DEVELOPMENT AND VALIDATION OF A FOOD FREQUENCY QUESTIONNAIRE TO ASSESS COCOA CONSUMPTION IN UNIVERSITY STUDENTS

e-mail: franciscoperez@ub.edu

Filipa Vicente[1,2], Sandra Saldaña-Ruíz[1], Manel Rabanal[1], María J Rodríguez-Lagunas[1,3], Paula Pereira[2], Francisco J. Pérez-Cano[1,3] and Margarida Castell[1,3]

[1] Departament de Fisiologia, Facultat de Farmàcia, Universitat de Barcelona, 08028, Barcelona, Spain
[2] Instituto Superior de Ciências da Saúde Egas Moniz, Egas Moniz Cooperativa de Ensino Superior, Quinta da Granja - Campus Universitário, Portugal
[3] Institut de Recerca en Nutrició i Seguretat Alimentària, Universitat de Barcelona (INSA-UB); 08028, Spain, Barcelona.

Introduction

Cocoa has been recognized as a valuable source of polyphenols[1,2], however epidemiological studies have shown a lower contribution of cocoa products [3,4]. These results could be due to the fact that the most commonly used Food Frequency Questionnaires (FFQ) poorly distinguishes cocoa and chocolate products, and then its contribution may be underestimated. In spite there are several studies concerning polyphenol consumption, data do not point out cocoa and cocoa products as relevant sources which could be due to the scarce distinction between cocoa and chocolate products [5,6]. Additionally there is no known data about cocoa consumption within students who are potential high consumers.

Considering this, **the aim of this study was to validate a food frequency questionnaire to assess cocoa consumption (C-FFQ) in a population of university students.**

Marterial and Methods

Sample

A group of 50 university students (Table 1) has been recruited from several health science graduation and post-graduation programmes in the Faculty of Pharmacy at the University of Barcelona. The study was previously approved by the Ethical Committee of the University of Barcelona and has been conducted according to the guidelines laid down in the Declaration of Helsinki. Written informed consent from all students was obtained after the objectives and procedures have been presented.

Procedure

Students have filled an specifically designed FFQ (Figure 1) based on ENCAT-2003[7], a 24 Hours Dietary recall and a validated questionnaire used as a gold standard, the "EFSA Gathering consumption data on specific consumer groups of energy drinks – Adults 18-65" [8].

Data management and Statistical analysis

The frequency of consumption obtained from C-FFQ and EFSA-Q has been converted to times daily. Data from both questionnaires have been compared as well as with 24HDR.

The agreement between C-FFQ with EFSA-Q and 24HDR has been evaluated with Bland Altman analysis. Spearman correlations test has also been conducted as well as the Wilcoxon test. The participants were classified in quintiles and proportions of subjects classified in the same, adjacent or grossly classified have been derived. Results were considered statistically significant at a two-tailed α level of 0.05. Statistical analysis was performed using PASW Statistics version 18.

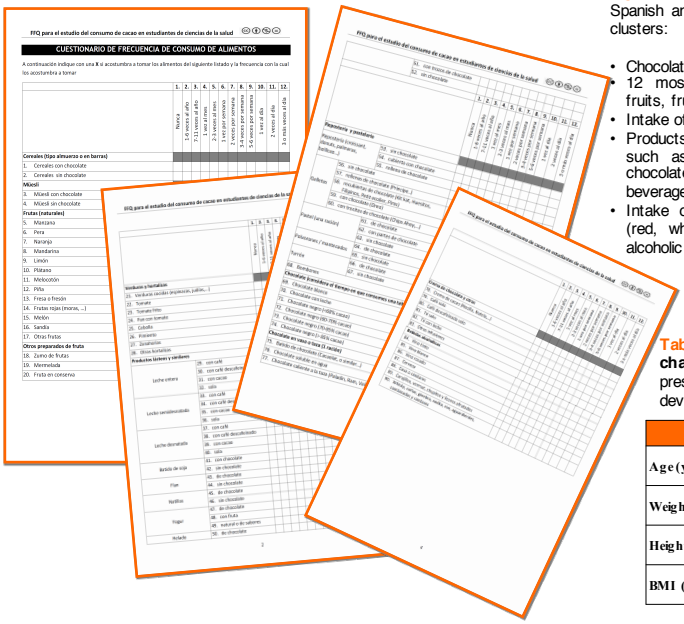

Figure 1 – The C-FFQ was written in Spanish and included **90 food items** with clusters:

- Chocolate with cereals
- 12 most commonly consumed fresh fruits, fruit juices, jam and canned fruit.
- Intake of vegetables
- Products that can contain chocolate, such as dairy, confectionery, kind of chocolate bars, cocoa/chocolate beverages and spreads.
- Intake of coffee, tea, infusions, wine (red, white or rosé), beer and other alcoholic beverages.

Table 1 – Sample demographic characteristics. Data are presented as average ± standard deviation as well as range.

N	50
Age (y)	24.10 ± 3.29 [20–31]
Weight (kg)	59.68 ± 8.70 [41–80]
Height (m)	1.67 ± 0.07 [1.48–1.80]
BMI (kg/m^2)	21.42 ± 2.27 [17.69–27.68]

Results

	C-FFQ	EFSA-Q	24HDR
Hot chocolate	0.0142 ± 0.0175	0.0464*± 0.0965	0.0000 ± 0.0000
Chocolate snacks	0.3228 ± 0.2678	0.1429*± 0.1384	0.3200 ± 0.6207
Chocolate Bars	0.1459 ± 0.1341	0.1000*± 0.1127	0.0450*± 0.0991
White	0.0134 ± 0.0259	0.0000 ± 0.000	0.0000 ± 0.000
Milk	0.0513 ± 0.0785	0.0571 ± 0.1041	0.0330*± 0.0818
Dark	0.0826 ± 0.1051	0.0429*± 0.0829	0.0120*± 0.0627
Other products	1.3801 ± 1.5036		0.7600*± 1.0606
Dairy	0.6211 ± 1.1300		0.3800*± 0.7796
Pastry	0.2849 ± 0.3430		0.0800*± 0.2740
Desserts	0.1564 ± 0.2930		0.0600*± 0.2399
Cereals	0.2077 ± 0.3821		0.1404*± 0.3981
Spreads	0.0990 ± 0.1871		0.0800*± 0.2740
Total w/o others	0.4829 ± 0.2898	0.2893*± 0.2333	0.3650 ± 0.6279
Total with others	1.8635 ± 1.6075	Not applicable	1.1250 ± 1.1533

Table 2 – Consumption frequency of a portion (times/day) of coffee and tea estimated by the C-FFQ, EFSA-Q and 24HDR (mean values and standard deviations).

	C-FFQ vs EFSA-Q		C-FFQ vs 24HDR	
	Spearman's coefficient (ρ)	p	Spearman's coefficient (ρ)	p
Hot Chocolate	0.341	0.015	n.d.*	
Chocolate snacks	0.479	0.000	0.320	0.023
Chocolate bars	0.330	0.019	0.279	0.050
Milk	0.429	0.002	0.358	0.011
Dark	0.569	0.000	0.330	0.017
Other			0.447	0.001
Dairy			0.666	0.000
Pastry			0.216	0.132
Desserts			0.118	0.416
Cereals			0.192	0.182
Spreads			0.228	0.112

Table 3 – Correlations between the consumption chocolate-derived products (times/day) from the C-FFQ with that obtained from the EFSA-Q and the 24HDR.

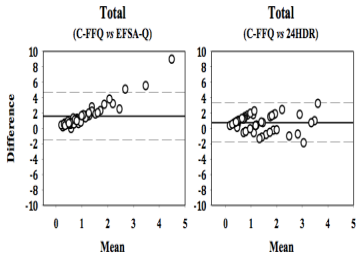

Figure 2 - Bland-Altman Plots for the daily intake frequency estimated by either C-FFQ and EFSA-Q or C-FFQ and 24HDR. Solid lines are the mean difference and dashed lines are lower and upper 95% limits of agreement.

Consumption frequency was differently estimated by the different approaches, although almost half of the sample was classified as high consumer for chocolate bars (42%, eating at least one chocolate bar -100 g- per week (Table 2). Correlations between C-FFQ with the EFSA-Q and with the 24HDR and the data from the quintiles classification show some particular distribution of population in each method (Table 3 and 4). Bland Altman analysis suggest better correlation of C-FFQ with the EFSA-Q than with the 24HDR (Figure 2)

	C-FFQ vs EFSA-Q			C.FFQ vs 24HDR		
	Same quintile	Adjacent quintile	Grossly classified	Same quintile	Adjacent quintile	Grossly classified
Hot chocolate	16 (32%)	21 (42%)	13 (26%)		n.d.	
Chocolate snacks	11 (22%)	22 (44%)	17 (34%)	11 (22%)	16 (32%)	23 (46%)
Chocolate bars	11 (22%)	23 (46%)	16 (32%)	16 (32%)	19 (38%)	15 (30%)
• **White**		n.d.*			n.d.**	
• **Milk**	11 (22%)	23 (46%)	16 (32%)	15 (30%)	21 (42%)	14 (28%)
• **Dark**	20 (40%)	18 (36%)	12 (24%)	16 (32%)	15 (30%)	19 (38%)
Others:				11 (22%)	20 (40%)	19 (38%)
• **Dairy**				21 (42%)	16 (32%)	13 (26%)
• **Desserts**				11 (22%)	15 (30%)	24 (48%)
• **Pastries**				11 (22%)	16 (32%)	23 (46%)
• **Spreads**				12 (24%)	15 (30%)	23 (46%)
• **Cereals**				16 (32%)	12 (24%)	22 (44%)
Total with others	20 (40%)	21 (42%)	9 (18%)	15 (30%)	22 (44%)	13 (26%)
Total without others	20 (40%)	21 (42%)	9 (18%)	11 (22%)	18 (36%)	21 (42%)

Table 4 – Classification of individuals regarding their consumption frequency for each of the foods considered of interest in the C-FFQ in three categories: high consumers, low consumers and non-consumers

Conclusions

In the present study, we assessed the validity of a 90-item FFQ designed for the precise evaluation of cocoa and chocolate products consumption (C-FFQ) through comparison to an EFSA-validated FFQ (EFSA-Q) and to a 24-hours dietary recall (24HDR). The results obtained show that this FFQ is able to provide precise data of frequency consumption for total and particular common cocoa products. Moreover, distribution of participants according to their consumption frequency by these three methods is quite similar as reflected by a low misclassification among methods.

Bibliography

[1] *Oxid. Med. Cell. Longev.* **2012**, *2012*, 906252
[2] *J. Chem.* **2013**, *2013*, 1–7
[3] *J. Nutr.* **2008**, *138*, 562–566.
[4] *Br. J. Nutr.* **2011**, *106*, 1090–1099
[5] *Nutr. Hosp.* **2008**, *23*, 242–252
[6] *Nutrition* **2014**, *30*, 236–239
[7] *Rev Esp Salud Publica* **2007**, *81*, 559–570
[8] *Eur. Food Saf. Authority. Support. Publ.* **2013**, *EN-394*, 1–190

Acknowledgments: We thank Eulàlia Roure and Jaume Serra from the "Servei Educació Sanitària i Programes de Salut" in the "Generalitat de Catalunya" for their assistance in the development of the FFQ. The study was supported by AGL2011-24279.