

**Research and Professional Briefs**

# Performance of the Quantitative Food Frequency Questionnaire Used in the Brazilian Center of the Prospective Study Natural History of Human Papillomavirus Infection in Men: The HIM Study

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**ABSTRACT**

The Natural History of Human Papillomavirus (HPV) Infection in Men: The HIM Study is a prospective multicenter cohort study that, among other factors, analyzes participants' diet. A parallel cross-sectional study was designed to evaluate the validity and reproducibility of the quantitative food frequency questionnaire (QFFQ) used in the Brazilian center from the HIM Study. For this, a convenience subsample of 98 men aged 18 to 70 years from the HIM Study in Brazil answered three 54-item QFFQ and three 24-hour recall interviews, with 6-month intervals between them (data collection January to September 2007). A Bland-Altman analysis indicated that the difference between instruments was dependent on the magnitude of the intake for energy and most nutrients included in the validity analysis, with the exception of carbohydrates, fiber, polyunsaturated fat, vitamin C, and vitamin E. The correlation between the QFFQ and the 24-hour recall for the deattenuated and energy-adjusted data ranged from 0.05 (total fat) to 0.57 (calcium). For the energy and nutrients consumption included in the validity analysis, 33.5% of participants on average were correctly classified into quartiles, and the average value of 0.26 for weighted kappa shows a reasonable agreement. The intraclass correlation coefficients for

all nutrients were greater than 0.40 in the reproducibility analysis. The QFFQ demonstrated good reproducibility and acceptable validity. The results support the use of this instrument in the HIM Study.

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**N**atural History of Human Papillomavirus (HPV) Infection in Men: The HIM Study is an international multicenter prospective cohort study that seeks to determine the incidence, persistence, and clearance of human papillomavirus infection in men and to identify the factors associated with these outcomes among populations from three different cities: Tampa, FL; Cuernavaca, Mexico; and São Paulo, Brazil (1).

The quantitative food frequency questionnaire (QFFQ) method was utilized to evaluate the food and nutrient intake of participants in the HIM Study, and a different QFFQ was used in each of the three cities. Measurement errors in FFQs generally lead to bias in estimates of the observed relative risk and a loss of power for detecting the relationship between diet and disease (2-5). Therefore, to correctly interpret epidemiologic studies based on this method, the instrument must be validated and calibrated (6). Moreover, the Brazilian QFFQ is the first FFQ to be developed based on the reported food intake of a population-based sample of residents in São Paulo, Brazil. This study is the first to evaluate the performance of the Brazilian QFFQ in the context of a multicenter study (7,8). Our study aimed to evaluate the validity and reproducibility of the QFFQ in measuring the intake of energy and 19 nutrients among men aged 18 to 70 years participating in the HIM Study in São Paulo, Brazil.

**METHODS**

**The HIM Study**

The HIM Study has been presented in detail elsewhere (1). São Paulo is the most populous city in Brazil, with around 10.4 million inhabitants, of which 5 million are men (9). For the HIM Study, individuals were recruited from the population that attended the Reference and Training Center for Sexually Transmitted Diseases and AIDS in São Paulo and from the general population of the city through publicity in various institutions and the media.

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## Design

Between January and September 2007, the first 120 individuals from the HIM Study's Brazilian cohort who attended the scheduled visit to the reference center and agreed to participate were included in the validation and reproducibility study. During the visits, the reference method, the 24-hour recall, and the QFFQ were applied; both of the measures were administered by trained interviewers in the same day. The follow-up interviews were conducted over a 1-year period, with 6-month intervals between each interview.

Participants who did not provide complete responses for the planned QFFQs and 24-hour recalls and those whose energy intake was <500 kcal or >4,000 kcal (10) were excluded. Thus, 98 individuals for the validation study and 93 for the reproducibility study were assessed. Approval for human subjects research was granted by the Ethical Committee of the School of Public Health at the University of São Paulo. The participants signed consent forms after an explanation of the purpose of the study.

## Assessment of Food Intake

**QFFQ.** The QFFQ was developed based on the foods cited by 708 men on the 24-hour recall in the Health Survey of the State of São Paulo—Population-Based Household Survey in Municipalities in the state of São Paulo, 1999-2000 (7,8). The QFFQ contained 54 food items and four portion size options (small, medium, large, and extra-large). The participants were asked to recall their frequency of consumption over the past year for each food item (from zero to 10 times a day, week, month, or year), along with the size of the portion consumed. To help participants visualize the portion sizes, household measures were available in the interview room.

**24-Hour Recall.** The 24-hour recall was collected using the multiple-pass method (11,12). All of the recalls were critically reviewed by a dietetics practitioner or undergraduate nutrition students with appropriate training to identify errors concerning the descriptions of the foods or preparations consumed as well as portion sizes and quantification. To quantify the nutrient intake, the Nutrition Data System for Research software (version 2.0, 2007, University of Minnesota, Minneapolis) was used. The intake was adjusted for within-person variability (deattenuated) by the method proposed by Iowa State University, using PC-SIDE software (version 1.0, 2003, Department of Statistics, Iowa State University, Ames) (13,14). PC-SIDE generates within- and between-person variances that were used to calculate the ratio of variances ( $V_{\text{within}}/V_{\text{between}}$ ) (13,14).

## Statistical Analyses

The statistical analyses were performed using STATA Statistical Software (version 10, 2007, StataCorp LP, College Station, TX), and the significance level was set at 5%. Variables that did not present a symmetrical distribution in relation to the means and medians were transformed to their natural logarithm or Box-Cox form (15). The adjustment of the dietary variables for energy from both the QFFQ and 24-hour recall was performed by the residuals method (16).

For the validation study, Pearson or Spearman correlation coefficients were used to investigate the crude, deattenuated, and energy-adjusted relationships between the energy and nutrient intake estimated by the third QFFQ and the average of the three 24-hour recalls. The reproducibility was verified between the second and third QFFQ. Crude and energy-adjusted intraclass correlation coefficients were used to investigate the linear correlations of consumption between the two QFFQs (17). Correlation values between 0.40 and 0.70 were considered acceptable (18-21).

The intake of energy and each nutrient variable were categorized into quartiles to investigate the proportion of individuals classified in the same quartile using both instruments (percentage concordance) and the proportion of individuals classified in opposing quartiles. Weighted kappa statistics were calculated for validation and reproducibility analysis, and values >0.40 indicated nutrients with moderate concordance (22-24).

The divergences between the information on the dietary variables were examined in accordance with the methodology proposed by Bland and Altman (25), both for validation and reproducibility. The energy and nutrient intake values were transformed into their natural logarithms, and linear regression analysis was performed. It was expected that the regression coefficients ( $\beta_1$ ) would be close to zero and would not present statistical significance. The mean agreement and limits of agreement (LOA) were obtained from the exponential of the mean difference and from the agreement limits transformed into percentages, respectively (26). A mean agreement of 100% represented the ideal, according to the methodology proposed by Ambrosini and colleagues (27).

## RESULTS AND DISCUSSION

There were no statistically significant differences between the subsample of the validation study and the entire group of participants from São Paulo. The mean age of the subsample was  $35.8 \pm 10.0$  years ( $P=0.27$ ) and the mean body mass index was  $26.1 \pm 3.6$ , indicating overweight ( $P=0.10$ ). Almost 48% of the subsample presented more than 12 years of schooling ( $P=0.21$ ) and 51% presented family income per month between \$501 and \$1,500 ( $P=0.13$ ). The same variables were tested to identify differences between the subsample and those individuals who were excluded or did not provide sufficient responses ( $n=22$ ), but no differences were detected in age ( $P=0.27$ ), body mass index ( $P=0.14$ ), schooling ( $P=0.98$ ), or family income per month ( $P=0.98$ ).

## Validity and Reproducibility

The correlation coefficients between the QFFQ and 24-hour recall for the energy-adjusted nutrients ranged from 0.05 (total fat) to 0.57 (calcium), with acceptable accuracy for the estimates of energy, fiber, riboflavin, calcium, and phosphorus. In the reproducibility analysis, it was observed that the QFFQ had estimated most of the nutrients investigated with acceptable reproducibility. The mean for the intraclass correlation coefficients was 0.54 for the crude data and 0.50 after adjustment for energy (Table 1).

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