

Original

Design of a self-administered online food frequency questionnaire (FFQ) to assess dietary intake among university population

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Abstract

Objective: To introduce and describe a new tool called UPV-FFQ to evaluate dietary intake of the university population. The new tool consists principally in a self-administered online food frequency questionnaire (FFQ).

Materials and methods: The tool UPV-FFQ has been developed by means of web pages applying the technology ASP.NET 2.0 and using the database SQL Server 2005 as support. To develop the FFQ has been used as model the paper and pencil FFQ called "Dieta, salud y antropometría en la población universitaria".

Results: The tool has three parts: (1) a homepage, (2) a general questionnaire and (3) a FFQ. The FFQ has a closed list of 84 food items commonly consumed in Valencia region. The respondents has to indicate the food items that they consume (2 possible options), the frequency of consumption (9 response options) and the quantity consumed (7 response options). The UPV-FFQ has approximately 250 color photographs that represents to three portion sizes. The photographs are useful to help the respondents to choose the portion sizes that more adjusts to their habitual portions. The new tool provides quantitative information of the habitual intake of 31 nutritional parameters and provides qualitative information of the general questionnaire. A pilot study was done for a total of 57 respondents. The media time spend to fill in was 15 minutes.

Conclusions: The pilot study concluded that the questionnaire was ease-of-use, low cost and time-effectiveness questionnaire. The format and the sequence of the questions were easily understood.

(Nutr Hosp. 2011;26:1451-1457)

DOI:10.3305/nh.2011.26.6.????

Key words: Dietary habits. Food frequency. Questionnaire. University population.

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Recibido: 3-V-2011.
 1.ª Revisión: 30-VI-2011.
 Aceptado: 12-VII-2011.

DISEÑO DE UN CUESTIONARIO DE FRECUENCIA DE CONSUMO DE ALIMENTOS AUTOADMINISTRADO ONLINE PARA EVALUAR LA INGESTA DIETÉTICA DE LA POBLACIÓN UNIVERSITARIA

Resumen

Objetivo: Introducir y describir una nueva herramienta llamada UPV-FFQ para evaluar la ingesta dietética de la población universitaria. Esta nueva herramienta consiste principalmente en un cuestionario de frecuencia de consumo de alimentos (CFCA) autoadministrado online.

Materiales y métodos: La herramienta UPV-FFQ se ha desarrollado a través de páginas web aplicando la tecnología ASP.NET 2.0 y usando la base de datos SQL Server 2005 como soporte. Para desarrollar este FFQ se ha empleado como modelo el cuestionario en papel llamado "Dieta, salud y antropometría en la población universitaria".

Resultados: La herramienta consta de tres partes: 1) una página de introducción; 2) un cuestionario general y 3) un CFCA. El CFCA consta de una lista cerrada de 84 alimentos comúnmente consumidos en la región valenciana. Los encuestados deben indicar qué alimentos consumen (2 posibles opciones de respuesta), la frecuencia de ingesta (9 opciones de respuesta) y la cantidad ingerida (7 opciones de respuesta). El UPV-FFQ presenta aproximadamente 250 fotografías a color con tamaños de ración para cada alimento para ayudar a los encuestados a escoger el tamaño de ración que más se ajusta a su porción habitual. La herramienta proporciona información cuantitativa de la ingesta habitual de 31 parámetros nutricionales y también proporciona información cualitativa proveniente del cuestionario general. Se realizó un estudio piloto con un total de 57 participantes con características similares a la población de estudio. El tiempo medio que emplearon para rellenarlo fue de 15 minutos.

Conclusiones: El estudio piloto concluyó que el UPV-FFQ era fácil de manejar, de bajo coste y de gran eficacia. Además, entendieron fácilmente el formato y la secuencia de las preguntas.

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Palabras clave: Hábitos dietéticos. Cuestionario de frecuencia de consumo de alimentos. Población universitaria.

Abbreviations

- CDV: Cardiovascular diseases.
 CFCA: Cuestionario de frecuencia de consumo de alimentos.
 FFQ: Food frequency questionnaire.
 IIAD: Instituto de Ingeniería de Alimentos para el Desarrollo.
 ITACA: Instituto Universitario de Aplicaciones de las Tecnologías y de la Información.
 SQL: Estructure query language.
 TIC: Tecnologías de la Información y la Comunicación.
 UPV: Universitat Politècnica de València.
 WHO: World Health Organization.

Introduction

The relationship between the diet and the health has been showed in many studies. Numerous researchers have studied the beneficial effects of a healthy diet. The World Health Organization (WHO) in one article stated that there is convincing evidence that the risk of suffering diabetes and obesity decreases with increased fruit and vegetable consumption.^{1,2} Many studies have documented the relationship between an unhealthy diet and the main chronic diseases, such as cardiovascular diseases (CVD) and diabetes, in industrialized countries. For example, the high intake of total and saturated fat is one of the most important dietary risk factors associated with a great number of chronic diseases³⁻⁶ and has a high prevalence in Western countries.⁵⁻⁹ These diseases are increasing very fast. It is necessary to develop policies of prevention, nutritional education and communication for the prevention of these chronic diseases. To design an effective campaign of prevention, it is first essential to assess the dietary intake of the population by means of the different types of dietary assessment instruments as diet records, 24-hour dietary recall, food frequency questionnaires (FFQs), and diet histories. FFQs have become a common way to measure usual dietary intake in epidemiological studies when one works with large samples sizes. They are low cost, less burden on subjects and ease-of-use.¹⁰⁻¹⁴ However, these advantages can be increased replacing the conventional administration modes such as paper and pencil by the use of Internet surveys. In the literature, many studies have exposed that Internet surveys have a number of advantages over traditional administration methods.¹⁵⁻²⁰ The Internet 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 Internet surveys is the speed and accuracy of data collection because responses from online questionnaires can be automatically stored on databases or statistical pack-

ages, saving time of data entry as well as reducing coding errors and the risk of lost data.²⁰⁻²⁴

In light of these considerations, a new self-administered online FFQ called UPV-FFQ was designed. The purpose of the UPV-FFQ is estimate dietary intakes over the previous year among university students of the Universitat Politècnica de València (UPV) (Comunidad Valenciana, Spain). This paper describes the development of this new tool and how it may be used.

Materials and methods

Development of the UPV-FFQ

A new self-administered semi-quantitative online FFQ called UPV-FFQ was created by the help of the Instituto Universitario de Aplicaciones de las Tecnologías de la Información (ITACA) from Valencia. The main technical goals for develop a FFQ are the following: to be easily accessible to a lot of people at the same time and in different places (by mean of Internet), to have configurable nutritional data and the possibility of changing the number of questions and his sequence. Based in this goals the system has an architecture based in a web portal developed with ASP.NET 2.0 in C# language, that technology is well known, with high stability and computational capacities. The system uses a relational database supported by a SQL Server 2005 that provides high store capacity and quick access to multiple users at the same time. All this technologies are installed on a Windows Server 2008 R2 and uses Internet Information Server 7 to publish the portal over Internet.

The UPV-FFQ collects information of the total daily diet over the preceding 12 months in the UPV university population. The UPV-FFQ is an online version of the existing validated paper and pencil FFQ called "Dieta, salud y antropometría en la población universitaria" developed by Dr. Jesús Vioque to estimate daily dietary intake among the university population of the Universidad Miguel Hernández de Elche (Alicante, Spain). This questionnaire is based on a reference period of the past year to capture the seasonal variation of foods available. The food list was on the basis of the common dietary habits of the Valencian region for this reason it was not necessary to modify the food list because both are geographically and culturally similar regions. The number of food items listed was 84 and they were classified into six groups to facilitate dietary reporting: dairy products (Group I); eggs, meat and fish (Group II); vegetables, legumes and fruits (Group III); bread, cereals and similar (Group IV); oils, fats and sweets (Group V); beverages and precooked (Group VI). The number of food items used in the present study was not increased beyond 130 foods. A questionnaire with more items may result in the subjects experiencing boredom, which may then impair accuracy of the answer.^{13,25}

For each food item, participants were asked to report their consumption frequency and portion size. Nine fre-

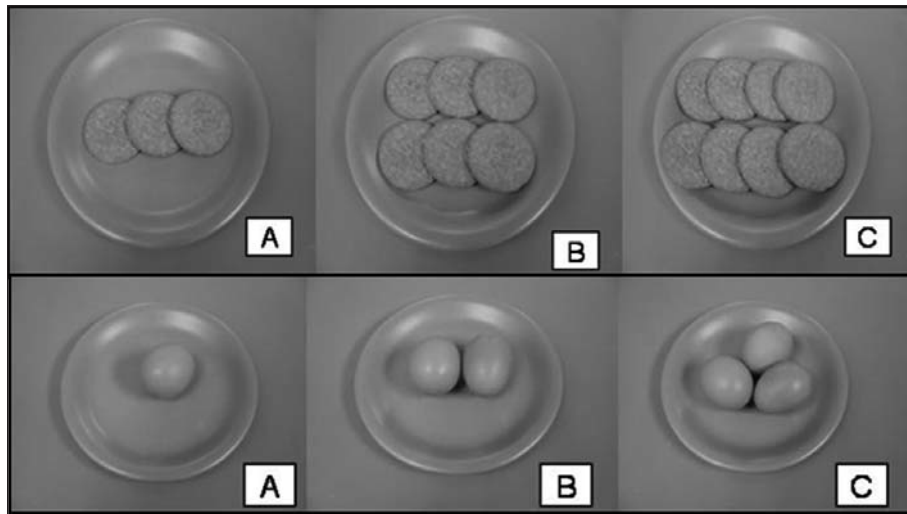


Fig. 1.—Photographs of the on-line UPV-FFQ.

quency responses options were given: none or once/month, 1-3 times/month, once/week, 2-4 times/week, 5-6 times/week, daily, 2-3 times/day, 4-5 times/day, and > 6 times/day. To obtain quantitative data three portion sizes per food item were photographed (small (A); medium (B); big (C)) and were presented in one colour photograph (fig. 1). Approximately, 250 photographs were displayed in the online FFQ. Participants had to choose their usual serving size between seven possible options of response: “a lesser quantity than in photo A”, “an equal quantity to in photo A”, “a quantity between photo A and B”, “an equal quantity to that in photo B”, “a quantity between photo B and C”, “an equal quantity to that in photo C”, “a greater quantity than in photo C”.

During the development phase, a pilot study was conducted to test for the comprehension and ease-of-use. Members from ITACA and Instituto de Ingeniería de Alimentos para el Desarrollo (IIAD) were invited via e-

mail to participate in the pilot study. A sample of 57 participants completed the online FFQ in a time of 15 minutes. This sample had an age between 20 to 35 years and had a similar education level and computer experience. Furthermore, it was recruited maintaining the same characteristics that the target population of the present study. The participants had to fill in the questionnaire and they could write all their suggestions and opinions. None of the participants reported difficulty with computer data entry and they describe that the questionnaire was very trouble-free and with a good comprehension.

Design of the UPV-FFQ

The UPV-FFQ has three principles parts: the home-page screen, general questionnaire screen and the FFQ itself.

Dieta, salud y antropometría en población universitaria.

El objetivo de esta encuesta es conocer los hábitos alimentarios y estilos de vida relacionados con antropometría y salud, así como determinar la utilidad de estos cuestionarios para estimar la ingesta dietética de forma auto-cumplimentada y por ordenador. Por ello, te rogamos poner la máxima atención a las instrucciones al completar tus respuestas. La información contenida en esta encuesta está sujeta a las leyes de protección de datos y del secreto estadístico. No será publicada ni cedida a nadie. Será utilizada sólo para los propósitos establecidos en este estudio. Esta encuesta es similar a la utilizada en otros estudios sobre la dieta, como la Encuesta de Nutrición de la Comunidad Valenciana. Agradecemos tu colaboración.

Correo electrónico: [REALIZAR CUESTIONARIO](#)

El cuestionario es totalmente anónimo, se solicita la dirección de correo para futuros accesos y para el envío de información.

Fig. 2.—First part of the UPV-FFQ: homepage.



Actividad física y ejercicio habitual:

¿Cuántas horas ve la televisión a la semana?

 horas

¿Cuántas horas al día sueles dormir, incluida la siesta?

 horas

¿Cuántos minutos de siesta sueles dormir al día?

 min

En tu actividad u ocupación principal estas ...

Casi siempre sentado.

Sentado la mitad del tiempo.

Casi siempre de pie, quieto.

Casi siempre caminando, levantando y llevando pocas cosas.

Casi siempre caminando, levantando y llevando muchas cosas.

Trabajo manual pesado.

¿Cuánto tiempo caminas o haces bicicleta al día?

Casi nunca.

Menos de 20 minutos al día.

De 20 a 40 minutos al día.

De 40 a 60 minutos al día.

Entre 1 y 1 hora y media al día.

Más de 1 hora y media al día.

Fig. 3.—Second part of the UPV-FFQ: general questionnaire.

The homepage screen

The homepage of the online FFQ contained information about data security and privacy and included a brief explication about the aim of the study. The participants obligatorily had to introduce his email address for future accesses and for the sending of information (fig. 2).

General questionnaire screen

The FFQ itself was preceded by a general questionnaire (fig. 3). This general questionnaire consisted of three topics: corporal perception (3 items), habits (5 items), and physical activity (9 items). The participants also indicated gender, age, weight (self-reported), height (self-reported), among others. The tool was programmed to require participants to answer all questions, if not they could not go on to the following screen.

FFQ itself

In this part, for every food group there is a screen to know if the participants consume some food inside this group (fig. 4a). Furthermore, there are 3 different screens for each food item. The first screen is a general question to know if the participants consume this food in particular (fig. 4b). The second one is about the frequency of consumption (fig. 4c). The third screen is about the portion size (fig. 4d). Each screen contained a box with information to help the participants to complete the questionnaire. Specifically, there are examples to calculate the frequency (x.e: a fruit available 6 months a year, which was eaten 'three times per week'

in season was converted to a frequency of 78 times yearly, in others words, 1.6 times weekly). Also, there is a headline with different colors that indicates the food group where participant is in this moment. Participants have an "Exit" button to leave of the questionnaire when they wanted and they continued for the same question when they entered again.

How is it used?

Figure 5 shows a flow chart explaining the use of the FFQ. The questionnaire begins with the Group I and successively continues with the other groups. The questionnaire asks a question to find out if the respondent eats any food contained within the Group I (do consume dairy products?). Two response options are given: "yes" or "no". If the answer is negative, the program sends him to the following food group (in this example, it would be the Group II); but if he confirms, a question is formulated to find out which specific food item inside the Group I is consumed by the respondent. The first food item inside the Group I is the full-cream milk (do you consume full-cream milk?). Again, two response options are given: "yes" or "no". If the answer is negative, the program moves you to the next food of the list (inside the same group). If the answer is affirmative, the respondent on the following screen indicates the consumption frequency of this food during the last year and has to choose one of the nine frequencies ranging from "never or < 1 month" to "6+ a day". On the following screen, the respondent has to answer to the question on the consumed quantity. He has to choose between three color photographs (A-C) that represents to three portion sizes per food: small, medium and big, respectively.

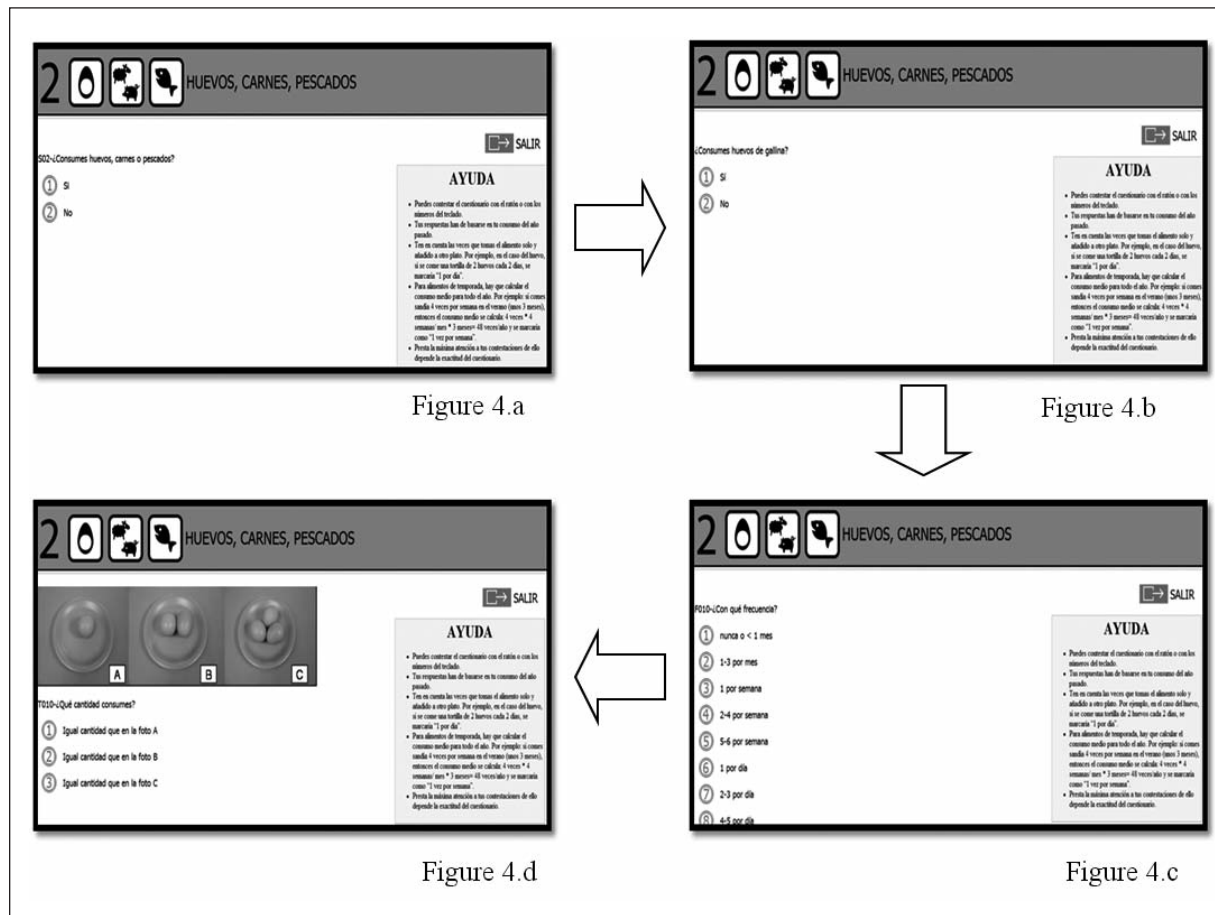


Fig. 4.—Third part of the UPV-FFQ: the FFQ. a) Screen to know if the participants consume some food inside this group; b) a general question to know if the participants consume this food in particular; c) the frequency of consumption; d) the portion size.

Nutrients conversion

Every time that one questionnaire is answered by one person the system computes the nutritional algorithm based on the base nutritional information and the answers, finally it stores the results in the database. These results can be exported through the same system for authorized personal to a Comma Separated Values (.csv) file and they also can be easily imported to statistical programs.

The answers obtained in the FFQ about the number of times that every food item was consumed (none or once/month, 1-3 times/month, once/week, 2-4 times/week,...) were transformed in number of times that were consumed a day. The frequency of consumption was multiplied by its serving weight. Finally, the total energy and the other nutrients were calculated by applying a table of composition of foods that contains the nutritional value of every food items of the list. This composition table was elaborated by means of the GEA program.

The UPV-FFQ converted automatically responses to nutrient intake. For each participant, the system provides the following dietetics variables per day: water

(ml), total energy (kcal), protein (g), total fat (g), total carbohydrate (g), dietary fibre (g), calcium (mg), iron (mg), iodine (mg), magnesium (mg), zinc (mg), sodium (mg), potassium (mg), vitamin B1 (mg), vitamin B2 (mg), niacin (mg), vitamin B6 (mg), folic acid (μg), vitamin B12 (μg), vitamin C (mg), vitamin A (μg), retinol (μg), carotenes (μg), vitamin D (μg), vitamin E(mg), fatty acids (saturated (g), monounsaturated (g), polyunsaturated (g), cholesterol (mg), phosphorous (mg), selenium (μg), alcohol(g), cis (g) y trans (g). The FFQ also provides the responses of the general questionnaire (corporal perception, habits and physical activity).

Discussion

In the current study, an online FFQ was developed to estimate daily dietary intakes in the UPV university population.

The online FFQ covered the time period of the preceding 12 months. Other authors have also used this time frame to estimate dietary intake.²⁵⁻²⁷ The long time is useful to capture the seasonal variation of foods



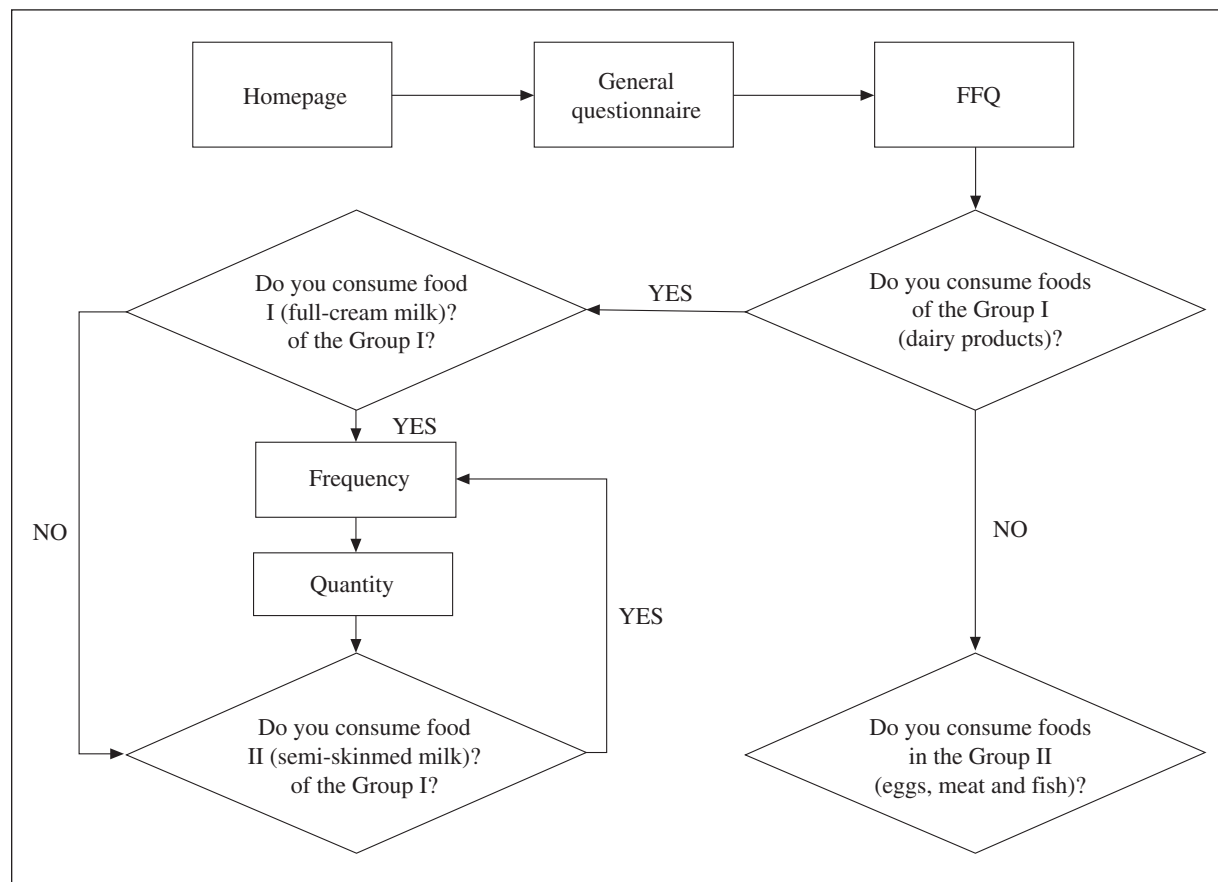


Fig. 5.—Flow chart explaining the use of the FFQ.

available and it can to magnify the memory problems, and it is probable that dietary habits of a shorter period can report.

Different authors have concluded that the choice of portion size is a difficult task. For this reason, the tool included discrete portion questions supported by approximately 250 photographs that help the participant to indicate the best fit portion size category. Furthermore, the inclusion of photographs helps to prevent the monotony because the questionnaire is more attractive.

The pilot study concluded that the questionnaire was easily administrable and it was completed in approximately 15 minutes. Moreover, it indicated that the target audience understood and the concepts were identified correctly.

This UPV-FFQ has some limitations to consider. First, this FFQ only can be useful in this specific population group (university population) and in this specific geographical area (Valencian region). If another target population is studied or in another geographical area, it would be necessary to adapt the food list and to do another pilot study. Second, the questions about frequency and portion size were closed and furthermore a predefined food list was used, consequently, some information about the foods actually eaten may be missed.

Additional work is need to study the validity and reproducibility of the UPV-FFQ, and so, they are currently being assessed.

Acknowledgements

González-Carrascosa, R. has a predoctoral scholarship of the Generalitat Valenciana (Spain).

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