Original Article

An internet-based food frequency questionnaire for a large Chinese population

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Background and Objectives: National dietary surveys are needed and difficult to conduct in China. The current study aims to develop and validate an internet-based diet questionnaire for Chinese (IDQC) to assess intakes in Northern China. **Methods and Study Design:** We recruited 292 city residents by email and telephone in Harbin to obtain the IDQC and 3-day diet diaries. The food group and nutrient intakes from the IDQC were validated against those from the 3-day diet diaries. Paired sample *t*-tests were used to compare the methodological differences, and repeatability was estimated using Pearson's correlations. Cross-classification was used to calculate the percentage agreement in quartiles for all food groups and nutrients. **Results:** Positive correlations were found between the IDQC and 3-day diet diaries for all food groups after energy adjustment (from 0.28 for seeds and nuts to 0.63 for dairy products). Positive correlations were observed for all nutrients between the IDQC and 3-day diet diaries, with correlations ranging from 0.37 for folic acid to 0.98 for iodine. The overall agreements for food groups and nutrients were above 69.2%, indicating satisfactory consistency between the IDQC and 3-day diet diaries. **Conclusions:** The IDQC can be used to estimate the food and nutrient intakes in a Northern China population for both clinical nutrition epidemiological and public health nutritional purposes. The questionnaire system IDQC (v1.0) is freely available at http://www.yyjy365.org/diet/.

Key Words: validation, internet, food frequency questionnaire, nutrients, China

INTRODUCTION

The prevalence of chronic diseases has dramatically increased in China in recent years, and constitutes a serious health threat to the population.[1] Specifically, 9.7% of Chinese have diabetes, and 15.5% have pre-diabetes in terms of age-standardized prevalence.[2] Dietary habits are a major factor in the development of chronic diseases such as hypertension, hyperlipidemia, diabetes, cardiovascular disease and cancer.[3-6] Dietary factors are also important in the prevention of asthma, prostate disease and Alzheimer's disease and much more.[7-9] Thus, the dietary risk factors for these need to be established in order that preventive measures may be implemented widely in China.

Since the last national nutrition survey in China in 2002, no further nationwide studies on food intake have been reported. Due to the large population and territory of China, it is difficult to carry out national dietary surveys frequently, and an easier method is needed. The rapid development of the internet and mobile devices in China offers novel and promising possibilities for investigation in large populations within a short period of time. As internet-based questionnaires can be simultaneously sent to a very large sample group with low cost and high efficiency, our nutrition research group designed and developed an online lifestyle and dietary questionnaire to calculate daily food intake in the population and a real-time feedback report will be provided to the participants, when they finished the questionnaires.

The aim of the internet-based diet questionnaire for Chinese (IDQC) was to provide a quick and easy tool for researchers to survey the food intakes of large Chinese populations. The present study was conducted to test the utility of this tool in Northern China. 3-day diet diaries were used to verify the effectiveness and repeatability of this online questionnaire.

MATERIALS AND METHODS

Subjects and study design

Harbin city residents were randomly recruited by mobile

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text and telephone call from February 1st to April 15th, 2014. A total of 554 individuals aged 18-65 years were enrolled in this questionnaire. All subjects were asked to complete all demographic and diet questions online within 2 weeks, including age, gender, educational level, smoking, alcohol use, and physical activity (three groups: none, those without any regular intensive physical activities; moderate, those who engage in regular intensive physical activities at least once a week; and vigorous, those who engage in physical activities at least three times a week). The diet questions are split into two parts: IDQC for the past 4 months and 3-day diet diaries. After finishing the IDQC, it is locked for 4 months before the subjects start next one. Mobile text/phone calls were used to remind participants of the 3-day diet diaries. All participants were asked to record all foods and approximate amounts eaten for 3 days. Among the 554 subjects, 292 fulfilled the inclusion criteria for the study (completion of all items, including demographic questionnaire, 3-day dietary diaries, and IDQC). Online informed consents were obtained from all subjects at the time of recruitment. The study conformed to the provisions of the Declaration of Helsinki and was approved by the Public Health School Medical Center at Harbin Medical University.

Development of the IDQC

The IDQC was developed by collaboration between researchers from the Departments of Nutrition and Bio-Informatics at Harbin Medical University. The goal of this team was to design a simple tool for dietary data collection and dietary nutritional education in Chinese population.

To determine all the food items to be included, 250 residents with diverse age, sex, and jobs were randomly selected from community centers in five administrative districts in Harbin, the largest city in Northern China. Trained interviewers asked these residents to complete a questionnaire including demographic information, 24h food recall, and the amount of each food. Two hundred and five participants clearly remembered their food intake and finished this face-to-face questionnaire. A table was then generated from the results, including food name, frequency of intake, and amount. Most of the food items (99%, n=135) in the records were adopted into the IDQC, and one was abandoned for rare consumption. The frequency and proportion size of each food item were set according to the responses from the 24 h diet recalls. The 135 food items were divided into 16 categories, including: grains, potatoes, legumes, vegetables, fungi, fruits, seeds and nuts, livestock, poultry, dairy products, eggs, fish, snacks, sweets, condiments, and beverages.

Then, the questionnaire was converted to HTML format and placed on a secure web server at net.cn (http://www.yyjy365.org/diet/) with option buttons for each question. To aid the estimation of the portion sizes, food images of different weights were provided as references; for example, the illustration for orange showed one medium-sized weighing 200 g. Each food could be selected by clicking the appropriate check box. The participants had to choose the frequency of consumption and amount of each food item in the IDQC. For example, apples, the frequency needed to be chosen from one of the following options: never (less than once/month), 1-3 times/month, once/week, 2-3 times/week, 4-5 times/week, once/day, twice/day, and three times or more/day. Six levels were included for the amount of the food items: ≤1 liang (a Chinese food weight unit, 1 liang=50 grams), 2-3 liang, 4-5 liang, 6-7 liang, 8-9 liang, and ≥1 kg. However, small portions of food, such as for shallots, were recorded as <10 g, 20-30 g, 40-50 g, 60-70 g, 80-90 g, or >100 g. Beverages were recorded as the number of bottles (550 mL/bottle). For the validation study, 3-day diet diaries were recorded and averaged in order to compare the results with the IDQC and assess the general dietary patterns. 3-day diet diaries were developed based on the concept of 24h dietary recall for 3 days.

Food group and nutrient intakes

The means of the amounts for each food group were calculated into g/day for each questionnaire. Food group intake was calculated by converting the serving sizes (liang) into grams, and then totalling these weights for each of the 16 food groups. After converting the intakes from the IDQC and 3-day diet diaries to grams, we calculated the nutrient intakes using the Food Nutrition Calculator (V1.60; Shixinghengxun, Beijing, China), according to China Food Composition.[10] Each nutrient intake is the total quantity from all food items. The nutrients in our analysis included energy (kcal), protein (g), fat (g), carbohydrate (g), fiber (g), cholesterol (g), vitamin A (VA, μgRE), vitamin B-1 (VB-1, mg), vitamin B-2 (VB-2,mg), folic acid (μg), niacin (mg), vitamin C (VC, mg), vitamin E (VE, mg), calcium (Ca, mg), phosphorus (P, mg), potassium (K, mg), sodium (Na, mg), magnesium (Mg, mg), iron (Fe, mg), zinc (Zn, mg), selenium (Se, μg), copper (Cu, mg), manganese (Mn, mg), and iodine (I, μg).

Statistical analysis

The means of the amounts of food groups and nutrients from the 3-day diet diaries were calculated and compared with those from the IDQC. Comparisons between the two surveys were conducted in terms of both nutrient and food group amounts. All statistical analyses were performed using SPSS software (version 18.0; Beijing Stats Data Mining Co. Ltd, Beijing, China). The general characteristics of all the participants were defined by descriptive statistics (median and interquartile range). All food groups and nutrients were log-transformed and energy-adjusted by residual methods in linear regression models to improve normality. Paired-sample *t*-tests were used to investigate the differences in food groups and nutrients between the IDQC and 3-day diet diaries. Un-adjusted and energy-adjusted correlations in food groups and nutrients between the IDQC and 3-day diet diaries were described using Pearson's correlations. Cross-classifications were used to estimate the consistency of the IDQC and 3-day diet diaries. All participants were divided into quartiles according to their intakes of energy-adjusted food groups and nutrients. Then, we calculated the percentage of agreement between the two methods and categorized them into three quartiles: agreement, disagreement, and extreme disagreement. The participants in the same and adjacent quartiles were considered to have sufficient consistency between the IDQC and 3-day diet

diaries results. Participants that had a discrepancy of one quartile between the methods were classified into the disagreement group, while those with two or more quartiles difference were classified into the extreme disagreement group. A p value of 0.05 was used as the threshold for statistical significance.

RESULTS

Demographic characteristics

The demographic characteristics of all participants are shown in Table 1. The study population was 69.5% women and 30.5% men, and the median age was 35 years, with an interquartile range of 24 to 43 years. 95.9% participants were highly educated and graduated from college and above. Some (22.3%) of the population drank alcohol and 11.0% smoked.

Table 1. Demographic characteristics of all participants (n=292)

	Median or %	Q_1-Q_3
Age (years)	35.0	24.0-43.0
Male (%)	30.5	
Height (m)	1.65	1.60-1.71
Weight (kg)	55.0	50.0-65.0
BMI (kg/m^2)	20.5	19.2-23.5
WC (cm)	75	69.0-80.0
Education (%)		
Senior high school and lower	4.1	
College	63.0	
Postgraduate and above	32.9	
Income (yuan/month)		
<3,000	11.6	
3,000~5,000	57.9	
>5,000	30.5	
Physical activity (%)		
None	58.6	
Moderate	40.4	
Vigorous	1.0	
Alcohol use (%)	22.3	
Smoke (%)		
Never	89.0	
<1 cigarette/day	5.5	
1-10 cigarettes/day	3.1	
>10 cigarettes/day	1.0	
Ex-smoker	1.4	

BMI: body mass index; WC: waist Circumstance; Q_1-Q_3: interquartile range.

Food group and nutrient intakes from the IDQC and 3-day diet diaries

Sixteen food groups and 24 nutrients are summarized in Tables 2 and 3. All the data are presented as the median and interquartile range for skewed distribution. The intakes of food groups and nutrients in the IDQC were higher than those in the 3-day diet diaries. Repeatability analyses revealed positive correlations between the IDQC and 3-day diet diaries in all food groups (Table 2), as follows: legumes (r=0.42), fruit (r=0.48), livestock (r=0.47), dairy products (r=0.61), and beverages (r=0.41) all had strong, significant correlation (r>0.4). Lower, but still significant, correlation coefficients (<0.3) were seen in poultry (r=0.22), fish (r=0.28), snacks (r=0.25), sweets (r=0.19), and condiments (r=0.27). The correlations for the other food groups were moderate, from 0.30 to 0.40. After adjusting the total energy intake, almost all the correlation coefficients increased. In terms of nutrient intakes (Table 3), all the nutrients had significant, positive correlations higher than 0.40, ranging from 0.40 to 0.96, except VA (0.37). The mean of the correlation coefficients was 0.52, which also increased after energy adjustment.

Cross-classification of food groups and nutrients

For the food groups (Table 4), dairy products and beverages had over 80% agreement, while the agreements for fungi and snacks were lower than 70%; the agreements for other food groups were between 70% and 80%. The cross-classification percentages of nutrients between the IDQC and 3-day diet diaries were listed in Table 5. I and Na had the highest percentages of agreement (100% and 95.9%, respectively). The other nutrients ranged from

Table 2. Comparisons of the IDQC and 3-day diet diaries by food groups

Food groups	IDQC		3-day dietary diaries		p value	r	$r^\dagger$
	Median	Q_1-Q_3	Median	Q_1-Q_3			
Grains (g)	282	158-412	275	211-391	0.63	0.34*	0.39*
Potatoes (g)	28.0	12.3-66.6	20.4	5.40-62.5	0.15	0.38*	0.41*
Legumes (g)	44.4	17.1-112	28.1	3.62-91.7	0.04	0.42*	0.44*
Vegetables (g)	225	118-417	184	82.9-287	<0.01	0.37*	0.44*
Fungi (g)	27.5	9.50-45.5	8.33	1.25-41.7	0.04	0.31*	0.30*
Fruits (g)	193	99.4-363.	117	25.0-250	<0.01	0.48*	0.44*
Seeds and nuts (g)	23.6	8.80-45.6	1.30	0.20-12.5	0.02	0.30*	0.28*
Livestock (g)	49.8	24.9-85.3	50.0	22.9-117	0.02	0.47*	0.46*
Poultry (g)	17.5	7.00-28.0	5.56	3.07-40.0	0.90	0.22*	0.32*
Dairy products (g)	66.9	20.10-156	25.0	4.20-135	<0.01	0.61*	0.63*
Eggs (g)	18.2	9.00-26.4	16.7	0.95-25.0	0.01	0.35*	0.32*
Fish (g)	18.4	8.80-38.9	3.10	1.20-11.3	0.02	0.28*	0.32*
snacks (g)	43.8	21.0-85.8	16.7	2.47-62.5	0.54	0.25*	0.26*
Sweets (g)	3.15	1.40-6.29	1.21	0.30-2.71	0.24	0.19*	0.31*
Condiments (g)	3.50	0.70-8.01	0.74	0.21-4.17	0.13	0.27*	0.29*
Beverages (mL)	15.8	7.00-47.4	3.55	0.17-15.3	<0.01	0.41*	0.53*

IDQC: internet-based diet questionnaire for Chinese; Q_1-Q_3: interquartile range.
r: unadjusted Pearson correlation coefficient; †energy-adjusted Pearson correlation coefficient.
$^*p$<0.05.

Table 3. Comparisons of the IDQC and 3-day diet diaries by nutrients

Nutrients	IDQC		3-day dietary diaries		*p* value	*r*	$r^{\dagger}$
	Median	Q_1-Q_3	Median	Q_1-Q_3			
Energy (kcal)	2338	1553-3150	2060	1483-2562	<0.01	0.51*	--
Protein (g)	79.7	50.9-111	67.4	49.0-97.1	<0.01	0.54*	0.53*
Fat (g)	65.9	44.6-92.8	57.9	33.6-79.8	0.02	0.53*	0.59*
Carbohydrate (g)	355	236-455	309	228-408	<0.01	0.45*	0.46*
Fiber (g)	16.6	9.21-24.3	11.1	7.41-17.0	<0.01	0.49*	0.51*
Cholesterol (g)	332	215-517	255	120-4065	0.01	0.54*	0.55*
VA (μgRE)	677	392-1243	352	160-665	0.05	0.37*	0.43*
VB-1 (mg)	1.17	0.76-1.65	1.00	0.65-1.28	<0.01	0.50*	0.47*
VB-2 (mg)	1.33	0.82-1.74	0.60	0.60-1.45	<0.01	0.51*	0.55*
Folic acid (μg)	70.7	34.4-117	22.5	8.10-88.9	<0.01	0.40*	0.37*
Niacin acid (mg)	17.6	11.4-24.6	15.4	10.3-19.7	<0.01	0.51*	0.47*
VC (mg)	104	56.2-193	65.5	29.8-107	<0.01	0.40*	0.39*
VE (mg)	33.2	23.4-51.1	28.1	16.6-43.4	<0.01	0.71*	0.80*
Ca (mg)	580	331-828	401	238-623	<0.01	0.49*	0.52*
P (mg)	1220	797-1745	981	711-1325	<0.01	0.54*	0.50*
K (mg)	2295	1369-3423	1750	1136-2422	<0.01	0.50*	0.47*
Na (mg)	2803	1949-3997	2356	1516-3615	<0.01	0.81*	0.75*
Mg (mg)	420	267-644	318	222-448	<0.01	0.48*	0.45*
Fe (mg)	24.1	15.7-33.0	19.0	13.7-25.2	<0.01	0.42*	0.44*
Zn (mg)	13.1	8.51-18.4	10.2	7.54-14.7	0.03	0.58*	0.60*
Se (μg)	55.2	35.8-84.8	43.2	31.1-62.5	0.10	0.45*	0.48*
Cu (mg)	3.10	2.08-4.52	2.37	1.63-3.31	<0.01	0.42*	0.44*
Mn (mg)	6.79	4.70-9.76	5.12	3.72-7.23	<0.01	0.46*	0.40*
I (μg)	102	64.8-177	100	59.8-149	<0.01	0.96*	0.98*

IDQC: internet-based diet questionnaire for Chinese; Q1-Q3: *i*nterquartile range; VA: vitamin A; VB-1: vitamin B-1; VB-2: vitamin B-2; VC: vitamin C; VE: vitamin E; Ca: calcium; P: phosphorus; K: potassium; Na: sodium; Mg: magnesium; Fe: iron; Zn: zinc; Se: selenium; Cu: copper; Mn: manganese; I: iodine.
r: unadjusted Pearson correlation coefficient; †Energy-adjusted Pearson correlation coefficient.
*$p<0.05$.

Table 4. Agreements (%) between quartiles of IDQC and 3-day diet diaries in food groups

Food groups	Same or adjacent	Disagreement	Extreme disagreement
Grains	74.7	17.8	7.5
Potatoes	75.4	17.1	7.5
Legumes	78.0	11.0	11.0
Vegetables	70.6	20.6	8.8
Fungi	69.2	23.3	7.5
Fruits	77.4	15.8	6.8
Seeds and nuts	71.9	17.8	10.3
Livestock	78.1	13.0	8.9
Poultry	70.6	21.2	8.2
Dairy products	87.0	10.3	2.7
Eggs	78.8	14.4	6.8
Fish	74.0	17.8	8.2
snacks	69.9	19.9	10.2
Sweets	70.6	19.9	9.5
Condiments	71.2	20.6	8.2
Beverages	80.8	13.7	5.5

IDQC: internet-based diet questionnaire for Chinese.

69.4% (Mg) to 86.3% (VE), while those in the extreme disagreement quartile ranged from 2.0% (energy) to 9.9% (Mg).

DISCUSSION

With the rapid economic development in China, the diet pattern has changed significantly. Although malnutrition has reduced substantially, the incidence of diet-related diseases has increased dramatically,[11] especially overweight, with the most rapid increase in the world.[12] Unbalanced eating patterns are strongly associated with the prevalence of chronic metabolic disorders, such as hypertension, hyperlipidemia, type 2 diabetes, and cardiovascular diseases.[6,13-17] However, no reliable national data is available to show the current problems in Chinese dietary habits. That is, the eating patterns contributing to chronic diseases are unclear, and finding appropriate modifications of dietary intake to reduce nutrition-related chronic disease is both important and urgent. Currently, it is difficult to conduct national surveys in China due to its large population and vast territory, along with the additional problematic factors of finance, materials, manpower, and

Table 5. Agreements (%) between quartiles of IDQC and 3-day diet diaries in nutrients

Nutrients	Same or adjacent	Disagreement	Extreme disagreement
Energy	79.5	18.5	2.0
Protein	76.0	16.5	7.5
Fat	80.2	16.4	3.4
Carbohydrate	78.1	17.8	4.1
Fiber	77.4	18.5	4.1
Cholesterol	75.3	17.1	7.6
VA	75.3	18.5	6.2
VB-1	77.4	17.1	5.5
VB-2	78.8	15.1	6.1
Folic acid	69.9	24.7	5.4
Niacin acid	74.7	16.4	8.9
VC	70.6	21.2	8.2
VE	86.3	11.0	2.7
Ca	77.4	16.4	6.2
P	71.2	19.2	9.6
K	77.4	17.1	5.5
Na	95.9	4.11	0.0
Mg	69.4	20.7	9.9
Fe	73.3	17.8	8.9
Zn	71.2	21.2	7.6
Se	69.9	20.6	9.5
Cu	76.0	16.4	7.6
Mn	75.3	17.8	6.9
I	100	0.00	0.00

IDQC: internet-based diet questionnaire for Chinese; VA: vitamin A; VB-1: vitamin B-1; VB-2: vitamin B-2; VC: vitamin C; VE: vitamin E; Ca: calcium; P: phosphorus; K: potassium; Na: sodium; Mg: magnesium; Fe: iron; Zn: zinc; Se: selenium; Cu: copper; Mn: manganese; I: iodine.

the time-consuming nature. Therefore, a low cost and simple method is greatly needed.

Self-administered dietary recall questionnaire is a traditional method of dietary intake data collection in epidemiological studies, and can be applied in large populations.[18,19] Food frequency questionnaire (FFQ) is the most commonly used method to measure average long-term dietary patterns.[20] The internet makes communication low cost, fast and easy-to-use with no limitations of distance, economy, time and manpower. Thus, the IDQC was designed to assess diet quality and nutrient intakes in a Northern Chinese population. The IDQC includes not only the FFQ, but also short-term food intake by tracking food intake for 3 days, which is then averaged to obtain dietary trends over time. This method can collect more comprehensive and accurate information on diet variations, thus allowing nutritionists and researchers to more easily understand dietary problems. Furthermore, it can promote the building of basic medical services and improve residents' dietary habits according to the instantaneously generated report after completion of the questionnaire. Thus, the IDQC has the potential to be used repeatedly in very large populations with relatively low administrative and analysis costs.

In the present study, the utility of the IDQC was evaluated by comparing it with 3-day diet diaries. From the analysis, significant, positive correlations were found in all food groups and nutrients, with higher values from the IDQC than the 3-day diet diaries. The energy-adjusted correlation coefficients ranged from 0.28 to 0.53 for the food groups and 0.43 to 0.98 for the nutrients. In the cross-classification, high percentages of the participants were in the agreement and moderate agreement quartiles for both the food groups and nutrients.

Cade and his colleagues proposed 0.40 as the threshold for high correlation in food groups between FFQs and diet records.[21] Additionally, Willett et al suggested that correlations may reach 0.6 to 0.7, when FFQs are compared with multiple diet records;[22] however, it is difficult to reach this threshold. In Matthyset al' study, their correlation ranged from 0.20 to 0.64 for different food groups.[23] Similar questionnaire results were found for fruit and vegetable intake among Dutch adults.[24] The correlations of nutrients in the "Dietary Approaches to Stop Hypertension" online questionnaire ranged from 0.44 to 0.69, and the average nutrient intakes were higher in the online questionnaire than 24h dietary records.[25] In a Spanish dietary study, the correlations of dietary nutrients between diet history and seven 24h recalls ranged from 0.26 to 0.76.[26] The actual correlations often do not reach the threshold of 0.4, because many bias and methodological issues in dietary recall surveys are unavoidable, such as sample population, completion time, technique defects, individuals' attitudes, and many other unidentified factors.[23,27-30] Food group and nutrient intakes are often higher in food frequency questionnaire than 3-day diet diaries, possibly due to overestimation in long-term diet recall.[31]

The IDQC was developed as a self-administered, cost-effective monitoring tool for assessing food habits to ease the heavy burden of written records. Additionally, many manual operations can be avoided, such as type-in, check, calculation and so on, as the subjects select their personal information on computes with images as references. Meanwhile, proposals on better dietary quality is offered to each participants based on their current diet habits and lifestyle. Thus, the IDQC is a novel and convenient tool of dietary assessment for large populations in China.

In the present study, the validity of the IDQC was evaluated by comparing it with 3-day diet diaries. The average intake of the food groups and nutrients in the IDQC were well correlated with the 3-day diet diaries. In conclusion, the IDQC can be utilized as a recording tool and quick measure to capture the characteristics of food intake in the Chinese population in clinical practice and daily life.

Limitations

A limitation in the current study is the use of a Northern Chinese sample population, and thus, the study lacks generalizability for the southern populations of China. Further research is warranted to address whether or not the IDQC is effective and understandable to southern users, who likely have different lifestyle, dietary habits and educational levels.

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AUTHOR DISCLOSURES

There is no conflict of interests.

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Original Article

An internet-based food frequency questionnaire for a large Chinese population

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中国大人群营养素评价的网上膳食调查问卷

背景与目的：在中国进行全国性膳食调查紧迫且难以实行。本研究的目的是建立一个适用于中国人的网上膳食调查问卷（IDQC）并在北方人群中验证其有效性。**方法与研究设计：**通过电子邮件和电话招募 292 名哈尔滨居民，完成 IDQC 和 3 天膳食日记。通过与 3 天膳食日记中的数据比较，来验证 IDQC 中食物组和营养素的准确性。应用配对样本 *t* 检验，比较两种调查方法中食物组和营养素的平均水平，应用皮尔森相关系数分析问卷的重复性。将两种调查方法中的食物组和营养素摄入量四等分后，应用交叉分组计算问卷一致率。**结果：**校正总能量摄入后，所有食物组在 IDQC 和 3 天膳食日志间均呈正相关（相关系数的变化范围从种子和坚果类的 0.28 到奶制品的 0.63）。所有营养素在 IDQC 和 3 天膳食日志间仍然呈明显正相关，相关系数由叶酸的 0.37 到碘元素的 0.98。食物组和营养素的一致率均在 69.2%以上，表明 IDQC 和 3 天膳食日志间有令人满意的一致性。**结论：**在中国北方，IDQC 能够用于临床营养流行病学和公共健康目的的食物和营养素摄入量估计。问卷调查系统 IDQC（v1.0）见：http://www.yyjy365.org/diet/。

关键词：验证、网络、食物频率问卷、营养素、中国