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Short Communication

Validity and reliability of a self-administered food frequency questionnaire for the JPHC study: The assessment of amino acid intake

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ABSTRACT

Background: The Japanese database of food amino acid composition was revised in 2010 after a 24-year interval. To examine the impact of the 2010 revision compared with that of the 1986 revision, we evaluated the validity and reliability of amino acid intakes assessed using a food frequency questionnaire (FFQ).

Methods: A FFQ including 138 food items was compared with 7-day dietary records, completed during each distinct season, to assess validity and administered twice at approximately a 1-year interval, to assess reliability. We calculated amino acid intakes using a database that compensated for missing food items via the substitution method. Subjects were a subsample of two cohorts of the Japan Public Health Center-based prospective study. A total of 102 men and 113 women in Cohort I and 174 men and 176 women in Cohort II provided complete dietary records and the FFQ, of whom 101 men and 108 women of Cohort I and 143 men and 146 women of Cohort II completed the FFQ twice.

Results: In the comparison of the FFQ with dietary records, the medians (ranges) of energy-adjusted correlation coefficients for validity were 0.35 (0.25–0.43) among men and 0.29 (0.19–0.40) among women in Cohort I, and 0.37 (0.21–0.52) and 0.38 (0.24–0.59), respectively, in Cohort II. Values for reliability were 0.47 (0.42–0.52) among men and 0.43 (0.38–0.50) among women in Cohort I, and 0.59 (0.52–0.70) and 0.54 (0.45–0.61), respectively, in Cohort II.

Conclusions: The FFQ used in our prospective cohort study is a suitable tool for estimating amino acid intakes.

Introduction

Studies assessing the association between dietary amino acids and cardiovascular disease risk have shown that dietary intake of cysteine was inversely associated with the risk of stroke in women.[1] Higher methionine intake was associated with an increased risk of acute coronary events in men.[2] Higher intake of animal protein, which is richer in methionine than vegetable protein, was also associated with an increased risk of ischemic heart disease in men, although vegetable protein had no effect.[3] Furthermore, sulfur amino acids (SAA), including methionine and cysteine, changed lipid metabolism and influenced serum lipoprotein concentrations.[4] Thus, the association between amino acids and cardiovascular disease has gained attention in recent years. It is necessary to examine the association between individual amino acid intake and the risk of cardiovascular disease in Japanese subjects because of limited evidence in this group.

In Japan, the amino acid composition of foods, based on the Standard Table of Food Composition, was re-issued in 2010 after an interval of 24 years.[5] The updated version includes 337 food items,

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including 42 new items, and now shows protein as the sum of amino acid residues, total amino acids, ammonia, SAA as the sum of methionine and cysteine, and aromatic amino acids (AAA) as the sum of phenylalanine and tyrosine. Prior to publication of the revised table, Ishihara et al had developed a database using the previous amino acid composition table and evaluated the validity of a food frequency questionnaire (FFQ) for estimating amino acid intake.[6] However, the 2010 revision of the amino acid composition table of foods was substantial, so it is worthwhile to examine the validity and reliability of amino acid intakes based on this revision.

In the present study, we assessed the validity and reliability of amino acid assessment via a FFQ that was used in a large follow-up study of middle-aged Japanese men and women.

Methods

Validity and reliability study

The Japan Public Health Center-based prospective Study on Cancer and Cardiovascular Diseases (JPHC Study) is a population-based prospective cohort study that included Cohort I in Ninohe, Yokote, Saku, and Chubu (formerly named Ishikawa) public health center (PHC) areas from 1990, and Cohort II in Mito, Nagaoka (formerly named Kashiwazaki), Chuo-higashi, Kamigoto, Miyako, and Suita PHC areas from 1993. A 5-year follow-up survey in Cohort I was conducted for residents who remained alive in 1995, and we estimated their nutrient intake using a food frequency questionnaire (FFQ05).[7] The same FFQ was used for the 5-year follow-up survey in Cohort II in 1998.

Subjects in the validity and reliability study were a subsample of participants in the JPHC Study Cohorts I and II. Details of the study protocol have been reported elsewhere.[8,9] In brief, the validity study of Cohort I was initiated in February 1994, and that of Cohort II was initiated in May 1996. Subjects for the validity analysis included participants who completed dietary records for 28 days (14 days for Chubu PHC area) and the FFQ for measuring the validity of FFQ05 (FFQv) among healthy volunteers with normal weight and without dietary restrictions. A total of 247 participants (122 men and 125 women) from four PHC areas in Cohort I and 392 participants (196 men and 196 women) from six PHC areas in Cohort II were recruited on a voluntary basis. For the reliability study, we analyzed data of participants who responded to the FFQ again at a 1-year interval, except in the Mito PHC area (9-month interval), for measuring the reliability of FFQ05 (FFQr) among the subjects in the validity analysis. The study was approved by the human ethics review committee of the National Cancer Center of Japan.

Dietary records

Dietary records were provided through 7 consecutive days on four separate occasions (a total of 28 days), in spring, summer, autumn, and winter, except for the Chubu PHC area, where a subtropical climate prevails. In that area, 7-day dietary records were collected only twice (winter and summer) because the seasonal variation was not expected to be large. Research dietitians instructed the subjects to use a specially designed booklet to record all foods and beverages prepared and consumed. Participants were asked to provide detailed descriptions of each food, including the methods of preparation and recipes whenever possible. The dietitians checked the records at subjects' homes, workplaces, or community centers during the survey and reviewed them in a standardized way.

Food frequency questionnaire in 5-year follow-up survey (FFQ05)

Both self-administered FFQ05s asked about the usual consumption of 138 food items during the previous year. Nine frequency and three portion size categories were used to obtain data on dietary habits. Frequency was recorded as almost never, 1–3 times per month, 1–2 times per week, 3–4 times per week, 5–6 times per week, once per day, 2–3 times per day, 4–6 times per day, and 7 or more times per day. Portion size was recorded as less than half, same, and more than one and a half times the specified amounts. One FFQ05 was used to assess the validity of the FFQ (i.e., FFQv) compared with dietary records (the gold standard of dietary assessment),[10] and the other FFQ05 was used to assess the reliability of the FFQ (i.e., FFQr) with the FFQv. The sequence of data collection for the validity and reliability studies is shown in Fig. 1.

Amino acid database of foods

The Amino Acid Composition of Foods in Japan 2010 shows 18 amino acids and some additional proteins.[5] The table details 337

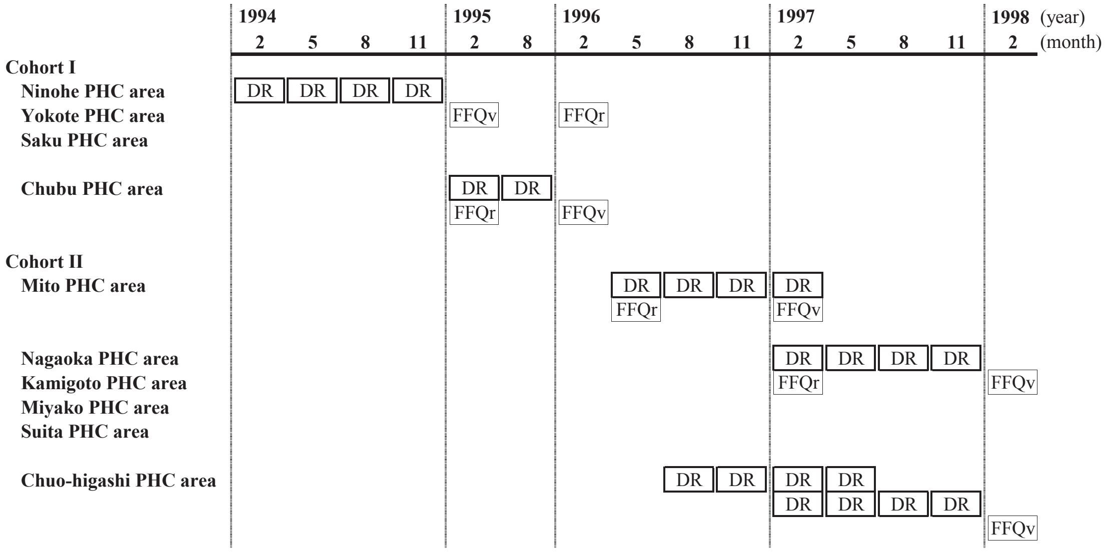

Fig. 1. The sequence of data collection. DR, dietary record; FFQ, food frequency questionnaire; PHC, Public Health Center.

Table 1
Amino acid intakes calculated using dietary record for 28 days (or 14 days in Chubu) and food frequency questionnaires in Cohort I and their correlations.

	Validation							Reliability					
	Dietary record		FFQv		% Difference[a]	Spearman correlation		FFQv		FFQr		Spearman correlation	
	Mean	SD	Mean	SD		Crude	Adjusted[b]	Mean	SD	Mean	SD	Crude	Adjusted[b]
Male (validation, n = 102; reliability, n = 101)													
Total protein, g	90.5	15.4	81.4	32.2	−10	0.45‡	0.30†	81.0	32.1	81.5	32.0	0.56‡	0.47‡
Isoleucine, mg	3844	676	3427	1400	−11	0.46‡	0.36‡	3411	1397	3442	1401	0.56‡	0.42‡
Leucine, mg	6842	1199	6153	2465	−10	0.48‡	0.35‡	6124	2461	6183	2464	0.57‡	0.43‡
Lysine, mg	5854	1075	5215	2365	−11	0.41‡	0.32†	5188	2361	5180	2435	0.58‡	0.43‡
Methionine, mg	2097	369	1864	782	−11	0.45‡	0.29†	1857	782	1853	797	0.58‡	0.44‡
Cystine, mg	1349	233	1189	422	−12	0.52‡	0.39‡	1184	421	1205	429	0.59‡	0.52‡
SAA, mg	3413	584	3022	1190	−11	0.48‡	0.31†	3010	1189	3027	1201	0.57‡	0.47‡
Phenylalanine, mg	3952	685	3548	1369	−10	0.49‡	0.36‡	3531	1364	3584	1359	0.56‡	0.47‡
Tyrosine, mg	3031	526	2762	1093	−9	0.49‡	0.34‡	2749	1090	2777	1091	0.57‡	0.45‡
AAA, mg	6974	1210	6306	2457	−10	0.49‡	0.36‡	6275	2449	6360	2444	0.56‡	0.46‡
Threonine, mg	3528	622	3131	1309	−11	0.47‡	0.35‡	3116	1306	3127	1319	0.59‡	0.46‡
Tryptophan, mg	1045	180	950	372	−9	0.49‡	0.40‡	946	371	955	369	0.57‡	0.47‡
Valine, mg	4549	803	4107	1629	−10	0.50‡	0.35‡	4089	1627	4121	1621	0.58‡	0.42‡
Histidine, mg	2997	547	2689	1183	−10	0.35‡	0.35‡	2671	1175	2653	1171	0.59‡	0.42‡
Arginine, mg	5515	955	4846	1919	−12	0.48‡	0.33‡	4823	1914	4845	1922	0.62‡	0.47‡
Alanine, mg	4610	804	4025	1665	−13	0.47‡	0.33‡	4008	1663	3995	1687	0.61‡	0.47‡
Aspartic acid, mg	8413	1507	7446	3072	−11	0.50‡	0.37‡	7408	3063	7433	3056	0.62‡	0.50‡
Glutamic acid, mg	15,668	2593	13,593	5198	−13	0.42‡	0.38‡	13,522	5174	13,874	5430	0.54‡	0.50‡
Glycine, mg	4074	691	3512	1459	−14	0.41‡	0.25*	3495	1455	3516	1475	0.56‡	0.47‡
Proline, mg	4605	815	4213	1638	−9	0.45‡	0.43‡	4193	1633	4323	1714	0.51‡	0.50‡
Serine, mg	4034	701	3584	1379	−11	0.50‡	0.36‡	3568	1376	3616	1375	0.56‡	0.49‡
Total amino acid, mg	85,709	14,599	75,941	30,428	−11	0.45‡	0.34‡	75,572	30,348	76,388	30,402	0.56‡	0.46‡
Ammonia, mg	1788	313	1605	603	−10	0.50‡	0.42‡	1596	600	1638	619	0.53‡	0.52‡
Median[c]						0.48	0.35					0.57	0.47
Female (validation, n = 113; reliability, n = 108)													
Total protein, g	75.0	12.8	75.8	39.5	1	0.37‡	0.26†	75.3	40.0	75.8	26.9	0.67‡	0.43‡
Isoleucine, mg	3229	561	3240	1718	0	0.37‡	0.29†	3218	1734	3248	1199	0.65‡	0.40‡
Leucine, mg	5718	985	5790	3014	1	0.39‡	0.30†	5751	3042	5805	2106	0.65‡	0.39‡
Lysine, mg	4901	896	4932	2901	1	0.33‡	0.28†	4900	2932	4908	2000	0.62‡	0.43‡
Methionine, mg	1727	300	1736	944	1	0.38‡	0.27†	1727	956	1727	663	0.64‡	0.40‡
Cystine, mg	1117	189	1111	520	0	0.40‡	0.28†	1107	526	1122	374	0.73‡	0.50‡
SAA, mg	2818	479	2821	1457	0	0.39‡	0.23*	2807	1475	2823	1022	0.66‡	0.43‡
Phenylalanine, mg	3304	567	3346	1710	1	0.39‡	0.29†	3326	1728	3362	1173	0.68‡	0.40‡
Tyrosine, mg	2518	434	2597	1341	3	0.38‡	0.30†	2582	1355	2609	941	0.66‡	0.41‡
AAA, mg	5819	1001	5947	3047	2	0.38‡	0.31‡	5910	3078	5972	2108	0.68‡	0.40‡
Threonine, mg	2939	516	2945	1612	0	0.38‡	0.27†	2927	1630	2943	1112	0.65‡	0.44‡
Tryptophan, mg	870	149	897	457	3	0.38‡	0.32‡	891	461	901	321	0.67‡	0.44‡
Valine, mg	3806	658	3873	1996	2	0.39‡	0.32‡	3849	2016	3880	1387	0.66‡	0.40‡
Histidine, mg	2449	447	2482	1443	1	0.26†	0.19*	2467	1461	2481	971	0.60‡	0.38‡
Arginine, mg	4468	802	4473	2407	0	0.39‡	0.24†	4457	2445	4491	1626	0.69‡	0.50‡
Alanine, mg	3775	672	3740	2065	−1	0.39‡	0.25†	3723	2095	3725	1394	0.67‡	0.49‡
Aspartic acid, mg	7003	1271	7049	3928	1	0.40‡	0.32‡	7012	3975	7033	2563	0.69‡	0.48‡
Glutamic acid, mg	13,299	2182	13,017	6578	−2	0.34‡	0.32‡	12,918	6618	13,089	4507	0.67‡	0.42‡
Glycine, mg	3322	582	3246	1812	−2	0.37‡	0.19*	3233	1840	3236	1246	0.68‡	0.48‡
Proline, mg	4003	680	4080	1959	2	0.36‡	0.39‡	4042	1960	4123	1477	0.63‡	0.43‡
Serine, mg	3381	582	3384	1701	0	0.40‡	0.31‡	3367	1720	3411	1211	0.68‡	0.44‡
Total amino acid, mg	71,613	12,187	71,656	37,763	0	0.37‡	0.28†	71,210	38,158	71,814	25,899	0.66‡	0.41‡
Ammonia, mg	1527	265	1551	771	2	0.38‡	0.40‡	1538	774	1555	514	0.69‡	0.50‡
Median[c]						0.38	0.29					0.67	0.43

AAA, Aromatic amino acids; FFQ, food frequency questionnaire; SAA, sulfur-containing amino acids.
Values reported in mg, unless otherwise noted.
Significance level: *$P < 0.05$, †$P < 0.01$, ‡$P < 0.001$.

[a] (FFQ mean − dietary record mean)/dietary record mean.

[b] Amino acid were adjusted for total energy intake using the residual method.

[c] Median of correlation coefficients for crude amino acids and for energy-adjusted intakes of amino acids.

food items, including 133 items that were re-analyzed or newly added to the previous edition. Nevertheless, the revised amino acid composition covered only 18% of 1878 food items in the Standard Table of Food Composition in Japan 2010.[11] Thus, we calculated amino acid intakes using the National Institute for Longevity Sciences Amino Acid Composition Table of Food (2010), which compensated for missing food items using the substitution method (e.g., using similar food or different parts of the same food) and contained 1745 food items (covering 93% of 1878 food items).[12]

Statistical analysis

The mean intakes of total protein and amino acids according to both the 28 days (14 days for Chubu PHC area) of dietary records and FFQ were calculated by sex and cohort group. Percentage differences were calculated using the following formula: difference in mean intake = (FFQ − dietary record)/dietary record. Spearman's rank correlation coefficients between intakes according to the dietary record and the FFQ were calculated for crude values and energy-adjusted values. For the residual model, the mean daily consumption of energy was calculated using the Standardized Tables of Food Composition in Japan, fifth revised and additional edition.[13] A P value < 0.05 was considered statistically significant. All statistical analyses were performed using SAS version 9.4 (SAS Institute Inc., Cary, NC, USA).

Results

The participants in the validity study included 215 subjects (102 men and 113 women) from Cohort I and 350 subjects (174 men and 176 women) from Cohort II. The mean (standard deviation [SD]) age was 55.6 (5.2) years among men and 53.3 (5.3) years among women in Cohort I, and 58.9 (7.6) years among men and 55.9 (7.1) years among women in Cohort II. The mean (SD) energy intakes on dietary records and the FFQ were 2386 (436) kcal and 2304 (654) kcal among men and 1854 (322) kcal and 1953 (800) kcal among women, respectively, in Cohort I, and 2269 (353) kcal and 2193 (651) kcal among men, and 1764 (257) kcal and 1835 (658) kcal among women, respectively, in Cohort II. Participants in the reliability study included 209 subjects (101 men and 108

Table 2
Amino acid intakes calculated using dietary record for 28 days and food frequency questionnaires in Cohort II and their correlations.

	Validation							Reliability					
	Dietary record		FFQv		% Difference[a]	Spearman correlation		FFQv		FFQr		Spearman correlation	
	Mean	SD	Mean	SD		Crude	Adjusted[b]	Mean	SD	Mean	SD	Crude	Adjusted[b]
Male (validation, n = 174; reliability, n = 143)													
Total protein, g	88	15	76	29	−14	0.28‡	0.32‡	74	27	80	31	0.60‡	0.60‡
Isoleucine, mg	3706	660	3198	1267	−14	0.27‡	0.37‡	3136	1193	3378	1341	0.60‡	0.60‡
Leucine, mg	6599	1144	5756	2231	−13	0.28‡	0.37‡	5639	2093	6075	2355	0.59‡	0.60‡
Lysine, mg	5679	1159	4867	2134	−14	0.28‡	0.31‡	4767	2046	5140	2226	0.60‡	0.57‡
Methionine, mg	2020	383	1743	706	−14	0.29‡	0.27‡	1703	674	1829	725	0.60‡	0.56‡
Cystine, mg	1296	202	1105	375	−15	0.27‡	0.42‡	1087	357	1169	422	0.60‡	0.59‡
SAA, mg	3288	573	2820	1066	−14	0.27‡	0.31‡	2763	1019	2969	1135	0.60‡	0.56‡
Phenylalanine, mg	3816	630	3314	1223	−13	0.26‡	0.41‡	3253	1148	3506	1330	0.60‡	0.62‡
Tyrosine, mg	2922	506	2575	977	−12	0.28‡	0.37‡	2525	922	2722	1050	0.61‡	0.59‡
AAA, mg	6737	1134	5891	2205	−13	0.27‡	0.40‡	5779	2071	6226	2385	0.61‡	0.60‡
Threonine, mg	3414	626	2912	1167	−15	0.28‡	0.33‡	2857	1119	3081	1245	0.60‡	0.57‡
Tryptophan, mg	1015	173	889	336	−12	0.27‡	0.39‡	872	317	940	366	0.61‡	0.62‡
Valine, mg	4379	759	3833	1476	−12	0.29‡	0.38‡	3754	1386	4041	1559	0.60‡	0.60‡
Histidine, mg	2919	648	2504	1079	−14	0.29‡	0.30‡	2423	998	2646	1130	0.60‡	0.57‡
Arginine, mg	5283	942	4446	1664	−16	0.28‡	0.31‡	4372	1610	4716	1798	0.61‡	0.52‡
Alanine, mg	4421	829	3707	1472	−16	0.28‡	0.25‡	3639	1428	3925	1577	0.61‡	0.54‡
Aspartic acid, mg	8101	1488	6846	2684	−15	0.30‡	0.36‡	6727	2571	7240	2913	0.62‡	0.57‡
Glutamic acid, mg	15,442	2450	12,954	4766	−16	0.21†	0.42‡	12,745	4484	13,745	5210	0.58‡	0.63‡
Glycine, mg	3900	717	3229	1281	−17	0.26‡	0.21†	3180	1249	3443	1380	0.59‡	0.52‡
Proline, mg	4536	738	4073	1597	−10	0.28‡	0.52‡	3996	1453	4304	1652	0.58‡	0.70‡
Serine, mg	3898	645	3358	1241	−14	0.28‡	0.43‡	3298	1180	3542	1329	0.61‡	0.61‡
Total amino acid, mg	83,070	14,248	71,020	27,238	−15	0.25‡	0.35‡	69,699	25,851	75,143	29,224	0.59‡	0.58‡
Ammonia, mg	1750	276	1515	555	−13	0.25‡	0.46‡	1492	517	1606	613	0.59‡	0.65‡
Median[c]						0.28	0.37					0.6	0.59
Female (validation, n = 176; reliability, n = 146)													
Total protein, g	72	11	71	31	−2	0.34‡	0.36‡	70	28	75	28	0.66‡	0.53‡
Isoleucine, mg	3072	496	3014	1376	−2	0.35‡	0.39‡	2987	1237	3197	1224	0.66‡	0.53‡
Leucine, mg	5460	873	5400	2417	−1	0.35‡	0.39‡	5348	2168	5717	2136	0.66‡	0.54‡
Lysine, mg	4653	811	4587	2295	−1	0.34‡	0.34‡	4527	2037	4872	2038	0.65‡	0.47‡
Methionine, mg	1631	270	1609	751	−1	0.35‡	0.31‡	1581	665	1702	644	0.66‡	0.51‡
Cystine, mg	1065	157	1023	408	−4	0.33‡	0.36‡	1013	364	1082	375	0.65‡	0.54‡
SAA, mg	2673	417	2606	1146	−2	0.34‡	0.32‡	2568	1015	2758	1005	0.66‡	0.56‡
Phenylalanine, mg	3168	490	3111	1339	−2	0.36‡	0.41‡	3085	1196	3290	1208	0.66‡	0.56‡
Tyrosine, mg	2406	381	2412	1070	0	0.35‡	0.39‡	2390	954	2553	951	0.67‡	0.56‡
AAA, mg	5580	872	5530	2405	−1	0.35‡	0.40‡	5484	2157	5850	2167	0.66‡	0.57‡
Threonine, mg	2800	449	2727	1268	−3	0.34‡	0.34‡	2693	1123	2894	1123	0.66‡	0.51‡
Tryptophan, mg	840	132	837	370	0	0.36‡	0.42‡	830	329	885	334	0.66‡	0.55‡
Valine, mg	3628	574	3599	1596	−1	0.36‡	0.40‡	3565	1441	3809	1418	0.66‡	0.55‡
Histidine, mg	2320	404	2319	1250	0	0.33‡	0.35‡	2260	992	2441	1003	0.65‡	0.51‡
Arginine, mg	4245	660	4085	1779	−4	0.34‡	0.33‡	4030	1554	4318	1632	0.68‡	0.45‡
Alanine, mg	3557	560	3419	1566	−4	0.33‡	0.29‡	3362	1370	3628	1404	0.67‡	0.47‡
Aspartic acid, mg	6676	1055	6449	2901	−3	0.35‡	0.36‡	6389	2577	6828	2734	0.67‡	0.48‡
Glutamic acid, mg	12,974	2009	12,291	5287	−5	0.32‡	0.46‡	12,221	4750	13,025	4685	0.66‡	0.59‡
Glycine, mg	3120	493	2961	1360	−5	0.29‡	0.24†	2914	1176	3145	1216	0.68‡	0.50‡
Proline, mg	3920	682	3928	1776	0	0.35‡	0.59‡	3920	1642	4160	1540	0.67‡	0.61‡
Serine, mg	3243	505	3146	1359	−3	0.37‡	0.41‡	3117	1223	3328	1204	0.66‡	0.56‡
Total amino acid, mg	68,604	10,665	66,674	29,789	−3	0.33‡	0.38‡	65,996	26,395	70,630	26,433	0.66‡	0.54‡
Ammonia, mg	1481	226	1451	618	−2	0.36‡	0.51‡	1447	556	1538	567	0.64‡	0.57‡
Median[c]						0.35	0.38					0.66	0.54

AAA, Aromatic amino acids; FFQ, food frequency questionnaire; SAA, sulfur-containing amino acids.
Values reported in mg, unless otherwise noted.
Significance level: *$P < 0.05$, †$P < 0.01$, ‡$P < 0.001$.

[a] (FFQ mean − dietary record mean)/dietary record mean.

[b] Amino acid were adjusted for total energy intake using the residual method.

[c] Median of correlation coefficients for crude amino acids and for energy-adjusted intakes of amino acids.

women) from Cohort I and 289 subjects (143 men and 146 women) from Cohort II.

Amino acid intakes calculated using dietary records and the FFQs in Cohort I and their correlation are presented in Table 1. Eighteen amino acid intakes of FFQv were lower than those of dietary records in men (differences in percentages ranged from −9% to −14%), while values were similar in women (−2% to 3%). For validity, Spearman's correlation coefficients for energy-adjusted intake for all amino acids were statistically significant ($P < 0.05$). The median (range) was 0.35 (0.25–0.43) in men and 0.29 (0.19–0.40) in women. For reliability, the corresponding values were also significant ($P < 0.0001$): 0.47 (0.42–0.52) in men and 0.43 (0.38–0.50) in women.

We also assessed the validity and reliability in Cohort II (Table 2). Differences in percentages among 18 amino acids ranged from −10% to −17% in men and 0 to −5% in women. For validity, Spearman's correlation coefficients for energy-adjusted intake for all amino acids were statistically significant ($P < 0.01$). The median (range) was 0.37 (0.21–0.52) in men and 0.38 (0.24–0.59) in women. The corresponding values for reliability were also significant ($P < 0.0001$): 0.59 (0.52–0.70) in men and 0.54 (0.45–0.61) in women.

Discussion

The purpose of this study was to examine the validity and reliability of an FFQ for assessment of amino acid intakes. The validity was evaluated by comparing the results obtained from the FFQ with those from dietary records, and the reliability was estimated by calculating the intraclass correlation coefficients between results of two FFQs among the same participants. Results using the revised Table of Food Composition showed improved validity in comparison with results using the pre-revised Table of Food Composition and good reliability of the FFQ for ranking individuals.

Dietary intakes of amino acids from the FFQ were underestimated compared with those from dietary records. The underestimation ranged from −9 to −17% in men but only 0 to −5% in women. Because women spend more time at home than men,[14] women may respond to the questionnaire more accurately than men. To the best of our knowledge, no other study has assessed the validity of the FFQ for amino acids. While an association has been reported between dietary cysteine intake, which was calculated from the FFQ, and the risk of stroke in a Swedish cohort, this study only evaluated protein intake and not dietary cysteine intake at the amino acid level.[1,15]

Using a comprehensive database of amino acids that was constructed based on the Amino Acid Composition of Foods Revised edition, which was published in 1986 as a follow-up to the fourth edition of the Standardized Table of Food Composition in Japan and included 295 food items,[16] a previous study examined the validity of the same FFQ for the assessment of amino acids.[6] Compared with the previous study, the current study, using a new database, found better validity overall. Although the validity of the FFQ among women in a previous study was low, the median of energy-adjusted correlation coefficients was improved in both Cohort I (from 0.24 to 0.29) and II (from 0.29 to 0.38).[6] In the present study, component values were still calculated using the substitution method for many food items, although the number of original food items increased from 295 to 337. As more food items are added to the Standardized Table of Food Composition in Japan, results may get even better, since the addition of new foods in the 2010 version showed improvements over the previous version.

The energy-adjusted correlations for the reliability of the FFQ to estimate amino acid intakes were 0.57 in men and 0.67 in women of Cohort I, and 0.59 in men and 0.54 in women of Cohort II. These values indicated good reliability, although the present results cannot be compared with those of the previous study because the previous study, which was based on the previous edition of the amino acid composition table in Japan, did not examine reliability.[6]

In conclusion, compared with dietary records, the FFQ used in our prospective cohort study is a suitable tool for estimating amino acid intakes in Japanese men and women of this study population.

Conflicts of interest

None declared.

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Appendix

The investigators in the validation study of the self-administered FFQ in the JPHC Study (the JPHC FFQ Validation Study Group) and their affiliations at the time of the study were: S. Tsugane, S. Sasaki, and M. Kobayashi, Epidemiology and Biostatistics Division, National Cancer Center Research Institute East, Kashiwa; T. Sobue, S. Yamamoto, and J. Ishihara, Cancer Information and Epidemiology Division, National Cancer Center Research Institute, Tokyo; M. Akabane, Y. Iitoi, Y. Iwase, and T. Takahashi, Tokyo University of Agriculture, Tokyo; K. Hasegawa and T. Kawabata, Kagawa Nutrition University, Sakado; Y. Tsubono, Tohoku University, Sendai; H. Iso, Tsukuba University, Tsukuba; S. Karita, Teikyo University, Tokyo; the late M. Yamaguchi and Y. Matsumura, National Institute of Health and Nutrition, Tokyo.

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