

**The Japanese Situation and Subjects of Health and
Nutrition-related Research in the World: Country and
Agency Rankings in Article Production**

Report Overview

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The goal of this Discussion Paper is to promote discussion in our institution and solicit feedback from the people involved.

The contents of this Discussion Paper were organised according to the authors' personal opinions. Please note that these opinions do not necessarily reflect the official views of our institution.

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1 Aims of This Research

It was found that insufficient research into the relationship between diet and disease had been undertaken for Discussion Paper No. 63, ‘Survey on the Contribution of University to “Food Industrial Cluster” and “the Research of Functional Food”’ (April 2010; NISTEP).

The Cabinet issued the ‘New Growth Strategy’ in June 2010, within which the ‘health power strategy through “life innovation”’ is described. ‘Life innovation’, along with ‘green innovation’, is about to be raised as one of the two pillars of the 4th Science and Technology Basic Plan (FY2011–FY2015), currently being discussed. Thus, the study of the relationship between diet and disease has become increasingly important.

In addition, it was revealed that a stronger foundation of human nutrition research is required, including food and nutrition research; these requirements are detailed in the report, ‘What Will Come of the Construction of the Human Nutrition Study of the 21st Century, Nutrition Study Major Graduate School, and the Nutrition Profession Graduate School?’ (July, 2003), by the Science Council of Japan and the Preventive Medicine Research Liaison Committee on Nutrition and Food Science.

It was then decided that a survey would be conducted to help clarify the current state of Japanese nutrition research, as well as the subjects of health and nutrition-related research currently being undertaken worldwide. Such survey results will also assist in building a foundation of future study on human nutrition.

2 Method of Extracting Articles for Analysis

The worldwide status of research relating to health and nutrition was analysed, using the paper-based database Scopus.

Human nutrition-related or animal experiment-related articles were chosen from journals published between 2005 and 2009. Active research institutions and their research systems were examined by analysing these articles.

First, the target journals were examined for two types of journals:

- (1) Journal titles containing the word ‘nutrition’
- (2) Medical journals that have a large number of health and nutrition-related citations in Scopus, based on the number of hits received from performing searches for the following keywords: ‘food’, ‘diet’, ‘intake’, and ‘consumption’.

Furthermore, the journals in (1) above were extracted based on criteria (a)–(c) below; those in (2) were extracted based on criteria (a) and (b) below.

- (a) Papers whose title, abstract, or cited papers contained the keywords ‘food’, ‘diet’, ‘intake’, or ‘consumption’ and were published in a journal

(b) Impact Factor of the ISI Web of Knowledge, or the Source Normalised Impact per Paper (SNIP) of Scopus

(c) Publication ratios of human research nutrition-related papers and animal experiment nutrition-related papers to all papers

Using this methodology, 13 nutrition journals (e.g. *American Journal of Clinical Nutrition*) and six medical journals (e.g. *International Journal of Obesity*) were extracted (see Chart 1). Next, 5,926 human research nutrition-related papers and 1,769 animal experiment nutrition-related papers were extracted by checking the titles and abstracts of 9,859 proposed papers that had been published in these journals.

As for the validity of analysing these journals, four experts in this field (three domestic and one international) were queried, and the objective of this research was explained to them. They offered opinions relating to the extent of the research scope of the nutrition and medical journals analysed. In response to their opinions, it was explained that the research conditions had been set so as to emphasize more on nutrition journals and on extraction-based journals, given that the volume of papers involved was becoming too large to be analysed effectively. These four experts understood these methodologies and the rationale therein, and were in agreement with them.

Chart 1 Journal list

No.	Title of journal	Proposed number of articles analyzed (ALL)	Human research nutrition related paper (H)	Animal experiment nutrition related paper (A)	H + A	ALL/ (H + A)(%)
N1	AMERICAN JOURNAL OF CLINICAL NUTRITION	1507	1351	20	1371	91.0%
N2	JOURNAL OF NUTRITION	1393	614	483	1097	78.8%
N3	NUTRITION METABOLISM AND CARDIOVASCULAR DISEASES	214	127	16	143	66.8%
N4	BRITISH JOURNAL OF NUTRITION	1490	751	467	1218	81.7%
N5	EUROPEAN JOURNAL OF CLINICAL NUTRITION	849	745	1	746	87.9%
N6	PUBLIC HEALTH NUTRITION	712	593	0	593	83.3%
N7	NUTRITION	575	281	172	453	78.8%
N8	EUROPEAN JOURNAL OF NUTRITION	281	133	84	217	77.2%
N9	NUTRITION JOURNAL	165	140	6	146	88.5%
N10	ANNALS OF NUTRITION AND METABOLISM	297	183	79	262	88.2%
N11	JOURNAL OF RENAL NUTRITION	174	103	2	105	60.3%
N12	JOURNAL OF NUTRITION EDUCATION AND BEHAVIOR	197	99	0	99	50.3%
N13	ASIA PACIFIC JOURNAL OF CLINICAL NUTRITION	318	239	8	247	77.7%
M1	AMERICAN JOURNAL OF EPIDEMIOLOGY	244	158	0	158	64.8%
M2	DIABETES CARE	224	138	0	138	61.6%
M3	JOURNAL OF APPLIED PHYSIOLOGY	217	66	38	104	47.9%
M4	ENDOCRINOLOGY	384	2	196	198	51.6%
M5	INTERNATIONAL JOURNAL OF OBESITY	333	181	71	252	75.7%
M6	DIABETES	285	22	126	148	51.9%
Sum		9859	5926	1769	7695	78.1%

3 Country and Agency Rankings: Article Production

(1) Analysis of the institutions and countries worldwide that produce articles

Because we studied which institutions and countries were producing research articles, we made ‘Ranking of the first author’s institution (number of articles, citation counts)’, ‘Ranking of the country of the first author’s institution (number of articles, citation counts)’, ‘Ranking of all institutions of authors’, and ‘Ranking of the country of all institutions of authors’ of each human research-related article and animal experiment-related article, from amongst the extracted articles. We treated data pertaining to animal experiment-related articles as complementary data, to determine

the validity of findings vis-à-vis human research-related articles; this was done on account of the limited number of papers involved.

The ranking of the first author's institution with regard to human research-related articles (i.e. number of articles) and the ranking of the first author's institution with regard to animal experiment-related articles (i.e. number of articles) are shown in Charts 2 and 3 respectively.

For human research-related articles, for example, Harvard University (in the United States) was No. 1; Western countries accounted for most of the countries in the top 20.

For Japanese institutions not ranking in the top 20, the National Health and Nutrition Research Institute ranked at 46th, while Tohoku University and Tokushima University ranked 114th and 129th respectively.

Chart 2 Ranking of the first author's institution: Human research-related articles (i.e. number of articles) ((N = 5,926))

World rank	Institution	Country/region	Number of papers	Percentage of all articles
1	Harvard University	United States	145	2.4%
2	Maastricht University	Netherlands	110	
3	University of California	United States	97	
4	Tufts University	United States	88	
5	University of Copenhagen	Denmark	85	
6	Institut national de la santé et de la recherche médicale (INSERM)	France	75	
7	University College London	United Kingdom	67	
8	University of Minnesota	United States	57	
9	University of Toronto	Canada	56	
10	Karolinska Institute	Sweden	53	14.1%
11	Johns Hopkins University	United States	49	
12	Wageningen University	Netherlands	45	
12	University of Helsinki	Finland	45	
12	Deakin University	Australia	45	
15	Institut National de la Recherche Agronomique (INRA)	France	44	
16	University of Oslo	Norway	43	
17	Laval University	Canada	41	
18	Pennsylvania State University	United States	38	
18	Lund University	Sweden	38	
18	University of Otago	New Zealand	38	21.2%
46	National Institute of Health and Nutrition	Japan	22	
114	Tohoku University	Japan	11	
129	University of Tokushima	Japan	10	

Note 1: The 'Percentage of all articles' next to No. 10 (14.1%) is the aggregate percentage for institutions from No. 1 to No. 10, in turn divided by the total number of articles (5,926); the number next to No. 18 (21.2%), similarly, is the aggregate percentage for institutions from No. 1 to No. 18, divided by 5,926.

Note 2: In this chart, separate campuses or colleges are amalgamated with their respective umbrella universities, even if some institutions count them separately.

Note 3: No. 5, University of Copenhagen merged with the Royal Veterinary and Agricultural University in January 2007. For this reason, pre-2007 papers from the Veterinary and Agricultural University were counted as those belonging to University of Copenhagen.

Note 4: Most of the papers from No. 6 (INSERM) and No. 15 (INRA) were research papers in which the first author had worked with other institutions, thus creating institutional 'overlap'.

Note 5: No. 7 University College London is not considered a part of Imperial College London, because they have been separate institutions since July 2007.

For animal experiment-related articles, the No. 1 institution was INRA; it was also responsible for most of the papers from the top Western institutions. No non-Western institution ranked highly in terms of human research-related articles; however, a Brazilian institution did rank within the top 20.

In this sense, there were differences among the institutions that appeared in the top 20, when comparing them on the basis of producing animal experiment-related articles and human research-related articles. No Japanese institution ranked within the top 20; however, Hokkaido University, Tohoku University, and Kyoto University all tied for No. 29.

Chart 3 Ranking of the first author's institution: Animal experiment-related articles (i.e. number of articles) (N = 1,769)

World rank	Institution	Country/region	Number of papers	Percentage of all articles	
1	Institut national de la santé et de la recherche médicale (INSERM)	France	74	4.1%	
2	University of California	United States	42		
3	Tufts University	United States	23		
4	University of Illinois	United States	21		
5	University of Wisconsin	United States	20		
6	Texas A and M University	United States	19		
7	University of São Paulo	Brazil	18		
7	Martin Luther University of Halle-Wittenberg	Germany	18		
7	Pennsylvania State University	United States	18		
7	Harvard University	United States	18		15.3%
11	French Institute of Health and Medical Research (INSERM)	France	17		
12	University of Alberta	Canada	15		
12	University of Manitoba	Canada	15		
12	University of Aberdeen	United Kingdom	15		
15	University of North Carolina	United States	13		
16	McGill University	Canada	12		
16	State University of Campinas	Brazil	12		
16	University of Barcelona	Spain	12		
19	University of Texas	United States	11		
19	University of Helsinki	Finland	11		
19	University of Granada	Spain	11		
19	Baylor College of Medicine	United States	11		
19	University of Nottingham	United Kingdom	11	24.7%	
29	Hokkaido University	Japan	9		
29	Tohoku University	Japan	9		
29	Kyoto University	Japan	9		

Note 1: The 'Percentage of all articles' next to No. 7 (15.3%) is the aggregate percentage for institutions from No. 1 to No. 7, in turn divided by the total number of articles (1,769); the number next to No. 19 (24.7%), similarly, is the aggregate percentage for institutions from No. 1 to No. 19, divided by 1,769.

Note 2: In this chart, separate campuses or college are amalgamated with their respective umbrella universities, even if some institutions count them separately.

Note 3: Most of the papers from No. 1 (INRA) and No. 11 (INSERM) were research papers in which the first author had worked with other institutions, thus creating institutional 'overlap'.

The rankings of the countries of the first author's institution with regard to publishing human research-related articles and animal experiment-related articles (i.e. numbers of articles) are shown in Charts 4 and 5 respectively. The No. 1 country in terms of human research-related articles and animal experiment-related articles was the United States; Japan, meanwhile, ranked No. 9 in the former and No. 2 in the latter.

Next, rankings were tabulated for the first author's institution and country of

institution, with regard to human research-related articles and animal experiment-related articles (i.e. a citation index). Some institutions' rankings with regard to number of citations were higher relative to their ranking vis-à-vis numbers of articles—for example, the German Institute of Human Nutrition Potsdam-Rehbruecke (number of articles: No. 41; citation index: No. 11).

In addition, rankings were tabulated for all authors' institutions, and for the countries in which all authors' institutions are located. The results thereof were similar to those found in Charts 2–5, with some slight differences.

Chart 4 Ranking of country of first author's institution: human research-related articles (i.e. number of articles) (N = 5,926)

Chart 5 Ranking of country of first author's institution: animal experiment-related articles (i.e. number of articles) (N = 1,769)

World rank	Country/region	Number of papers	Percentage of all articles	World rank	Country/region	Number of papers	Percentage of all articles
1	United States	1591	26.6%	1	United States	521	30.1%
2	United Kingdom	525		2	Japan	162	
3	Australia	326		3	France	144	
4	Netherlands	302		4	Canada	105	
5	Canada	267		5	Spain	93	
6	Germany	230		6	United Kingdom	86	
7	Spain	219		7	Brazil	70	
8	France	218		8	Germany	63	
9	Japan	195		9	China	61	
10	Italy	185	68.5%	10	Korea	57	77.0%
11	Sweden	179		11	Taiwan	39	
12	Denmark	152		12	Australia	37	
13	Finland	151		13	Italy	35	
14	China	115		14	Netherlands	34	
15	Brazil	107		15	India	32	
16	Norway	89		16	Denmark	23	
17	Greece	86		17	Switzerland	20	
18	India	82		18	Argentina	19	
19	New Zealand	77		19	New Zealand	16	
20	Iran	70	87.2%	20	Belgium	15	92.3%

Note: In Chart 4, the 'Percentage of all articles' next to No. 10 (68.5%) is the aggregate percentage for institutions No. 1 to No. 10, in turn divided by the total number of articles (5,926). The number next to No. 20 (87.2%), similarly, is the aggregate percentage for institutions No. 1 to No. 20, divided by 5,926; The figures in Chart 5 were tabulated in the same manner.

(2) Analysis of Japanese institutions that produce articles

Furthermore, rankings were tabulated solely for institutions within Japan, in order to examine Japanese contributions more closely. The ranking of the first author's institution with regard to producing human research-related articles (number of articles) and the ranking of the first author's institution with regard to animal

experiment-related articles (number of articles) in Japan are shown in Charts 6 and 7 respectively.

No. 1 for the first author's institution with regard to human research-related articles was the National Institute of Health and Nutrition, while No. 1 with regard to animal experiment-related articles was Hokkaido University. The differences between these two modes of ranking were slight.

Next, rankings were tabulated for the first author's institution, with regard to the production of human research-related articles and animal experiment-related articles (i.e. a citation index).

Some companies—like Kao Corporation—increased rankings with regard to the number of citations, compared to rankings with regard to human research-related articles.

In addition, rankings were tabulated for the institutions of authors. These rankings were similar to those seen in Charts 6 and 7, with some slight differences. Moreover, published articles were extracted where the first author's institution was located in Japan. Analysis was performed for all 881 authors of those papers. Each author's rate of contribution to the body of articles was also tabulated by examining weight changes in the order of the author of each article. On the other hand, the following steps were also performed: the first authors and corresponding authors were extracted only, and each author's rate of contribution to the body of articles was tabulated with more weight being accorded to the first author than to contributing authors. The results thereof indicated that authors that belong to research institutions (i.e. from independent administrative institutions, schools of medicine, or faculties of medicine of national universities) tended to make large contributions. It was also found that authors belonging to private companies or a department of nutrition of a women's university also made sizeable contributions.

Chart 6 Ranking of the first author's institution:
Human research-related articles (Japan) (i.e.
number of articles) (N = 195)

Rank	Institution	Number of papers
1	National Institute of Health and Nutrition	22
2	Tohoku University	11
3	University of Tokushima	10
4	Tokyo University	9
5	Cao Corporation	8
6	National Cancer Center	7
6	University of Tsukuba	7
8	Kyushu University	5
8	Niigata University	5
10	National Institute of Public Health	4
10	University of Toyama	4
10	University of Shizuoka	4
10	Gifu University	4

Chart 7 Ranking of the first author's institution:
Animal experiment-related articles (Japan) (i.e.
number of articles) (N = 162)

Rank	Institution	Number of papers
1	Hokkaido University	9
1	Tohoku University	9
1	Kyoto University	9
4	National Food Research Institute	8
4	Kyushu University	8
6	University of Shizuoka	6
6	Kao Corporation	6
8	Shizuoka University	5
8	Obihiro University of Agriculture and Veterinary	5
10	National Institute of Health and Nutrition	4
10	Tokyo University of Agriculture	4

4 Research Systems of Agencies that Produce Health and Nutrition-related Research Articles

We analysed the research systems of agencies that produce health and nutrition-related research articles—for example, Harvard University and the like—while considering balance of countries. Chart 8 summarises data pertaining to departments or divisions of the world's top agencies in producing human research-related articles. These results indicated that most articles were produced by departments of nutrition, divisions of nutrition, faculties of medicine, or faculties of agriculture; most articles related to public health, even if there were differences among the institutions.

Additionally, it was found that there were differences among universities in terms of departments or divisions of nutrition, owing to the interdisciplinary nature of nutrition studies.

Chart 8 Data from departments or divisions of the world's top agencies that produce human research-related articles

Institution		Country	Public Health	Medicine	Agriculture	Other
Harvard University		United States	Many papers have been produced by Department of Nutrition, Harvard School of Public Health.	Papers have been produced by Department of Nutrition, Harvard Medical School.		Many papers have been produced by Department of Medicine, Brigham and Women's Hospital.
University of California	Davis	United States	<i>The Master of Public Health has not produced any papers.</i>	Papers have been produced by Department of Medical Pathology and Laboratory Medicine.	<ul style="list-style-type: none"> Many papers have been produced by Department of Nutrition, College of Agricultural and Environmental Science. Papers have been produced by USDA Western Human Nutrition Research Center, Department of Nutrition. 	Paper was produced by the Graduate Group in Nutrition Biology , a cooperative interdepartmental organization of more than 73 faculty from 17 departments in two colleges (Agricultural and Environmental Sciences and Letters and Science) ; and the Division of Biological Science) and two professional schools (Medicine and Veterinary Medicine).
University of California	Los Angeles	United States	Papers have been produced by School of Public Health.	Papers have been produced by Center for Human Nutrition, David Geffen School of Medicine.		
Tufts University		United States	Papers have been produced by Nutrition/Infection Unit, Department of Public Health and Community Medicine, School of Medicine.			<ul style="list-style-type: none"> Many papers have been produced by Jean Mayer USDA Human Nutrition Research Center on Aging. Papers have been produced by Gerald J. and Dorothy R. Friedman School of Nutrition Science and Policy.
Maastricht University		Netherlands	<ul style="list-style-type: none"> Many papers have been produced by Nutrition and Toxicology Research Institute Maastricht, Faculty of Health, Medicine and Life Science. Paper has been produced by School for Public Health and Primary Care, Faculty of Health, Medicine and Live Science. 			
University of Copenhagen		Denmark	<i>The Department of Public Health, Faculty of Health Science has not produced any papers..</i>	Papers have been produced by Institute of Preventive Medicine, Faculty of Health Science.		
University of Toronto		Canada	Paper has been produced by Department of public Health Sciences, Research Institutem Hospital for Sick Children.	Many papers have been produced by Department of Nutrition Sciences, Faculty of Medicine.	Many papers have been produced by Department of Human Nutrition, Faculty of Life Sciences which had inherited Department of Nutrition, Royal Veterinary	

Institution	Country	Public Health	Medicine	Agriculture	Other
Karolinska Institute	Sweden	Papers have been produced by Department of Public Health Sciences .	Many papers have been produced by Nutritional Epidemiology, Division of Epidemiology, Institute of Environmental Medicine .		
University College London	United Kingdom	<ul style="list-style-type: none"> Many papers have been produced by Department of Epidemiology and Public Health, Royal Free and University College London Medical School. Paper has been produced by Department of Paediatric Epidemiology, Institute of Child Health. 			Papers has been produced from Institute of Child Health .
King's College London		Paper has been produced by Department of Public Health Sciences, School of Medicine .	Many papers have been produced by Department of Nutrition and Dietetics, School of Biomedical and Health Sciences .		
London School of Hygiene and Tropical Medicine		Papers have been produced by Nutrition and Public Health Intervention Research Unit, Department of Epidemiology and Population Health .			
University of Helsinki	Finland	Papers have been produced by Department of Public Health, Faculty of Medicine .	Papers have been produced by Institute of Clinical Medicine, Faculty of Medicine.P	<ul style="list-style-type: none"> Many papers have been produced by Division of Nutrition, Department of Applied Chemistry and Microbiology, Faculty of Agriculture and Forestry. Papers have been produced by Department of Clinical Chemistry, Faculty of Veterinary Medicine. 	

Note 1: INSERM was not included in this chart, because its departments could not be distinguished.

Note 2: Two schools were included that had produced many articles on behalf of the University of California.

5 Situations in the Major Countries that Produce Health and Nutrition-related Research Articles

For each country that ranked within the top 30 according to the first author's institution that produces human research-related articles, the No. 1 article-producing institution in that country was determined. In France, Japan, India, and South Africa, that top-ranking institution was a research institution. However, the No. 1 article-producing institution in most countries was a university, although the list contained some medical colleges like the Karolinska Institute in Sweden.

Most article-producing departments were departments of medicine or life science. However, a division of nutrition has been established in each of the following: Department of Agriculture, University of Bonn (Germany); University of Milan (Italy); and University of Helsinki (Finland).

Each country that ranked within the top 30 according to the first author's institution that produces human research-related articles, was studied for the number

of articles produced each year. Eighteen countries—including the United States, Australia, and the Netherlands—had ratios exceeding 100% for 2005–2009 and ratios exceeding 100% for 2009–2008. Especially noteworthy are China and India, whose growth ratios for 2005–2009 were 277% and 256% respectively—each of which indicates a 2.5-fold or greater growth. On the other hand, Japan’s growth ratio for 2005–2009 was above 100%, but that for 2008–2009 was below 100%.

6 Discussion

(1) Situation of health and nutrition-related research in the world

Western institutions ranked highly in terms of the first author’s institution in producing human research-related articles. Especially noteworthy was the United States, which ranked four institutions within the top 10 and ranked No. 1 in terms of countries, thus demonstrating its overwhelming strength in this research area.

Looking at the results of ranking the countries of the first author’s institution in producing human research-related articles (i.e. number of articles), Sweden, Denmark, Finland, and the Netherlands were found to have produced many articles. This trend became prominent as a result of standardising articles by population, the number of researchers, and the total internal research budget. As far as Asian countries are concerned, China and India are each increasing remarkably in prominence. China might overtake Japan, although Japan has produced more articles than any other Asian country.

Within each of the top 30 countries, the No. 1 article-producing institution was usually a university or college: Harvard University, in the United States; University of Toronto, in Canada; Peking University, in China; University of São Paulo, in Brazil; and Seoul National University, in South Korea. These universities have established departments of nutrition; divisions of nutrition within faculties of medicine (or medical schools), public health, or agriculture; or they have institutions or centres that are at the same level as a faculty. In the long run, these universities hope to maintain or increase the number of articles they produce.

(2) Comparison of Japan and foreign countries on health and nutrition-related research

Looking at the top-ranking countries in terms of publishing human research-related articles, departments or divisions of nutrition within universities possessing a human nutrition research and training department or division were predominant. On the other hand, within the upper ranks, Japan has only the University of Tokushima and the University of Shizuoka, each of which has a division of nutrition. As mentioned earlier, in many countries, the ‘big producers’ of articles tended to be universities that have departments or divisions of nutrition. This result suggests that education on

human nutrition is not adequate in Japan—in other words, it can be said that Japan is not satisfactorily fostering research in human nutrition.

Although the study of nutrition has not been emphasised in Japan historically, that considered, one could say that Japan has ranked exceptionally highly (i.e. No. 9) in terms of the country of the first author's institution in producing human research-related articles (i.e. number of articles).

In examining the rankings, faculties of medicine among local national universities in Japan have produced many articles; it is conceivable that a relatively small number of researchers who place emphasis on human nutrition have been eagerly producing articles, in isolation, even if their university does not have a department or division of nutrition. However, the human resources needed to undertake the next wave of research have not been developed in Japan, and so Japan's No. 9 ranking is probably not sustainable in the longer term.

(3) The subjects of health and nutrition-related research in Japan

There is the strong possibility that an expansion in health and nutrition-related research in Japan could contribute to worldwide health, given that Japan has attracted worldwide attention as a country of longevity.

While policy changes enacted by the Japanese government have led to 'life innovation', the volume of research in Japan into diet and health issues will need to increase in the future. The 'Japanese diet' has attracted considerable attention from around the world, despite the fact that there is no consensus as to what exactly constitutes this diet and little evidence that it even contributes to longevity. All these unanswered research questions are in line with the fact that human research-related articles have been produced mostly by Western research institutions, resulting in Japan's relatively lower world ranking.

In human nutrition science, it was necessary to use research results imported from Western countries, owing to a shortage of Japanese research results. It may not be sufficient to apply to Japanese the conclusions derived by Westerners in Western locations.

It can be presumed that China and South Korea may have increased their research output in recent years, given their sense of 'crisis' that Western countries hold too much power in the various areas of human nutrition research.

As mentioned earlier, even if someone wants to study human nutrition in Japan, researcher-training universities (i.e. undergraduate, postgraduate) are severely lacking in both quantity and quality currently. Human nutrition is a highly interdisciplinary academic discipline; it involves various sciences, and it is a documented science found on many websites of the world's top universities. To mitigate Japan's aforementioned quantity–quality issues, schools of medicine, public health, and the like should create mixed teams of researchers from various university schools

and departments. By doing so, undergraduate and postgraduate schools of human nutrition could be created that can offer professional-level nutrition education.

There are some good models that Japanese institutions can follow in creating strong nutrition-research bodies. For example, University of California, Davis (human nutrition ranking: No. 3) has a Graduate Group in Nutritional Biology, which is a cooperative interdepartmental organisation containing more than 73 faculty members from 17 departments. Another is the University of Chile (human nutrition ranking: No. 52) has the Instituto de Nutrición y Tecnología de Alimentos (INTA) as a multidisciplinary and multiprofessional centre. Many countries have increased the number of articles produced by investing people and money in human-nutrition initiatives; the population of the country is clearly not a determining factor.

Therefore, Japan must take steps as soon as possible to place more focus on human nutrition, for the good of both itself and the future of humanity.

(4) Study limitations of this survey, and future research subjects

We extracted journal information by placing great emphasis on nutrition journals, in light of the volume of proposed articles analysed. For medical journals, we extracted journals reporting on diabetes and endocrinology, given that the Impact Factor of ISI Web of Knowledge or the SNIP of Scopus was large and contained numerous published papers, and because we could not extract journal reporting on cardiovascular disease or cancer. In future research, we might extract from a wider array of journals by broadening the Impact Factor criterion and analysing more medical journals.

Nutrition journals were not extracted on the basis of certain areas of nutrition (e.g. enteral nutrition), as it was not always possible to meet such extraction criteria. In future research, we might extract and analyse articles that touch upon these specialty fields. Although the current study treats animal experiment-related articles as comprising complementary data, we might be able in the future to place more emphasis on animal experiment-related articles by extracting journals that cite keywords relating to experimentation involving the use of animals.

In truth, if one were to review all the possible and viable research subjects, it would involve analyses of many times the number of papers 10,000 papers; such analysis incurs considerable time- and effort-costs. However, such analysis is integral to advancing meaningful research agendas, and academic societies must look to engage in such research, if they are to realise further developments in the area of human nutrition.