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REPRODUCIBILITY OF A DESIGNED SEMI-QUATITATIVE FOOD FREQUENCY QUESTIONAIRE IN GENERAL POPULATIONS IN THE NORTH VIETNAM

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Abstract

Objectives: To examine a reproducibility of a semi-quantitative food frequency questionnaire (SQFFQ) in general populations in the North Viet Nam in 2017. Methods: A Cross-sectional survey using methods of 24-hour recall records of food intake (24-FR, the reference group) in 300 households of three commune general populations that have 1,334 persons. SQFFQ was tested for 600 participants which found 310 participants eligible in linking with persons of 300 households. The R^2, which was used to compare the energy and estimated nutrients obtained by both methods, was calculated before and after adjustment for total energy intake, age and sex, performed in STATA 10. Results: For macro

[5*]Corresponding author. **Key words:** SQFFQ, validation, general populations, Viet Nam.

nutrients intake estimated by two methods of 24-FR and SQFFQ, the intake amounts consisted of energy (kcalo, 1934.5 versus 1901.4); protid (gram, 87.8 versus 81.4); lipid (gram, 43.5 versus 41.7); and glucid (gram, 295.5 versus 294.5). there is a small correlation for lipid (adjusted R^2= 0.20); a moderate correlation for protid (adjusted R^2= 0.38) and glucid (adjusted R^2= 0.36), a strong correlation for energy (adjusted R^2= 0.53). Conclusions: The designed SQFFQ was being validated having good characteristics of feasibility, practical and reliability in the general populations located in the North Viet Nam.

Background

Characteristics of data collection tool of epidemiological studies have ability to reproduce but also have a considerate sensitivity, thus a specific study is essentially required [6]. To address the association between diet and cancer, a semi-quantitative food frequency questionnaire, (SQFFQ) has been designed and used to collect data [8]. The reproducibility of SQFFQ has been validated in the United States [3] and in Japan [8]. The designed SQFFQ has also been repeatedly used for a periodic every 4-year from 1976 to date to collect data of dietary habits of study participants [4].

Applying the methods of developing SQFFQ of the Japanese [7, 8] and the U.S. at the Harvard T.H. Chan School of Public Health [3, 12], the SQFFQ was developed in general populations located in the Red River Delta in the Northern Viet Nam. In brief, the development of database of nutritional status of 300 households by 24-hour recall records of food intake was completed. Then based on a contribution of major nutrients up to cumulative 90%, food items were selected. Average amount intake and standard deviation was estimated for each selected food item. Number of food items were selected respectively for beer and liquor (3); fat and oil (2); a polished rice (1); cereal and products (6); nuts and seeds (4); vegetables (15), fruits (14), meat (13); seafood (13), condiments and sauces (5); milk and eggs (6); dried fishes, sausage, spring-roll (3). In total, there were 85 food items included in the SQFFQ. Food frequency intake was designed to collect dietary habits during the last year, included 7 levels of frequency, such as seldom or never intake, 6-11 times/year, 1-3 times/month, 1-2 times/week, 3-4 times/week, 5-6 times/week, and 1-3 times/day.

Objective: To examine a reproducibility of the SQFFQ in general populations in the North of Viet Nam in 2017.

I. Methods

1. Design

A Cross-sectional survey using 24-hour recall records of food intake (24-FR, the reference group) and SQFFQ (being tested) were applied [3, 8, 12]. Study sites were at 3 communes represented 3 provinces located in the Red River Delta in the North Viet Nam, named Hung Yen, Ha Nam, Bac Ninh (in proximity to the Hanoi city). Study time was in the 4th quarter of 2017. Sample size was calculated using STATA 10. Referred to the result of the latest Viet Nam National Nutritional Survey in 2009-2010, the estimated energy intake (mean±S.D) was 1925 kcalo±587 [1]. Assume: a=0,05 (two sides); a=0,90; m1=2005 kcalo, m2=1845 kcalo; sd1=617, kcalo; sd2=557 kcalo; n1/n2=1; 24-FR completed 1 time, completed SQFFQ was 1 time; the desired R^2 = 0.50. The STATA statement command of sampsi 2005 1845, sd1(617) sd2(557) method(change) pre(1) post(1) r1(.5), the required samples were 284 study participants.

2. Conducted 24-hour recall records of food intake

A household survey of 24-hour recall records of food intake was conducted in 3 consecutive weekdays for 300 households in Hung Yen, Ha Nam and Bac Ninh province by using the designed questionnaire from the National Nutrition Institute and its guidelines in combination with in person interview at participants house by the trained interviewers. All households members were registered for their breakfast (main=1/addition=2); lunch (main=3/addition=4); dinner (main=5/addition=6); places of intake could be at home or outside. A ration was weighted by age and sex for each family member, then sum up for total rations daily and for three days.

Every food item in each meal was registered its weight(gram), then converted into a clean-raw weight(gram). All clean-raw food items were converted into 86 nutrients for every household, for one single day and for three days in average. Total amount intake of each nutrient of each household was divided to number of rations to obtain an average intake of nutrients per person per day (one ration). The participants of 300 households consumed 257 food items during three days. After excluded one household having incomplete survey, total eligible 299 households with 1,334 persons had successfully completed 24-hour recall records of food intake. During the three days, 3,989 person-day were registered and the number of rations was 3,417. We excluded 278.0 rations that had breakfast or lunch or dinner outside of their home. The remaining is 3,138 rations that had breakfast, and lunch and dinner at their home.

3. Conducted a nutritional survey using the designed SQFFQ

After completion of the household survey of 24-hour recall records of food

intake for 3 consecutive weekdays, we conducted a nutritional survey using the designed SQFFQ by in person interview at participants households by the trained interviewers. The study participants comprised 600 persons recruited from 3 communes represented 3 provinces Hung Yen, Ha Nam, and Bac Ninh (located around the Hanoi city). The SQFFQ inquired dietary habits during one previous year (for one year) for 85 foods/recipes and frequency in 7 categories: seldom or never intake, 6-11 times/year, 1-3 times/month, 1-2 times/week, 3-4 times/week, 5-6 times/week, and 1-3 times/day. Nutrients intake per person per day were estimated by the following formulation, which based on the Vietnamese food composition table, version 2007.

$$n = f^* n_a^* (w/100)^* k/365$$

Where f was frequency intake during last year; na was amount of nutrient per 100 gram; w was average weight intake for one time; k was weighted size of intake (small=0.8, medium=1.0, large=1.2).

4. Linked participants ID of two studies

We linked persons who completed the SQFFQ with persons who participated in the 24-hour recall records of food intake. Inclusion criteria was persons had fully participated three meals, that was breakfast (main=1/addition=2); lunch (main=3/addition=4); and dinner (main=5/addition=6) at their home. As the result, 310 participants were included in the final model of data analysis.

5. Data analysis

The food intake registered by the 24-hour recall records of food intake and the SQFFQ were converted into energy and 85 nutrients (based on the Vietnamese food composition table version 2007) The R^2, which compared the energy and nutrient values obtained by both methods, was calculated before and after adjustment for total energy intake, age and sex, performed in STATA 10. The absolute value of R^2 indicating the strength of relationship was grouped as following labels: $0- < 0.1$: none or very weak relationship, $0.1 - |R^2| < 0.25$: weak relationship; $0.25 - |R^2| < 0.5$: moderate relationship; $|R^2| = / > 0.5$: strong relationship [5]. Due to lack of data in the Vietnamese food composition table, version 2007, we did not estimate the correlation R^2 when the estimated amount of nutrients was to be one unit or lower.

II. Results

The study comprised 310 participants (men 153, women 157), who completed both 24-hour recall records (24-FR) of food intake and SQFFQ. Men and women combined for age, the youngest was 12 and the oldest was 81; a mean age was 47.6. For body high (cm), the lowest was 145 and the highest was 182,

an average was 160.5. For body weight (kg), the lowest was 35, highest was 85, an average was 55.4 which illustrated in the Table 1.

Table 1. Characteristics of study participants

Variable	n	Mean	S.D.	Min	0.25	Mdn	0.75	Max
age	306	47.6	13.8	12.0	36.0	47.5	58.0	81.0
high	307	160.5	7.1	145.0	155.0	160.0	165.0	182.0
weight	307	55.4	7.8	35.0	50.0	55.0	60.0	85.0

Note: there were un-known data of age of four participants and high and weight of three participants; S.D.: Standard deviation; Min: Minimum; Mdn: median; Max: Maximum.

For macro nutrients intake estimated in two methods of 24-FR and SQFFQ, the amounts consisted of energy (kcalo, 1934.5 versus 1901.4); protid (gram, 87.8 versus 81.4); lipid (gram, 43.5 versus 41.7); and glucid (gram, 295.5 versus 294.5). Similar observation was seen for major nutrients of other groups of vitamin, mineral, fatty acids, and amino acids (Table 2). Due to lack of data in the Vietnamese food composition table, version 2007 and the estimated amount intake was too small, the nutrients were not analyzed for the correlation R^2, as following: galactoza, maltoza, lactoza, B2, B9, D, glycetin, margaric, arachidic, behenic, lignoceric, myristolei, palmitolei, linolenic, arachidonic, eicosapen, dososahex, sumtrans, and sacaroza (Table 2).

For the macro nutrient, there was a small correlation (relationship) for lipid (adjusted R^2= 0.20); a moderate correlation for protid (adjusted R^2 = 0.38) and glucid (adjusted R^2 = 0.36), a strong correlation for energy (adjusted R^2 = 0.53) (Table 2 and Figure 1).

For the sugar group, the very weak correlation was seen (adjusted R^2 = 0.05), fructoza (adjusted R^2 = 0.04), and glucoza (adjusted R^2 = 0.03). Similar observation for mineral such as calci (adjusted R^2 = 0.06), mangan (adjusted R^2 = 0.04), natri (adjusted R^2 = 0.03); For vitamin groups, in detailed of vitamin C (adjusted R^2 = 0.06), B12 (adjusted R^2 = 0.03), A (adjusted R^2 = 0.07), D (adjusted R^2 = 0.04), K (adjusted R^2 = 0.04), bcaroten (adjusted R^2 = 0.04), acaroten (adjusted R^2 = 0.01); for folat (adjusted R^2 = 0.07) (Table 2).

A small (weak) correlation was seen for vitamin group of B1 (adjusted R^2 = 0.20), B2 (adjusted R^2 = 0.18), PP (adjusted R^2 = 0.23), and vitamin H (adjusted R^2 = 0.22). A moderate correlation was seen for mineral group of phosphor (adjusted R^2 = 0.38), kali (adjusted R^2 = 0.32), zinc (adjusted R^2 = 0.33), selen (adjusted R^2 = 0.34); for vitamin group of B5 (adjusted R^2 = 0.37); for amino group of methionine (adjusted R^2 = 0.31), tryptophan (adjusted

Table 2. Estimated nutrients intake of 24-hour recall records and SQFFQ, and their correlations

No	Nutrient	24-hour recall records: n	Mean	S.D.	SQFFQ Mean	S.D.	Adjusted R-squared (R^2)
1	water	310	585.0	188.9	531.5	178.7	0.19
2	energy	310	1934.5	341.3	1901.4	335.5	0.53
3	protein	310	87.8	20.3	81.4	21.0	0.38
4	lipid	310	43.5	15.6	41.7	14.3	0.20
5	glucid	310	295.5	58.6	294.5	53.4	0.36
6	celluloza	310	6.3	2.5	6.2	2.2	0.04
7	ash	310	11.4	3.1	10.0	2.4	0.24
8	sugar	310	9.2	8.8	10.1	6.0	0.05
9	galactoza	310	0.1	0.1	0.0	0.0	0.09
10	maltoza	310	0.0	0.0	0.0	0.0	0.05
11	lactoza	310	1.0	1.8	0.2	0.7	0.03
12	fructoza	310	1.3	1.6	2.0	1.3	0.04
13	glucoza	310	1.1	1.3	1.7	1.2	0.03
14	sacaroza	310	0.5	1.1	1.7	1.4	0.01
15	calci	310	552.5	385.9	394.8	123.1	0.06
16	iron	310	13.5	3.6	11.9	2.7	0.18
17	magie	310	206.2	68.2	187.9	47.0	0.15
18	mangan	310	5.0	2.5	4.5	0.8	0.04
19	phospho	310	1045.3	267.2	938.9	219.4	0.38
20	kali	310	2267.2	568.8	2165.2	513.8	0.32
21	natri	310	655.9	623.9	602.5	199.2	0.03
22	zinc	310	10.6	2.4	10.0	2.1	0.33
23	copper	310	1479.1	373.9	1431.2	280.6	0.19
24	selen	310	148.2	32.8	148.5	27.3	0.34
25	C	310	135.5	86.9	126.5	63.6	0.06
26	B1	310	1.4	0.5	1.1	0.3	0.20
27	B2	310	0.9	0.4	0.6	0.2	0.18
28	PP	310	16.2	5.5	14.8	3.8	0.23
29	B5	310	6.5	1.5	6.6	1.2	0.37
30	B6	310	1.7	0.9	1.7	0.7	0.11
31	folat	310	287.7	125.2	247.6	94.9	0.07
32	B9	310	0.0	0.0	0.0	0.0	-
33	H	310	16.1	5.1	16.4	3.4	0.22
34	B12	310	4.5	11.3	1.6	0.8	0.03
35	A	310	287.8	299.0	220.0	118.6	0.07
36	D	310	0.8	1.4	0.2	0.2	0.04
37	E	310	3.3	1.9	2.9	1.2	0.10
38	K	310	425.5	280.1	292.7	175.1	0.04
39	bcaroten	310	6700.8	3789.6	4798.3	2528.7	0.04
40	acaroten	310	72.1	205.9	85.3	88.2	0.01
41	bcryptoxan	310	176.7	423.4	193.2	166.6	0.03
42	lycopen	310	842.8	2424.9	1348.9	1090.9	0.04
43	luteinzeax	310	9359.7	6412.1	6441.7	3907.2	0.04

44	purin	310	202.5	109.0	169.7	75.1	0.17
45	sumisoflav	310	10.2	11.1	9.1	5.6	0.04
46	daidzein	310	3.9	4.3	3.5	2.2	0.04
47	genistein	310	5.9	6.4	5.3	3.2	0.04
48	glycetin	310	0.8	0.9	0.7	0.5	0.04
49	total saturated fatty acid	310	11.1	5.4	9.4	3.7	0.13
50	palmitic	310	7.1	3.2	6.6	2.5	0.15
51	margaric	310	0.0	0.0	0.0	0.0	0.03
52	stearic	310	2.8	1.3	2.5	1.1	0.11
53	arachidic	310	0.0	0.1	0.0	0.0	0.12
54	behenic	310	0.1	0.1	0.0	0.0	0.13
55	lignoceric	310	0.0	0.0	0.0	0.0	0.13
56	sumacidnol	310	14.6	6.5	13.1	5.1	0.15
57	myristolei	310	0.0	0.0	0.0	0.0	0.00
58	palmitolei	310	1.1	0.9	0.8	0.4	0.07
59	oleic	310	13.3	5.8	12.1	4.6	0.15
60	sumacidno2	310	6.6	3.2	5.8	2.1	0.10
61	linoleic	310	5.8	2.9	5.1	1.9	0.09
62	linolenic	310	0.6	0.2	0.5	0.2	0.09
63	arachidoni	310	0.2	0.1	0.1	0.1	0.15
64	eicosapen	310	0.1	0.1	0.0	0.0	0.10
65	dososahex	310	0.0	0.1	0.0	0.0	0.10
66	sumtrans	310	0.0	0.0	0.0	0.0	0.08
67	cholestero	310	275.5	200.5	262.1	136.3	0.06
68	phytostero	310	30.8	32.4	27.6	18.7	0.05
69	lysin	310	4103.8	1427.3	3551.2	1102.5	0.26
70	methionin	310	1581.8	496.5	1411.9	365.7	0.31
71	tryptophan	310	814.0	223.3	728.8	178.2	0.31
72	phenylalan	310	3042.7	723.5	2810.5	620.2	0.36
73	threonin	310	2584.3	721.1	2304.3	595.1	0.34
74	valin	310	3672.7	964.4	3332.6	784.1	0.35
75	leucin	310	5165.8	1384.1	4693.1	1116.6	0.34
76	isoleucin	310	3165.0	951.8	2766.8	701.7	0.30
77	arginin	310	4447.8	1076.6	4300.1	962.3	0.35
78	histidin	310	1735.1	460.9	1566.8	419.4	0.32
79	cystin	310	954.7	231.6	910.7	192.3	0.35
80	tyrosin	310	2138.5	595.2	1954.2	479.7	0.32
81	alanin	310	3370.0	943.6	3207.4	805.1	0.30
82	aspartic	310	5731.7	1565.1	5425.8	1312.5	0.29
83	glutamic	310	10361.6	2604.3	10399.2	2452.4	0.32
84	glycin	310	3011.0	848.8	2853.5	752.6	0.26
85	prolin	310	3015.3	889.1	2705.9	645.2	0.26
86	serin	310	2924.2	784.5	2852.2	658.3	0.29

$R^2 = 0.31$), phenylalan (adjusted $R^2 = 0.36$), threonine (adjusted $R^2 = 0.34$), valin (adjusted $R^2 = 0.35$), leucine (adjusted $R^2 = 0.34$), isoleucine (adjusted $R^2 = 0.30$), arginine (adjusted $R^2 = 0.35$), histidine (adjusted $R^2 = 0.32$), cystin (adjusted $R^2 = 0.35$), tyrosin (adjusted $R^2 = 0.32$), alanine (adjusted $R^2 = 0.30$), glutamic (adjusted $R^2 = 0.32$), (Table 2).

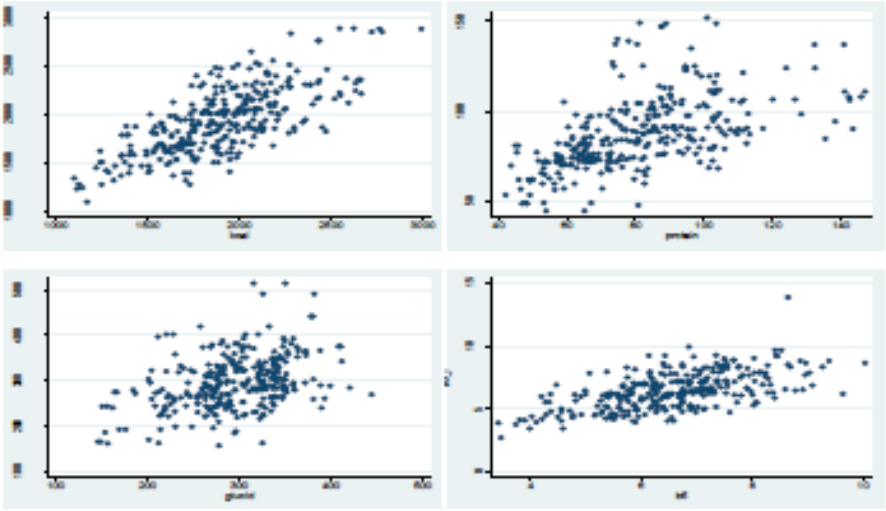

Figure 1. Scatterplots and correlation between 24-hour recall records and SQFFQ for energy (kcal, adjusted R^2=0.53), protid (protein, adjusted R^2=0.38), glucid (glucid, adjusted R^2=0.36), and Vitamin B5 (b5, adjusted R^2=0.37)

III. Discussions

The reproducibility of the designed semi-quantitative food frequency questionnaire (SQFFQ) in general populations in the North of Viet Nam was validated and the findings show that a strong positive correlation for energy and a moderate positive correlation for major macro nutrient of protid and glucid and number of minerals, amino acids. Among vitamins, only a moderate positive correlation was seen for the vitamin B5. The listed macro nutrients and listed micro nutrients having a strong or major positive correlation have highlighted the designed SQFFQ being feasibility, practical and reliability in the general participated populations. These findings in here have consisted with the studies performed in Japanese population for the designed SQFFQ [7, 8]; and studies performed in the United State at the Harvard T.H. Chan School of Public Health and Harvard School of Medicine. The designed SQFFQ was used to

collect data for the Nurses Health Study (from 1976 to date), the Health Professionals Follow-up Study (from 1986 to date) and the Nurses Health Study II (from 1989 to date) [3, 12].

The designed SQFFQ has ability to reproduce in term of energy, protid, glucid, zinc, selen, and some major amino acids, vitamins and mineral that are related as protective factors against cancer in the human [13, 14]. The present findings also suggest promoting observation study on the association between diet and cancer to explore the underlying of the association between them in low- and middle-income countries in general and in Viet Nam. This possibility can progress in understanding the mechanism of the development of cancer (diet related to about 35% of all cancer [2]), and other non-communicable diseases (NCD) of diabetes and cardiovascular diseases relating to diet. Unhealthy diet has been recognized being major risk factors of NCD, which occurred in low- and middle-income countries as much as about 80% worldwide [9-11].

The present work has calculated the adjusted R^2 for 67 of 86 nutrients according to Vietnamese food composition table, version 2007 thus it will promote the advanced study in the near future in the country and in the region for the association between diet and NCD.

The present study certainly has a limitation, such as about 19 nutrients were unable to analysis due to missing of the data in the Vietnamese food composition table, version 2007 and group of sugar and fatty acids showing a null or small correlation between 24-hour recall records of food intake and the designed SQFFQ. This minor correlation might be generated from the database collected from one survey only due to the limited constraint time of work. The next survey is initiating and new findings are expected to be published soon.

Conclusion

The designed semi-quantitative food frequency questionnaire (SQFFQ) was being validated has positive characteristics of feasibility, practical and reliability in general populations located in the Red River Delta in the North of Viet Nam. The SQFFQ can be used to collect data for the analytical epidemiological studies of cancer and other non-communicable diseases.

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Conflicts of Interest. None to declare

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