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Original

New technologies applied to food frequency questionnaires: a current perspective

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Abstract

The food frequency questionnaires are widely used in epidemiological researches like dietary assessment method. Traditionally, they have been self-administered in paper but the use of information and communication technologies has led to develop Internet and computerized food frequency questionnaires. It is the objective of this article to offer a global perspective of the new technologies applied to FFQ. It will be presented the purpose of the food frequency questionnaire, the number of strengths of the web-based surveys versus print-surveys and finally, a description of the manuscripts that have used web-based and computerized FFQ.

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Key words: Internet. Computers. Questionnaires. Diet surveys.

Introduction

There are different types of dietary assessment instruments like food frequency questionnaires (FFQs), 24-hour dietary recall and so on. At this moment, food frequency questionnaires are usually used in epidemiologic studies when one works with large samples sizes, thanks to their ease of administration, minimal burden to respondents and low cost. In earlier years, the usual way of administration of the FFQs has been in-person by paper. Nowadays, the progress of the information and communication technologies (ICT) has allowed using another ways of
Food Frequency Questionnaire (FFQ)

Food frequency questionnaires are designed to measure "habitual" dietary intake, over a defined period of time. At present, in epidemiologic studies dietary intake is still assessed by means of food frequency questionnaires. The primary aim in these studies is often to classify individuals into groups by estimated intake and the FFQs have the ability to assign individuals correctly by nutrient intake. The FFQ includes a defined list of foods which are sometimes grouped into categories. In general, all questionnaires present a general question (Do you eat bread?) and subjects have to respond yes or no, and if confirmed, they indicate the frequency of consumption ("how often?"). In this way, the questionnaire only provides qualitative information and they are called "non-quantitative" FFQs because they do not collect information on portion size. It is possible to obtain quantitative information by asking the quantity consumed ("How much?").

The advantages of the web-based surveys versus print-surveys

Conventional survey administration modes such as mail, in-person, telephone and central site have been practically replaced by the use of e-mail and web-based surveys. In the literature, many studies have exposed that Web-based surveys have a number of advantages over traditional mail methods. The web-based survey allows collecting data continuously, regardless of the time of day and day of week, and without geographical limitations. Furthermore, these surveys are less expensive and can be conducted in large samples. Another advantage of web-based surveys is the speed and exactness of data collection because responses from online questionnaires can be automatically stored on databases or statistical packages, saving time of data entry as well as reducing coding errors and the risk of lost data. But, they also have some disadvantages. The most cited disadvantages are sample frame and non-response bias. Another important disadvantage is that the researcher often has no way of knowing whether there is more than one respondent at one computer address, or if one respondent is completing a questionnaire from a variety of computers.

A current perspective

Some authors have worked in new technologies applied to food frequency questionnaires. In total, nine studies were selected and they were divided into two groups depend of the purpose of the study: the first group included those papers whose principal aim was validity and reproducibility of a FFQ and the second group incorporate papers whose objective was to present and describe the tool FFQ. The main characteristics, the most important results and conclusions of the studies of the first and the second group can be seen in the table I and II, respectively.

Discussion

Chronic diseases, especially cardiovascular diseases, are increasing rapidly in the western world, resulting in the inevitable rise in health expenditures. FFQs can classify individuals into groups by estimating their intake and can thus identify those who may be at nutritional risk. Recently, conventional FFQ administration modes such as mail, in-person and telephone have started to be replaced by the use of e-mail and web-based FFQ. This paper has identified studies that have developed FFQ applying new technologies showing that they can be as valid as the methods standard for certain aims and population. Moreover, self-administered web-based or computerized FFQs present more advantages than disadvantages as compared with printed-FFQs.

These reviewed manuscripts, which included participants with a wide age ranging between 16 and 72 years, show that self-administered web-based and/or computerized FFQ can be appropriate to assess dietary intake of a wide range of ages. The participants with older ages and those who had never used a computer did not have problems in completing the questionnaires. Furthermore, it is possible to develop this type of questionnaires for different target population.

The number of food items listed on reviewed FFQ ranged from 69 to 206 and they are generally classified in groups to facilitate dietary reporting. The food items were based on the common dietary habits of the study population. The participants were asked to indicate frequency of consumption, on average, for each food. Sometimes, they also had to indicate the quantity consumed to obtained semi-quantitative information. It is not easy to obtain semi-quantitative trustworthy information, we agree with authors who consider that it is necessary to include colour photographs of food items showing different portion sizes per food. The photographs can make the questionnaire more attractive, to prevent the monotony and to help the participant to select the portion size category that best fit their daily portion.

FFQs are designed to assess "habitual" intake, over a defined period of time. The time periods used
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<th>Author</th>
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| Engle et al.    | Healthful volunteers    | Long Island, New York | To assess usual dietary intake during the last three months | To evaluate the reproducibility and validity of a computer-assisted, self-administered FFQ | - 85 foods and food grouping  
- How frequently  
- Portion size  
- A general questionnaire on demographic and anthropometric characteristics | All participants completed seven-day food records once and the computer-assisted FFQ twice  
Reproducibility was good (Spearman correlation coefficient r = .76; 67% for validity; correlations between FFQ and food record was better than FFQ vs. food record. Takes about 45 minutes to administer | Calcium intake calculated by OsteoCalc was higher than calculated by the other two assessment tools. There was significant difference between OsteoCalc and HHHQ. |
| Smith et al.    | Postmenopausal women    | Alabama (United States) | To estimate calcium intake during the past year | Comparison of a personal computer-based FFQ (Osteo-Calc) with 2 other assessment tools: Calcium Score Sheet and HHHQ  
- 70 food items considered  
- Questions on frequency intake with 4 frequency ranges  
- Questions on amount of calcium consumed  
- A general questionnaire (age, weight, height...) was included | Each participant completed 3 questionnaires: OsteoCalc, Calcium Score Sheet and HHHQ  
Takes about 45 minutes to administer | Calcium intake calculated by OsteoCalc was higher than calculated by the other two assessment tools. There was significant difference between OsteoCalc and HHHQ. |
| Heatherton et al.| Female students from a  | Dundon (New Zealand)  | To estimate the intake of total, non-hormone, and meat items as well as dietary components which influence bone metabolism (vimentin C, phytate, calcium, milkfat, poultry, tofu, and coffee) during the past month | To evaluate the validity and reliability of the FFQ in relation to bone mineral density and calcium intake | - 206 food items were chosen for frequencies  
- Questions on frequency of consumption for that meal  
- Questions to describe the serving size | All participants completed 10-day and weighed diet records,  
FFQ was completed by 22 participants a second time  
There was significant difference in the intake of vitamin C, meat, milkfat, and phytate from the FFQ and OsteoCalc. It was higher than the other two assessment tools. Participants did not have trouble completing the questionnaire. Takes about 20 to 30 minutes to administer | 

**Table I** Summary of selected studies on applying new technologies in FFQs (Group I)
in the selected studies were the previous year, previous three months and the previous month. In the literature there are other studies that have used other periods of time like the previous six. It is not prudent to use a very short period of time, for example, the previous day because it has the disadvantage of not capturing the seasonal variation of foods available. For the other hand, when a longer period of time is used, participants have more difficult to remember their dietary intake.

The principal aim of these studies was to evaluate validity and the reproducibility by means of a test-retest design. Although the validity is estimated by comparison with food records, 24-hour recalls and diet history, some authors like Engle and Cade are agreeing on there is no accepted “gold standard” for assessing dietary individual intake by which to judge the validity of other methods.

FFQs are the dietary assessment method most used in epidemiologic research. For this type of research it would be very important to have a set of web-based and computerized FFQs, among which there could select those more adapted to every research. This would suppose an important saving of time and money because web-based or computerized FFQs present more advantages than printed FFQs. But there are not many studies about the applications of ICT in FFQ, for this reason, it is necessary to develop new computerized and web-based FFQs and to improve the FFQs already developed to be able to obtain more and better information.

As result of this work, at the Polytechnic University of Valencia was started the development of a new self-administered semi-quantitative Internet-FFQ to assess total daily dietary intake among university students.

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References