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Food Composition Database in Korea

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The food composition database is used to evaluate the nutritional value of foods in Korea. It is used as a source for basic data in many fields, not only for the establishment of the National Food Supply Plan but also for nutritional research, to aid in the drafting of the National Food Policy, and in clinical and epidemiological research. The database is also used by institutional and commercial food services and by the food processing industry among others. In 1970, the Rural Development Administration(RDA) published the "Korean Food Composition Table" for the first time and it has since become the established authority on food composition for the entire nation. The latest published food composition table (the 6th edition, published by the National Rural Living Science Institute, KDA) covers 2,337 kinds of foods and consists of two volumes. The National Rural Living Science Institute, the Korea Food and Drug Administration, and the National Fisheries Research and Development Institute have continuously improved production of food composition data in Korea. As consumers have grown more interested in the quality and safety of foods and raw agricultural products, we can expect even further development of food composition data through improvements in quality and increases in quantity. We need to develop more comprehensive food composition data by diversifying the kinds of foods that are included, unifying analytical methods, and increasing the number of nutrients covered. Moreover, food composition data must be modified in other ways to make for a better food composition database for the convenience of users.

Key words : Food, Composition, Nutrients, Database, Analysis

INTRODUCTION

The Food Composition Database consists of the basic data used to evaluate the nutritional value of foods in Korea. It consists of the basic data used in many fields, not only for the establishment of the National Food Supply Plan but also for nutritional research, the drafting of the National Food Policy, and in clinical and epidemiological research.

Every nation in the world establishes recommended dietary allowances in order to promote national health, and formulates plans concerning food production and supply so that people can meet their daily allotments[1]. Each country also publishes a food composition table giving information about the nutrient content of its food and processed foodstuffs.

The first food composition table was published in 1878 by a German named Konig and the practice was established by two Americans, Mr. Atwater and Mr. Woods, in 1896. Since then, in line with the development of analytical technology, food composition tables have improved in quality and quantity. Every nation in the world uses its own food composition table covering its most common foods. As the volume of such data expands, the variety of food composition tables has developed such that there now exists a Nutrient Database. There are a wide variety of Food Composition Tables, from those printed in simple booklets to those on CD-ROM and on the Web.

In Korea, Food Composition Table, which is published by the National Rural Living Science Institute every five years, lists the nutrient content of all foods in terms of the raw agricultural products and processed foodstuffs used to produce them[2-8]. This is the basic data that is used to evaluate the nutritional value of foods in Korea. It is used as the basic data in many fields, not only for the establishment of National Food Supply Plan but also for nutritional research, the drafting of the National Food Policy, and in clinical and epidemiological research. The database is also used by institutional and commercial food services and the food processing industry. As consumers around the world grow even more interested in the quality and safety of foods and raw agricultural products, we can expect further development of the National Standard Table for food composition through supplementation of its quantity and quality.

FOOD COMPOSITION DATABASE IN KOREA

1. History of 『Food Composition Table』

A. Statement of publication

In 1970, the Rural Development Administration published

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the "Korean Food Composition Table" for the first time and it has since become the established authority on food composition for the entire nation[2]. Thereafter, beginning with the 3rd revision in 1986[5], a revised edition was published every five years by the National Rural Nutrition Institute (forerunner of the National Rural Living Science Institute), RDA. The National Rural Living Science Institute published the 6th edition of the food composition table (Table 1)[8]. The Nutrient Database is readily available via the Internet and can be used for dietary intake measurements, for the evaluation of national food balance and for various other types of work.

Table 1. Itemized statement of Korean food composition table

Food composition table	Published Year	Publishing Organization
First edition	1970	Rural Development Administration (RDA)
1st revision	1977	〃
2nd revision	1981[1)]	National Rural Nutrition Institute, RDA
3rd revision	1986	〃
4th revision	1991	〃
5th revision	1996	National Rural Living Science Institute, RDA
6th revision	2001	〃

1) Published in every 5 years after 2nd revision in 1981

B. Contents of food composition

The food composition table is compiled after analyzing new food products and new food combinations in which the public has shown interest. The quality of the food composition table was enhanced by adding data on amino acids in the 1st revision[3], data on fatty acids, cholesterol, vitamin B6 and B12 in the 2nd revision[4], data on vitamin E in the 4th revision[6], and data on vitamin D, dietary fiber and micronutrients in the 5th revision[7].

The number of foods in the table has increased in line with the cultivation of new plants, discovery of edible plants in the wild, the development of processed food and health-enhancing products, and increases in the importation of agricultural products from abroad. The reason for increasing the number of nutrients covered in the food composition table is to increase the number of nutrients in recommended dietary allowances and to boost interest in micronutrients, which are reported to boost physical well-being in addition to general health (Table 2).

The 1st edition contained data on the nutrient analysis of 476 kinds of food products supported by FAO Korea, the Korean Nutrition Society and the Korean Applied Nutrition Program under the supervision of the Rural Development Administration with the support of UNICEF, FAO, and WHO[2]. This data was quoted in the annals of America and the FAO. The food products are classified into 14 groups and recorded food compositions include calories, proximate composition, three kinds of minerals (calcium, phosphorus, iron) and five kinds of vitamins (vitamin A, B1, B2, C, Niacin). Vitamin A was indicated using the unit, IU.

A total of 541 kinds of foods were recorded in the 1st revision (1977) on the basis of the 1st edition published in 1970, and 65 new varieties of rice, imported konjak, butter, and instant curry were added. The content of amino acids was also included.

Products in the 2nd revision of the food composition table included 815 kinds of food, of which 203 were fish and shellfish[4]. There was a subdivision of 17 categories and the content of vitamin A was applied to the RE (Retinol Equivalent) parallel with IU and the calorie unit of measurement was changed to kcal. The contents of vitamin B6, B12, folic acids, pantothenic acids, amino acids, fat acids, sodium, and cholesterol were recorded in volume II.

A total of 1,080 kinds of food was included in the 3rd revision (1986)[5]. In this revision, the groups of food products were arranged in alphabetical order. Potassium composition was added in volume II.

A total of 1,426 kinds of food were included in the 4th revision (1991)[6]. The contents of sodium and potassium moved to volume II from volume I. Calories were indicated as energy and placed in the first column, with water as the first nutrient.

Table 2. Revised statement of Korean food composition table

Recorded Contents	The number of recorded food products (kinds)						
	1st edition('70)	1st revision('77)	2nd revision('81)	3rd revision('86)	4th revision('91)	5th revision('96)	6th revision('01)
<Volume 1>							
Proximate composition, minerals, vitamin	476	541	815	1,080	1,426	2,163	2,337
<Volume 2>							
Amino acids	-	163	185	185	251	437	577
Fatty acids	-	-	40	40	164	280	480
Cholesterol	-	-	17	53	164	280	296
Vitamin E	-	-	-	-	165	293	721
Dietary Fiber	-	-	-	-	-	203	202

A total of 2,163 kinds of food, with the addition of cooked processed foods[7], were included in the 5th revision (1996) and arranged into 18 groups. Vitamin A contents were converted into RE. contrast to the serial number system used in the 4th revision, foods were classified in either a large or small class of food products in the 5th revision. In volume II, nine kinds of micronutrients such as dietary fiber, magnesium, manganese, and copper were added.

In the 6th revision (2001), volumes I and II were published separately. In volume I, 2,337 kinds were included under the categories of proximate composition, minerals, vitamins and so on[8]. In volume II, special vitamins, amino acids, fatty acids, and mineral composition in infinitesimal quantities were included.

2. Food Composition Table (6th revised edition)

The latest published food composition table (the 6th edition) consisted of volumes I and II. Proximate composition, 2,337 kinds of minerals and vitamins were included in volume I and special vitamins, amino acids, fatty acids and micro minerals were included in volume II[8]. Contents were as follows.

< Volume I >

A. Recorded Foods

1) Scope of recorded foods

Concerning commonly used products, Volume I includes many kinds of foods that are cultivated in large quantities throughout Korea. Specifically, it compares the vegetables grown in greenhouses with those grown outdoors, fish and shellfish in nature as opposed to fish bred for commercial use, and meats by part, by-products and processed products. Food products were grouped into the categories of raw, dried, boiled, steamed and fried.

2) Classification & arrangement of foods

2.1) Classification & arrangement of food groups

The foods were categorized into 18 groups as follows: Ⅰ. Cereals Ⅱ. Potatoes and starches Ⅲ. Sugar and sweeteners Ⅳ. Pulses Ⅴ. Nuts and Seeds Ⅵ. Vegetables Ⅶ. Mushrooms Ⅷ. Fruits Ⅸ. Meats Ⅹ. Eggs Ⅺ. Fish and Shellfish Ⅻ. Seaweed ⅩⅢ. Milk ⅩⅣ. Oils and fats ⅩⅤ. Beverages ⅩⅥ. Seasonings ⅩⅦ Prepared foods ⅩⅧ. Others.

2.2) Food Arrangement

Foods were arranged in alphabetical order according to their Korean names within the same food groups. Also, different lettering styles were used to indicate that food products belonged in the natural food or processed food categories.

2.3) Food Numbering

Unlike in the 5th revision, the food number system rather than the consecutive number system was applied to the large and small classifications in each group of food products. In the large classification, foods were assigned consecutive two-digit numbers and were ordered under the heading, Food Group (01~18) while in the small classification, foods were assigned a three-digit number.

2.4) Food Name

The names of foods were written in Korean and English.

3) Source of Food Composition Data

The major data in this revision were quoted from the composition table of the Korea Marine Products (National Fisheries and Development Institute)[9], the Korea Foods Composition Table (National Korea Food & Drug Administration)[10], the Journal of the National Institute of Health (National Institute of Health)[11], the Report on Nutrition Improvement in Korean Rural Areas (Rural Nutrition Institute)[12], the Research Report on Rural Living Science (Rural Living Science Institute)[13], the 6th Revision of Recommended Dietary Allowances for Koreans (The Korean Nutrition Society)[14], the Standard Tables of Food Composition in Japan (Resources Council, Science and Technology Agency)[15], the Composition of Foods (United States Department of Agriculture)[16], and the Foods Composition Table for Use in East Asia (FAO and U.S. Department of Health, Education and Welfare)[17]. The source of quoted data was described in the form of "Cited Documents (Published Year)" on the data resource

B. Nutrients Composition

The arrangement and items in the nutrients composition were the same as in the 5th revision and the contents of the food composition were given in edible portions of foods per 100g. Energy was indicated to the integral number, proximate composition to the first decimal place, calcium, ash, sodium, potassium out of mineral composition to the integral numbers, and iron to the first decimal place. Vitamin A (RE, Retinol, beta-carotene) was indicated to the integral number, vitamin B1 and B2 to the second decimal place, and vitamin C and refuse % to the integral number.

1) Energy

Energy was calculated by using the FAO/WHO energy conversion factor according to the kind of food, energy conversion factor on the basis of the experimental results of energy measurement by the Japanese, and the Atwart energy conversion factor.

2) Protein

Protein was generally determined by quantification of nitrogen and the adoption of different nitrogen coefficients depending on the food.

3) Carbohydrates (Non-fibrous, fiber)

The value of carbohydrates was measured according to the standard means of calculation. However, in the 5th edition ('97,'00) of The Standard Tables of Food Composition in Japan, the value of fiber was included in the measurement for carbohydrates, and the number in parenthesis represented other analytical data or data in the 4th edition (1982)[15] of The Standard Tables of Food Composition in Japan.

4) Vitamin A

Vitamin A was expressed as the value of total vitamin A, retinol, and beta-carotene, and total vitamin A content represented the value after converting to R.E. (Retinol Equivalent).

<Volume II>

1) Vitamin B_6, Pantothenic acid, Vitamin B_{12}, Folic Acid, Vitamin D, Vitamin E, Vitamin K

Data was mostly sourced from "The 5th revision of Standard Tables of Food Composition in Japan (Resources Council, Science and Technology Agency, 2000)". The newly added vitamin K was sourced from "The 5th revision of Standard Tables of Food Composition in Japan (Resources Council, Science and Technology Agency, 2000)[15]" and the "Composition of Foods (United States Department of Agriculture)[16]". For some foods, vitamin B_6, B_{12}, pantothenic acid, and folic acid were sourced from the "Composition of Foods (United States Department of Agriculture)" and the "Foods Composition Table for Use in East Asia (FAO and U.S. Department of Health, Education and Welfare)[17]", vitamin D from "The 4th revision of Standard Tables of Food Composition in Japan "Follow-up Research Report on Vitamin D in Japanese Foods (1993, Community of Resource Research of Science & Technology Association)", vitamin E from "The 4th revision of Standard Tables of Food Composition in Japan: Research Report II-Fat Soluble Nutrients Table of Japanese Food(Resources Council, Science and Technology Agency, 1989)[15]".

2) Amino acids

The amino acid content of 307 kinds of common foods was cited from the "Report on the Analysis Research of Special Food Composition in Domestic Natural Foods Resources" (Rural Development Administration, 2000)[18]. Data on 144 items were added along with that on 163 kinds of food sourced from abroad. The amino acid content [mg amino acids/per 100g edible portion] of fish and shellfish was mostly sourced from the data of the Composition Table of Korea Marine Products (National Fisheries and Development Institute, 1995)[9], and those of other foods were sourced from the 4th revision of the Standard Tables of Food Composition in Japan: Follow-up Research Report-the Revision of Amino Acids Table in Japanese Foods (Resources Council, Science and Technology Agency, 1986)[15]".

3) Fatty acids and Cholesterol

The data on fatty acids and cholesterol were replaced and new information added from the "Research on Analysis of Special Foods Composition of Domestic Natural Foods Resources (RDA, 2000)[18]" and the "DB Constructing Business of Foods Composition Analysis of Fatty Acids (Korea Health Industry Development, 2001)[19]".

4) Dietary Fiber

The data on dietary fiber were sourced from domestic reports and "The 4th Revision of Standard Tables of Food Composition in Japan: Research Report IV-Vegetable Fiber in Japanese Foods (Resources Council, Science and Technology Agency, 1992)[15]".

5) Micro nutrients

The data on micronutrients in foods was sourced from "The 5th Revision of Standard Tables of Food Composition in Japan (Resources Council, Science and Technology Agency, 2000)" and the "Foods Composition Table for Use in East Asia (FAO and U.S. Department of Health, Education and Welfare)", "The 4th Revision of Standard Tables of Food Composition in Japan: Follow-Up Research Report III-Table of Mineral Contents in Japanese Foods (Resources Council, Science and Technology Agency, 1991)[15]", and the "Composition of Foods (United States Department of Agriculture)[16]".

3. Analytical Method of Food Composition

Water was mostly measured by weighing the reduction after drying. Protein was calculated by multiplying "nitrogen-protein conversion factors" by nitrogen quantity on the basis of "the law of Semimicro Kjeldahl". Lipid was measured using the "Soxhlet method" along with the ether or acid decomposition method. Ash was analyzed using the "direct ashing method" and carbohydrate was calculated by subtracting the contents of water, protein, lipid, and ashes from 100. We measured crude fiber according to the A.O.A.C. method[20].

Mineral contents were analyzed after treatment using either the "wet separation method" or the "dry ashing method." All minerals except phosphorus were analyzed using A.A. or I.C.P. Phosphorus content was measured

using colorimetric analysis". Vitamin A and carotene were analyzed by using "Colorimetric analysis" and HPLC. Vitamin B1 was measured using the "Thiochrom Fluorescence method" and C was analyzed as total Vitamin C quantity using "colorimetric analysis" (2, 4DNP). Niacin was measured using "colorimetric analysis" or the testing of a microscopic organism.

4. Food Nutrient Data Base by Portions Commonly Used

In 2002, the 'Food Nutrient Database by portions commonly used' was developed by using the following steps[21]. Selecting foods and dishes commonly consumed by Korean adults aged 20-64 years, analyzing the sizes of one portion and standard recipes, and calculating their nutritional value in terms of energy and 12 nutrients. The raw data of the 1998 National Health and Nutrition Survey was used as research materials[22].

Food nutritional values based on standard portions can be used by consumers to plan a balanced diet and to apply diet therapies in the treatment of obesity and food-related degenerative diseases such as diabetes mellitus, hypertension, etc. The booklet on nutritional values based on standard portions, which includes color pictures of standard portion sizes for each food or dish, is also helpful as a tool for consumer nutrition education.

The standard portion sizes for common foods and dishes in this study, drawn from the 1998 National Health and Nutrition Survey, will become basal data in the development of standard portion sizes in the Korean food guide tower, on food and nutrition labeling, and in the institutional and commercial food service system[22]. And standard recipes for common Korean dishes can be compiled using the recipes that result from this study.

CONCLUSION

The production of food composition data in Korea has been continuously improved by the National Rural Living Science Institute, the Korea Food and Drug Administration, and the National Fisheries Research and Development Institute. However, there are still many challenges such as the diversity of foods, lack of unity in analytical methods, and distrust of the data. Although "The food composition table" in Korea has been continuously improved in terms of the quantity and quality of its contents, the number of foods included is lower than those of food composition tables in Japan and the United States and the number of nutrients remains unsatisfactory.

Despite these limitations, the government uses the food composition table on Korean food as the basic data for the establishment of policies related to food and public health, and it is also used by businesses in the food industry. Moreover, it is indispensable for evaluating the quality of foods and agricultural products. For these reasons, a food composition database needs to be developed systematically at the national level.

The National Rural Living Science Institute, RDA was appointed as a Contact Point of MASIAFOODS of INFOODS (The International Network of Food Data System), an institute for the publication of professional and reliable food composition data. In the future, we expect not only to exchange data and information among nations via INFOODS but also to acquire new technology through an interchange of human resources. Through these steps, we hope to improve the quality of food composition data and food composition tables around the world.

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