developed for an adjunct trial to the New Mexico Women's Health Study, a population-based case-control study of breast cancer in non-Hispanic and Hispanic

women. The 140-item FFQ was a modified version of a questionnaire developed by the Human Nutrition Center, University of Texas School of Public Health — Houston for a Texas Hispanic population. The FFQ was revised to include important food sources of energy, macronutrients, and vitamins that were identified following an analysis of food intake recalls. Emphasis was placed on specific rather than grouped food items because recall is considered better for specific items. Usual portion size, based on two-dimensional food models, included data on number of servings, type of food model, and thickness of food. Common serving descriptions were included for each food item and were based either on food models or defined portion size. This FFQ was translated into Spanish. For further information contact R. Sue McPherson, Ph.D., Director, Human Nutrition Center, Associate Profession of Epidemiology and Nutrition, University of Texas — Houston School of Public Health, 1200 Herman Pressler, Houston, TX 77030. Phone: 713-500-9317.

Insulin Resistance Atherosclerosis Study FFQ, School of Public Health, University of South Carolina

The Insulin Resistance Atherosclerosis Study (IRAS) provided the opportunity to evaluate the comparative validity and reproducibility of a FFQ within and across subgroups of non-Hispanic white, Hispanic, and African-American individuals. The 114-item questionnaire was modified from the National Cancer Institute — Health Habits and History Questionnaire originally created by Gladys Block, Ph.D. This interviewer-administered FFQ was modified to include regional and ethnic food choices that were commonly consumed by the participants of the study. The FFQ contains nine categories of possible responses ranging from "never or less than once per month" to "two or more times per day." Portion sizes are determined simply as "small, medium, or large compared to other men/women about your age." At the end of the FFQ, an open-ended question is asked to describe foods that are usually eaten "at least once per week" that were not listed on the FFQ. Also, nine additional questions probe for information regarding common food preparation methods, specific fats used in cooking, and frequency of consumption of fruits and vegetables. For further information about the IRAS FFQ, contact Mara Z. Vitolins, Dr. P.H., R.D., Research Assistant Professor, Wake Forest University School of Medicine, Department of Public Health Sciences, Medical Center Blvd., Winston-Salem, N.C. 27157-1063. Phone: 336-716-2886. Fax: 336-713-4157. Email: mvitolin@wfubmc.edu.

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