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Note

Improved Analytical Precision of 1,4-Dihydroxy-2-naphthoic Acid by High Performance Liquid Chromatography Using Dithiothreitol as Mobile Phase Additive

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1,4-dihydroxyl-2-naphtoic acid (DHNA) is a bifidogenic growth stimulator from *Propionibacterium freudenreichii*. According to a method described earlier, the peak area of DHNA measured by a high-performance liquid chromatography (HPLC) gradually increases with repeated analyses of the same sample. We hypothesized that the oxidizability of DHNA was the cause of poor precision. Therefore, we attempted to develop an improved method using DL-dithiothreitol (DTT) as a mobile phase additive. A DHNA standard solution (5 μg/ml) was analyzed five times in a row by either the original or the improved method. The relative standard deviation (R.S.D.) of the peak area was 37.0% and 1.6%, respectively. The linearity of the improved method was confirmed in the range of 0.25-10 μg/ml (R^2 = 0.9998). These data indicate that the addition of DTT to the mobile phase improves precision of the analysis of DHNA by HPLC.

Keywords: 1,4-dihydroxyl-2-naphtoic acid (DHNA), HPLC analysis, dithiothreitol (DTT), mobile phase additive

Introduction

Bifidobacteria play important roles in enhancing digestive health and preventing disease (reviewed by Picard *et al.*, 2005). Kaneko *et al.* (1994) have found that *Propionibacterium freudenreichii* (*P. freudenreichii*) produced a bifidogenic growth stimulator (BGS), which promoted the specific growth of bifidobacteria. 1,4-Dihydroxy-2-naphthoic acid (DHNA) is a major BGS found in the culture broth of *P. freudenreichii* ET-3 (Isawa *et al.*, 2002). It has been reported that ingested culture of *P. freudenreichii* ET-3 improves the condition of the human intestine (Satomi *et al.*, 1999; Hojo *et al.*, 2002).

In previous papers, a reversed-phase high performance liquid chromatography (HPLC) method has been used to quantify DHNA concentration (Isawa *et al.*, 2002; Furuichi *et al.*, 2006). According to their method, we performed an analysis of DHNA in food samples. However, we observed poor precision, even in a series of analyses of exactly the same sample; the peak area of DHNA of the same standard solution was found to gradually increase with repeated analyses. Therefore, it is difficult to analyze DHNA contents accurately by the previous method. For a reliable food analysis, the accuracy and precision of measurement need to be improved. DHNA is structurally similar to vitamin K hydroquinone (Fig. 1). Vitamin K hydroquinone is known to be readily oxidized to vitamin K (Bell, 1982; Jarabak and Jarabak, 1995). In the same way, DHNA was easily oxidized to a quinone form (Isawa *et al.*, 2004). We hypothesized that the oxidizability of DHNA was the cause of poor precision. In this study, we described an improved HPLC method using a mobile phase containing DL-dithiothreitol (DTT) as an antioxidant.

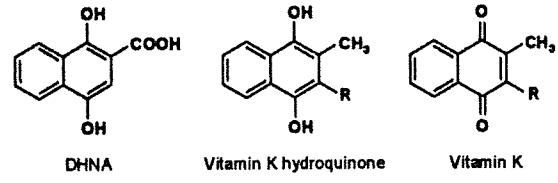

Fig. 1. Chemical structure of DHNA, vitamin K hydroquinone and vitamin K.

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Materials and Methods

Apparatus A Shimadzu liquid chromatographic system (Kyoto, Japan) consisting of an SCL-10A system controller, LC-10AD pump, SPD-10A UV-vis spectrophotometric detector, CTO-10A column oven, DGU-14A degasser and C-R7A Chromatopac was used. Capcell pak C18 MG (4.6 i.d. × 150 mm, 5 μm, Shiseido fine chemicals, Tokyo, Japan) with a guard column of Capcell pak C18 MG (4.6 i.d. × 35 mm, 5 μm) was used for both the original and improved methods.

Chromatographic conditions of original method This method followed the original method reported in previous papers (Isawa *et al.*, 2002; Furuichi *et al.*, 2006). HPLC conditions were: mobile phase, acetonitrile:methanol:water:acetate (15:25:190:0.1, v/v/v/v, adjusted to pH 5.5 with NH_4OH); flow rate, 1.0 ml/min; temperature, 45°C; detection wavelength: 254 nm. A concentrated solution (1000 μg/ml in methanol) of DHNA (Wako Pure Chemical Industries, Ltd., Osaka, Japan) was freshly prepared. Standard solution of DHNA (5 μg/ml) was prepared by diluting the concentrated solution in methanol:0.5% (w/v) sodium ascorbate (Wako Pure Chemical Industries, Ltd.) aqueous solution (1:1, v/v). Twenty microliters of this standard solution kept on ice was injected.

Improved chromatographic conditions HPLC conditions were: mobile phase, methanol:water:acetic acid (50:49:1, v/v/v) containing 50 mg/l DTT (Sigma, MO, USA); flow rate, 1.0 ml/min; temperature, 45°C; detection wavelength, 254 nm. The concentration of DTT was determined by preliminary experiments to be sufficient to inhibit pseudo-increases in peak areas. Twenty microliters of standard solution kept on ice was injected.

Standard solution and calibration curve for improved method Standard DHNA solutions of 0.25, 0.5, 1, 2, 5 and 10 μg/ml were prepared by diluting the concentrated solution (1000 μg/ml in methanol) with HPLC mobile phase, *i.e.*, methanol:water:acetic acid (50:49:1, v/v/v), containing 50 mg/l DTT. A calibration curve was constructed by plotting the peak area versus concentration, and slope along with the intercept and correlation coefficients for the calibration curve were determined. Each point was analyzed in triplicate.

Results and Discussion

A DHNA standard solution (5 μg/ml) was analyzed five consecutive times by previously reported method (Isawa *et al.*, 2002; Furuichi *et al.*, 2006). The peak area of DHNA increased about three-fold during these analyses, and did not yet reach a plateau (Fig. 2-A). The relative standard deviation (R.S.D.) of the peak area was 37.0%. Thus, the original method was not adequate for accurate determination. As mentioned in the Introduction, DHNA is readily oxidized, and so the standard solution used in the original method contained ascorbate, which can prevent DHNA oxidation (Hayashi and Yasuda, 2005). However, once it was injected into the HPLC column, DHNA and ascorbate were separated. We concluded that: 1) part of the DHNA is oxidized in the column to give the peak area of DHNA that is less than the actual value; 2) at the same time, some type of oxidizing substrate in the column is consumed; and 3) with repeated analyses, the peak area increases to the actual level according to the decrease in oxidizing substrate in the column.

Therefore, we attempted to use a mobile phase containing

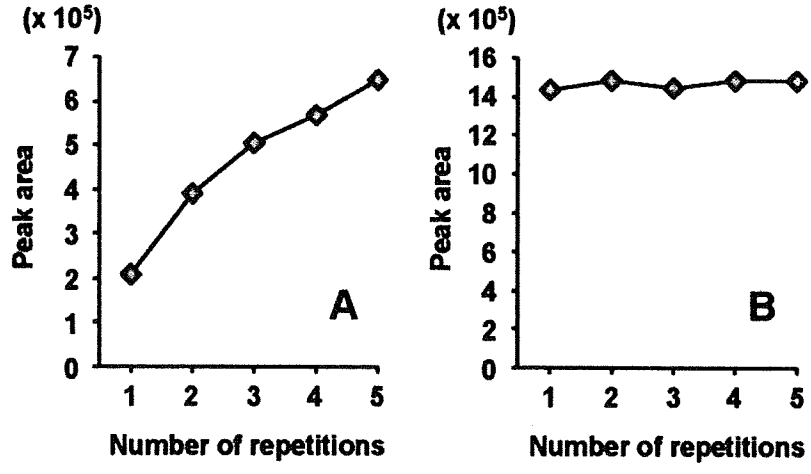

Fig. 2. Repeated analysis of DHNA standard solution (5 μg/ml) using original method (A) and improved method (B).

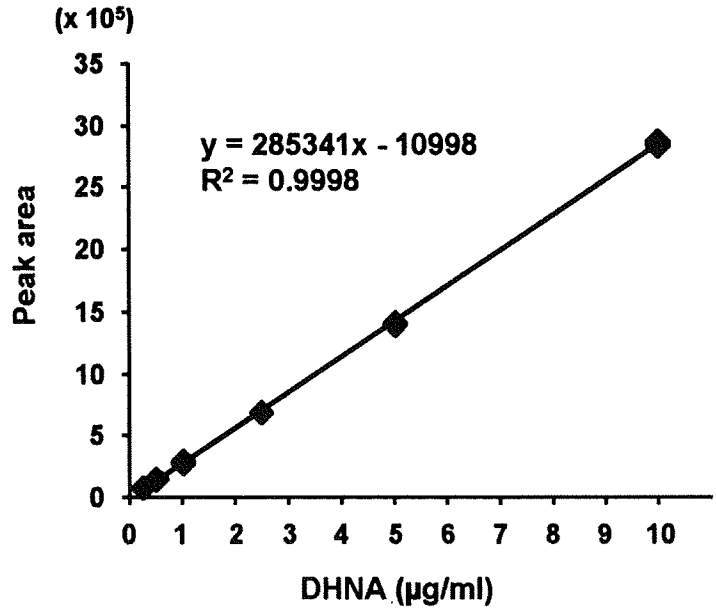

Fig. 3. Calibration curve of DHNA using improved method.

an antioxidant in order to prevent DHNA from oxidizing in the column. Ascorbate was not suitable for this purpose, because ascorbate has strong absorption at the detection wavelength (254 nm) and instability of ascorbate causes drift in the chromatographic baseline. For this reason, we used DTT as a relatively stable antioxidant with low absorbance at 254 nm. By using a DTT-containing mobile phase, reproducibility of the peak area of the standard solution was greatly improved, and the R.S.D. of the peak area was 1.6% (Fig. 2-B). The linearity of this improved method was evaluated by the correlation coefficients (R^2) of the calibration curve (Fig. 3). Linear curve fitting was applied to calculate the calibration curve in the range of 0.25-10 μg/ml. Excellent linearity was obtained between the peak area (y) and the corresponding concentrations (x). The R^2 of the calibration curve was 0.9998.

Sufficient accuracy and precision are necessary for reliable analysis. To analyze DHNA precisely, the reproducibility of the previous HPLC method was insufficient. We found that DTT as a mobile phase additive greatly improved the precision to perform accurate analysis. Addition of antioxidants to a mobile phase appears to be one way of improving the precision of analyses of easily oxidized compounds by HPLC. This study represents the first step toward accurate HPLC analysis of DHNA in foods. We validated the precision and linearity of our HPLC analytical method. The application of this method to food analysis is our next goal. Optimization and validation of the method, including extraction and pretreatment procedures, remain to be investigated.

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Use of Dietary Supplements among Preschool Children in Japan

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Summary This study was conducted to examine the characteristics and use of dietary supplements by preschool children in Japan. A survey was conducted among 2,125 parents of preschool children to discover the status of dietary supplement use and their attitudes towards supplement use by their children. Logistic regression models were used to determine which characteristics predict supplement use in this population. For detailed characterization, child supplement users were also categorized as either the users of vitamins and minerals only or the users of other supplement components. For parents of non-user children, the parent's knowledge and attitudes toward supplements for children were investigated. Fifteen percent of children had used dietary supplements. Two parent-related factors were especially important, the frequency with which they referred to nutritional labels and their own supplement use, which had a significant encouraging effect on their children's supplement use. The parents of child supplement users showed limited awareness of the government system concerning diet and food, placed safety over efficacy, selected products with natural ingredients, and did not seek consultations with professionals. These parents, especially those who were aware of the specially designed supplements for children, exhibited positive responses to supplement use by their children. It is likely that parents' knowledge and attitudes toward dietary supplements and nutrition have a striking effect on their children's use of supplements. Unfortunately, their knowledge at present was less than satisfactory. More accurate information on nutrition, dietary intake and dietary supplements must be disseminated.

Key Words dietary supplements, preschool children, Japan

Foods with health-promoting effects have been increasingly desired in recent years, and dietary supplements have been attracting attention in many countries throughout the world. In Japan, the market for dietary supplements has grown rapidly with the distribution of numerous products (*1*, *2*), but the environment surrounding dietary supplements is not well-organized. There is no clear definition of dietary supplements in Japan, and individuals apply their own interpretation of these products. However, it is understood that in general the term "supplement" corresponds to what are called dietary supplements in the United States.

The Japanese government regulates supplements and functional foods in two categories (*3*). One is Food for Specified Health Uses (FOSHU), and the other is Food with Nutrient Function Claims (FNFC), which contains vitamins and minerals that have accumulating scientific evidence for their safety and efficacy as in the Dietary Reference Intakes (*4*), and corresponds to dietary supplements in the United States. However, most of the products on the market are neither FOSHU nor FNFC and exist as general foods, without clear monitoring of their number and usage, which often contain ingredients that lack scientific evidence for their safety and efficacy (*5*, *6*). The Japan Health Food and Nutrition Food Association, an organization that represents the associated industries, has voluntarily prepared safety standards to guarantee the quality of such foods and places a JHFA (Japan Health Food Authorization) mark on their products. Unfortunately, the market for products with the JHFA mark seems to be small.

The number of adult supplement users in Japan has recently become larger and larger, as in the United States and other developed countries (*7–10*). According to recent studies in various areas of Japan, 55% of men and 61% of women have used supplements (*10*). The purpose of their use was for health maintenance, nutritional replenishment, beauty, and the prevention of illness. The respondents favored capsules and tablets; obtained their information from television, the Internet,

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merchandize fliers, and family or relatives; and purchased the supplements at pharmacies, drug stores, or through the Internet (*11–14*). Furthermore, the prevalence of supplement use is highest in the elderly; women; and individuals with a lower BMI, greater physical activity, a higher frequency of eating out, or high stress levels (*10, 15*).

Supplements are enriched with specific components such as vitamins, minerals, and other natural substances. The use of supplements would be beneficial for supplementation of a substance when its dietary intake is inadequate; however, adverse effects may be induced due to inappropriate use, the use of substances with little scientific evidence for their safety and efficacy, intake for disease prevention/curing without consultation with health professionals, and the use by high-risk-groups such as children and pregnant women.

Children, especially young children, are more vulnerable to the adverse effects of substances like dietary supplements. Therefore, taking supplements should be considered high risk for young children. In addition, young children are in the process of forming healthy dietary habits, so reliance on supplements may result in a disregard for the importance of healthy daily eating habits. In the United States where the use of supplements by adults became popular earlier than in Japan, it has been reported that supplement use by children is common and is being extended to infants (*16–23*). In those studies, it was shown that about 30 to 50% of children take supplements and that the factors that affect their use are families with higher incomes, only one child, or dietary problems, parents with a high education level, and parent's use of supplements. However, it remains unclear which factors enhance the use of supplements by children.

It is anticipated that the use of supplements by children will increase in Japan. However, there are no reports on supplement use by young children in Japan. Thus, in this study a questionnaire was administered to observe the current status of supplement use and the characteristics and factors that relate to the use of supplements in preschool children.

SUBJECTS AND METHODS

Subjects. The subjects of the survey were 2,125 parents of children attending 21 cooperating kindergartens and day-care centers (7 kindergartens and 14 day-care centers) located in 7 prefectures (Aomori, Yamagata, Ibaraki, Tochigi, Chiba, Saitama, and Kagawa) from May through September 2007. In Japan, kindergartens and day-care centers provide pre-school care and educational services. The former are schools for children 3 y of age or older where they are cared for, for an average of 4 h a day. The latter are child welfare facilities where infants and young children, even those younger than 12 mo of age, are taken care of while their parents are working. They are generally cared for for 8 h a day, which may be adjusted to suit their parents' work schedules. Responses were obtained from 1,533 parents (effective recovery rate: 72.1%), among which 96.5% were women, and 72.6% were in their 30s. Completion of the survey was considered informed consent. This study was conducted with the approval of the Research Ethics Committee of the National Institute of Health and Nutrition of Japan.

Questionnaires. Our descriptive study used an anonymous, self-reported survey. The questionnaire was distributed at kindergartens and day-care centers. Arrangements were made to have the sheets collected at each kindergarten or day-care center and mailed to the party conducting the survey. The questionnaire topics were as follows.

The characteristics of the parents and their children were obtained including: The parents' sex and age (in decades), the children's age, number of siblings, birth order, and social environment (kindergarten or day-care center). Home income and parent's education level were not investigated because we believe that such questions would have decreased the recovery of responses.

Parents' and children's dietary supplement use: Considerable confusion is unavoidable because there is no set definition for dietary supplements in Japan. In the current survey, they were defined as those food substances that were in a tablet, capsule, powder, granule, extract, or chewable tablet form, according to the definition similar to dietary supplements in the United States. The use of supplements by parents and children was defined by the following four categories: "daily use," "occasional use," "past use," and "have never used." Later in the study, the last category was renamed the "supplement non-users" while the others were grouped as "supplement users."

Parents' attitudes towards diet: Using The National Health and Nutrition Survey in Japan, 2004 (*24*), questions were posed on dietary problems and the desire for improvement as an expression of the parents' awareness of the issues concerning their children's diet. The extent of the use of nutritional labels was used to interpret the parents' interest in diet. To assess their level of knowledge about food, questions were asked about their awareness of the standard dietary intake and the dietary balance guide. This standard dietary intake refers to the "Dietary Reference Intakes for Japanese, 2005" (*4*), which was formulated by the Ministry of Health, Labour, and Welfare of Japan. This standard is designed to show the optimum amounts of energy and five types of nutrients for Japanese to consume according to their gender and age to maintain and promote their health, as well as to prevent energy and nutrient deficiencies, life-style-related diseases, and disorders due to excessive intake. The dietary balance guide (*25*) was prepared by the Ministry of Health, Labour, and Welfare and the Ministry of Agriculture, Forestry, and Fisheries of Japan: it shows an ideal diet and estimates the amounts of food to be consumed, with easy-to-understand illustrations so that the Japanese population will learn the basis of good eating habits.

The state of supplement use among children: The following topics were addressed with those children who

Table 1. Logistic regression analysis of characteristics associated with the number of children using supplements.

Characteristic	Children[a]			Characteristic considered[b]		
	Supplement users[c] % (*n*)	Supplement non-users % (*n*)	*p* value	Odds ratio	95% CI	*p* value
Total	15.0 (228)	85.0 (1,288)				
Age[d]	4.38±1.0	4.16±1.3	<0.01	1.13	0.98–1.31	ns[e]
Number of siblings[d]	1.98±0.7	1.97±0.7	ns			
Birth order			ns			
First	55.1 (125)	55.0 (705)		0.96	0.55–1.68	ns
Second	33.9 (77)	34.3 (440)		0.87	0.49–1.53	ns
Third or later	11.0 (25)	10.6 (136)		1.00		
Social environment			<0.01			
Kindergarten	71.9 (164)	59.3 (764)		1.51	1.03–2.22	<0.05
Day care center	28.1 (64)	40.7 (524)		1.00		
Area[f]			ns			
Tohoku	41.2 (94)	42.3 (545)		0.86	0.34–2.15	ns
Kita-Kanto	33.3 (76)	33.9 (436)		1.04	0.43–2.53	ns
Kanto	21.1 (48)	18.6 (239)		1.13	0.44–2.87	ns
Shikoku	4.4 (10)	5.3 (68)		1.00		
Sex of interviewed parents			ns			
Male	3.1 (7)	2.6 (34)		2.07	0.80–5.32	ns
Female	96.9 (220)	97.4 (1,253)		1.00		
Age of parents			ns			
<30	9.7 (22)	13.8 (178)		0.90	0.46–1.74	ns
30–39	74.0 (168)	72.5 (932)		0.97	0.61–1.52	ns
≧40	16.3 (37)	13.7 (176)		1.00		
Dietary problems			ns			
Many	10.9 (24)	9.2 (117)		1.66	0.93–2.94	ns
Some	63.3 (140)	62.3 (789)		1.16	0.80–1.68	ns
Non	25.8 (57)	28.5 (361)		1.00		
Desire to improve			ns			
Wish to improve	68.4 (154)	63.0 (800)				
All right as I am	24.0 (54)	24.3 (309)				
Have not considered	7.6 (17)	12.7 (161)				
Use of nutritional labels			<0.01			
Always	13.2 (30)	7.9 (102)		2.62	1.32–5.20	<0.01
Occasionally	51.8 (118)	44.0 (566)		1.90	1.11–3.23	<0.05
Rarely	25.4 (58)	27.4 (352)		1.78	1.01–3.14	<0.05
Never	9.6 (22)	20.7 (266)		1.00		
Dietary reference intake			ns			
Aware of contents	17.4 (39)	18.8 (240)		0.74	0.41–1.34	ns
Have heard about it	69.6 (156)	65.9 (843)		1.11	0.69–1.79	ns
Do not know	12.9 (29)	15.4 (197)		1.00		
Dietary balance guide			ns			
Aware of details	19.7 (44)	19.0 (242)				
Have heard about it	56.5 (126)	55.7 (710)				
Do not know	23.8 (53)	25.3 (323)				
Parents' supplement use			<0.01			
Daily	24.0 (53)	9.7 (120)		13.55	6.75–27.21	<0.01
Occasional	44.3 (98)	24.4 (302)		9.61	5.00–18.49	<0.01
Past	26.2 (58)	35.3 (437)		4.14	2.12–8.09	<0.01
Never	5.4 (12)	30.6 (378)		1.00		

[a] Categorical variables: *p* value calculated by χ^2 test. Continuous variables: *p* value calculated by *t*-test. The missing values were excluded.
[b] Logistic regression analysis.
[c] The users include "daily use," "occasional use," and "past use."
[d] Mean±SD.
[e] ns: not significant.
[f] Tohoku: Aomori and Yamagata, Kita-Kanto: Ibaraki and Tochigi, Kanto: Saitama and Chiba, Shikoku: Kagawa.

use supplements: how old were they when they began to take supplements, the types of ingredients in the supplements (Vitamin/Mineral and others), the form of the supplement, the purpose of their use, their source of information, the place where the supplements were purchased, what cautions were exercised when purchasing the supplements, and their impression of the effects of the supplement.

The attitudes of the parents of the non-supplement-using children toward supplements: The following questions concern those children who do not use supplements: the extent of knowledge of the parent about supplements that are specially prepared for children, the age at which the use of supplements should be approved, the probability of their future use, and their attitude towards supplement use by children.

Statistical analysis. The characteristics of the users of the children's supplements were compared against those of the non-users. The children using the supplements were divided into two groups: one that had experience of using only vitamins and minerals (the Vitamin-Mineral group) and one that had experience of using other components (the non-Vitamin-Mineral group), and a comparison was made based on the status of their use. To compare the parents' attitudes toward supplement use, those who did not give supplements to their children were stratified by the extent of their agreement with the concept of supplements for children. For inter-group comparisons, a *t*-test was performed for continuous variables, and the χ^2 test was used for categorical variables.

Logistic regression was performed to determine which factors (area, social environment, gender of the parent, age of the parent, age of the child, birth order, diet problems, use of nutritional labels, extent of awareness of dietary reference intakes, or parent's supplement use) predicted children's supplement use. These factors did not show any correlation in an evaluation of the multiple covariance among the tested variables, using Spearman's rank correlation coefficient ($\gamma<0.4$). The data were analyzed using SPSS 15.0J for Windows and HALBOU 7, and the level of significance was set at $p<0.05$.

RESULTS

Supplement use in parents and their children

The experience of supplement use by children was as follows: 2.1% ($n=32$) in the "daily use" group, 7.0% ($n=106$) in the "occasional use" group, 5.9% ($n=90$) in the "past use" group, and 85.0% ($n=1,288$) in the "have never used" group. Similarly, the experience of use by their parents was 11.8% ($n=173$) in the "daily use" group, 27.5% ($n=402$) in the "occasional use" group, 34.0% ($n=498$) in the "past use" group, and 26.7% ($n=391$) in the "have never used" group. These 4 groups of supplement use were indicative of the purchasing attitude of the parents; thus, the data were subjected to the Kruskal-Wallis test. The analysis revealed no difference among the 3 groups of "daily use," "occasional use," and "past use." Accordingly, the 3 groups were designated as the "users" group and the "have never used" group was designated as the "non-users" group in the remaining part of the study.

Characteristics of dietary supplement users

Table 1 shows the characteristics of the children who use supplements. No significant differences were noted in terms of the number of their siblings, birth order, place of residence, gender or age of the parents. However, the mean age in children was significantly higher in the users than in the non-users ($p<0.01$). The proportion of supplement users in kindergarten was also significantly higher than that in day-care centers ($p<0.01$). In the parents' evaluation of their children's dietary habits and their desire to improve them, more than half admitted to the existence of many or some problems, and their wish to improve them. These parents' attitude, however, did not influence the children's use of supplements. The reference to nutritional labels by parents during dining out or food shopping was significantly higher in the child users than in the non-users ($p<0.01$). Less than 20% of parents were aware of the Dietary Reference Intakes (4) and the Dietary Balance Guide (25), which provide basic information about nutrition and diet and were established by the Japanese government. Parents' awareness of this basic knowledge did not relate to the use of supplements by their children. There was a significant ($p<0.01$) relationship between parents' and children's supplement use.

Multivariate regression analysis revealed that three characteristics were independent predictors of children's supplement use (Table 1). These included the affiliation of children, parents' use of nutritional labels, and parents' supplement use. In particular, the more often the parent referred to nutritional labels and the higher the amount of supplements the parents used, the more frequently their children took dietary supplements. The present study failed to show any correlation between birth order, the children's age, the parents' evaluation of their diet or their desire for improvement.

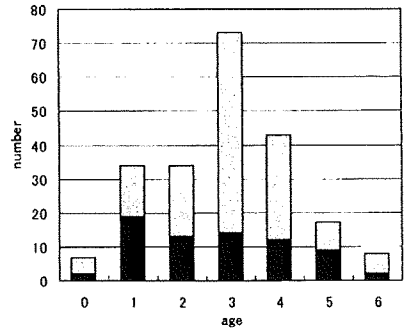

Fig. 1. Number and age of children that started using supplements: a comparison of two categories of supplements. □Vitamin-Mineral Supplement group: mean±SD=4.23±1.574 y. ■Non-Vitamin-Mineral Supplement group: mean±SD=3.88±1.736 y. $t=1.464$; $p=0.146$.

Table 2. Status of supplement use by children.

	Vitamin-Mineral Supplement group % (*n*)	Non-Vitamin Mineral Supplement group % (*n*)	*p* value[a]
Total	67.5 (154)	32.5 (74)	
Frequency of use			ns[b]
Past	43.5 (67)	31.1 (23)	
Occasional	45.5 (70)	48.6 (36)	
Daily	11.0 (17)	20.3 (15)	
Dosage form[c]			
Tablet	40.0 (58)	48.5 (32)	ns
Capsule	4.3 (6)	30.4 (21)	<0.01
Powder	6.2 (9)	15.9 (11)	<0.05
Granule	15.9 (23)	11.6 (8)	ns
Extract	0.7 (1)	1.4 (1)	ns
Chewable	55.2 (80)	43.5 (30)	ns
Purpose of use[c]			
Nutritional supplement	70.1 (101)	57.4 (39)	ns
Health promotion	20.8 (30)	41.2 (28)	<0.01
Disease prevention	12.5 (18)	35.3 (24)	<0.01
Body constitution	9.7 (14)	19.1 (13)	ns
Correcting constipation	7.6 (11)	4.4 (7)	ns
Physical strength	4.9 (7)	8.8 (6)	ns
Physical stamina	2.8 (4)	5.9 (4)	ns
Management of a chronic condition	1.4 (2)	2.9 (2)	ns
Observed/Noted at purchase[c]			
JHFA[d] mark (as a quality certificate)	12.1 (17)	6.0 (4)	ns
Extensively marketed	8.5 (12)	7.5 (5)	ns
Well-known manufacturer	24.1 (34)	14.9 (10)	ns
Natural materials	33.3 (47)	49.3 (33)	<0.05
Inexpensive	18.4 (26)	17.9 (12)	ns
Nutritional labels	41.8 (59)	43.3 (29)	ns
Without additives	35.5 (50)	40.3 (27)	ns
Non-allergenic	10.6 (15)	11.9 (8)	ns
Foods for Nutrient Function Claims	34.0 (48)	28.4 (19)	ns
Important points when purchasing			ns
Efficacy	9.7 (14)	7.4 (5)	
Safety	88.2 (127)	89.7 (61)	
Neither	2.1 (3)	2.9 (2)	
Consulted with:[c]			
Pharmacist	11.8 (17)	11.8 (8)	ns
Nutritionist	3.5 (5)	1.5 (1)	ns
Physician	6.3 (9)	10.3 (7)	ns
Store clerk	15.3 (22)	8.8 (6)	ns
Family and relatives	17.4 (25)	16.2 (11)	ns
Acquaintances and friends	17.4 (25)	29.4 (20)	<0.05
None	45.8 (66)	42.6 (29)	ns
Precautions for use[c]			
Observe specified quantity	74.3 (107)	71.6 (48)	ns
Do not take more than 2 types of supplements	11.8 (17)	13.4 (9)	ns
Eat regular meals	59.0 (85)	58.2 (39)	ns
Nothing in particular	10.4 (15)	6.0 (4)	ns
Felt efficacy			<0.05
Yes	37.9 (53)	53.7 (36)	
No	62.1 (87)	46.3 (31)	

[a] *p* value calculated by χ^2 test.
[b] ns: not significant.
[c] Multiple answers allowed within the category (percentage of those who selected).
[d] JHFA: Japan Health Food Authorization, which certifies the quality of health foods.

Table 3. Attitude of parents of non-supplement-using children towards supplement use.

	Awareness of supplements for children		p value
	Aware group % (n)	Unaware group % (n)	
Total	30.5 (359)	69.5 (818)	
Allowable age[a]	13.1±5.7	14.7±6.0	<0.01
Opinion of children's use[b]			<0.01
Allowable	19.0 (68)	12.1 (98)	
Only if absolutely necessary	70.3 (251)	74.4 (603)	
Should not be used at all	10.6 (38)	13.6 (110)	
Possible to give own child[b]			<0.01
Yes	44.6 (160)	32.2 (263)	
No	55.4 (199)	67.8 (554)	

[a] Mean±SD, p value calculated by t-test.
[b] p value calculated by χ^2 test.

and the children's experiences with supplement use.

Details of supplement use by children

Sixty-eight percent of child supplement users (n=154) took vitamins and minerals only, and the remaining (32.5%, n=74) were users who had experience of non-Vitamin/Mineral supplements. The five most reported non-Vitamin/Mineral supplements were fish oil (44.6%), xylitol (10.8%), proteins (9.5%), herbs (8.1%), and vinegar (4.1%). More of the non-Vitamin/Mineral group than the Vitamin/Mineral group had started using supplements at one year old, but the mean age at first use was similar in both groups (Fig. 1).

The details of supplement use by children were compared with regard to the Vitamin/Mineral and non-Vitamin/Mineral groups (Table 2). The frequency of supplement use was most often described by both groups as "occasional," but a number of children responded "daily." The most frequently used forms of supplements were chewable or ordinary tablets in both groups. The capsules and powder forms were more popular in the non-Vitamin/Mineral group than in the Vitamin/Mineral group. Many products used were labeled "For children" or "May also be used by children," but some parents gave their children products "that were identical to those prepared for adults" (22.4%) or for which were "not certain about their suitability for children" (3.3%). Nutritional supplementation was the most prevalent purpose given by both groups. Unlike the Vitamin/Mineral group, health promotion and prevention of diseases were also frequent purposes given by those in the non-Vitamin/Mineral group. There were no significant differences between the two groups in the sources of information obtained; the major sources of which were over the counter (34.0%), acquaintances and friends (30.1%), and newspapers and magazines (12.9%).

The products were purchased mainly at pharmacies (41.7%) or via mail order (37.4%). Notable differences between the two groups were as follows: the presence of nutritional labels, the absence of food additives, and foods with nutrient function claims (in descending order) were noted by the Vitamin/Mineral group, while the use of natural materials was frequently cited by those in the non-Vitamin/Mineral group. At the time of purchasing, both groups emphasized the importance of safety (more than 80%).

In giving supplements to children, most parents did not seek consultation from others, especially from health professionals such as pharmacists, nutritionists, or physicians. Any consultation, if it was sought, was from family and relatives, acquaintances, and friends, which were more prevalent consultants in the non-Vitamin/Mineral group than in the Vitamin/Mineral group (p<0.05). The precautions taken for use were "Observe the specified quantity" for more than 70%, and "Eat regular meals" for almost 60%. More parents in the non-Vitamin/Mineral group than in the Vitamin/Mineral group gained a feeling of the efficacy of the supplement used (p<0.05).

Attitude of parents of non-supplement-using children toward supplement use

Among the parents whose children were supplement non-users, 30.5% (n=359) were aware of the existence of supplements that have been specially designed for children. The former were designated as the "aware group" and the latter as the "unaware group," and these categories were used for further analysis (Table 3). The allowable age for using supplements ranged widely (1 to 60 y), with the mean age being significantly higher in the unaware group (p<0.01). More parents in the aware group than in the unaware group approved the use of supplements by children (p<0.01) and stated that they may give their children supplements in the future (p<0.01).

DISCUSSION

Dietary supplements, which are specific enriched components such as vitamins, minerals, and other natural substances, have received great attention worldwide. Such supplements allow the easy intake of a spe-

cific substance, but adverse effects may occur in cases of inappropriate use, especially in such use by young children, who are one of the high-risk-groups and therefore are more susceptible to adverse reactions. So far, there have been no reports on supplement use by preschool children in Japan. Thus, a survey was conducted in the present study to clarify the factors and characteristics related to the use of supplements among the children in 7 prefectures.

The present research has several inherent limitations. The subjects of this study did not represent the population of the entire country; thus, the results cannot be applied to the Japanese population as a whole. All of our data were self-reported, leading to the possibility that the respondents may have misreported some data. Furthermore, the survey is cross-sectional and does not allow for causal inferences. Finally, because of constraints related to respondent burden, we were unable to collect information about the parent's education and income. However, to our knowledge, this is the first report to observe supplement use in preschool children in Japan, and the results provide important information about how we can face problems related to the use of supplements by children.

As Table 1 shows, the prevalence of supplement use was 15% among young children up to the age of 6 y, indicating that the supplement use among young Japanese children is not as prevalent as in the United States (*17, 20, 22, 26–28*). There are supplements that have been specially designed for children, but 69% of the parents of the supplement non-user children were unaware of the existence of such supplements. Therefore, the lack of awareness of children's supplements may be one reason for the low prevalence of children's supplement use in this survey. The supplement use by adults in the United States has been increasing (*19, 29–31*) and similar trends, although somewhat delayed, have been observed in Japan (*7–9*). The parents who were aware of the existence of children's supplements generally displayed an affirmative approach to children's supplement use. Such attitudes were evident in setting a low minimum age at which they started using supplements and in showing a strong likelihood to provide their children with supplements. Accordingly, it is expected that children's supplement use will expand in the future along with growing awareness of the existence of children's supplements, and use by babies and cases of addiction might be expected to occur as well.

In the present study, it was found that three factors are related to the promotion of supplement use by children (Table 1). These included the affiliation of the children (kindergartens versus day-care center), nutritional label use by parents, and parents' supplement use. In particular, parents who used supplements on a daily basis were 14 times more likely to give supplements to their children than the parents who did not use them. This observation coincided well with previous reports from the United States (*20, 32, 33*), indicating that the effect of the parents' history of supplement use is marked. These findings were expected because children cannot decide about the use of supplements by themselves; therefore, children's supplement intakes are totally dependent on their parents' action.

Those parents who spent more time with their children (who attended kindergartens only for a short time) and those parents who referred to nutritional labels in selecting food were more likely to give their children supplements. These results are similar to the results of previous studies (*32, 34*), suggesting that the level of parents' interest towards nutritional balance, diet, and the welfare of their children relate to the use of supplements by their children. The parents' interest or sense of responsibility, rather than their pursuit of a way to take in nutrients, may lead to them supplying supplements to their children.

This questionnaire revealed two problems: the use of non-vitamin/mineral supplements and misunderstandings about the use of supplements by parents. Supplements should be used to supply ingredients that are in short supply in everyday meals. If the substances are vitamins and minerals, the evaluation of potential shortages can be made properly in general, because many of the nutrients have the adequate intake level and upper limit as the Dietary Reference Intakes (*4*) and are permitted to be labeled as Nutrient Function Claims (FNFC) by the Japanese government (*3*). On the other hand, the ingredients of non-Vitamin/Mineral often have poor evidence for their efficacy or safety and require particular care in their use. Thus, we divided the supplements into two categories (Vitamin/Mineral versus others ingredients) to analyze this survey. As a result, 32.5% of the child supplement users had experience in taking supplements that consisted of non-Vitamin/Mineral ingredients. The number of Non-Vitamin/Mineral users in Japan is slightly higher than in the United States, where about 80% of the child supplement users take supplements containing Vitamin/Minerals. It should be pointed out that some children also use herbal supplements (8.1%). Generally, the efficacy and safety of such herbs are not tested in children, and the intake of herbs by children may induce adverse reactions. In fact, attention has been drawn to the use of herbs both by adults and children because of safety issues (*33, 35*).

An excessive expectation and misunderstanding of dietary supplements by parents were suggested in this study. In purchasing supplements for children, parents confirmed the presence of nutritional labels and considered safety more seriously than efficacy, indicating that they have a strong desire to select safe products for their children. Nevertheless, these parents tended to select products with a natural source so as to avoid additives, while ignoring quality assurance guarantees such as the JHFA mark, which is an assurance of the quality of the products issued by the Japan Health Food and Nutrition Food Association. Consistent with a report in the United States (*36*), the use of supplements by Japanese children was based not on the advice of specialists but more frequently on consultation with friends and acquaintances. Furthermore, the parents who used the

non-Vitamins/Mineral supplements were characterized by their intention to promote health and prevent disease.

This phenomenon might be related to the flood of information available in the mass media. Mass media information is sometimes exaggerated, but is nevertheless perceived as truth by consumers, and therefore greatly influences supplement use and feeding behavior (*37*). In the present study, less than 20% of parents were aware of Dietary Reference Intakes (*4*), the dietary guidelines for Japanese, but considered the labels of foods that made nutrient claims related to the required amount and the health effects of certain vitamins and minerals for Japanese (*3*). These results show that parents cannot obtain proper knowledge about food and nutrition and the government systems related to nutritional labeling due to the poor communication system between consumers and professionals, and due to the flood of information released from the mass media.

The present findings indicate the existence of the same factors and characteristics related to the use of supplements among young children between Japan and the United States, although the culture, dietary habits, and governmental regulation systems are not the same. Some reports suggest that excessive nutrient intake or premature use of supplements is a health risk (*22*, *27*), and other reports describe a lack of difference in nutrient intake from food between those children using and not using supplements (*22*, *32*). In children who are still in the process of forming healthy dietary habits and are growing rapidly, reliance on supplements may result in a disregard for the importance of healthy daily eating habits. Easy use of supplements may be an obstacle for children to establishing a healthy diet in the future. Taken together, it is critical to give parents correct information relating to diet and nutrition, the importance of a balanced diet for children, and the food labeling system. With those individuals in mind, information on expanding the range of the study subjects with the characteristics of the daily or long term use and information on parents in relation to supplements and nutrition should be investigated in depth so that an appropriate response to supplement use can be formulated.

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健康食品素材の品質と製品の有効性・安全性

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Ingredient quality and evidence of safety and effectiveness in health foods

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The most important problem of so-called health foods, which are sometimes consumed like medicine to prevent diseases but are legally classified as food, would be the inconsistent quality of ingredients and end-products. The quality of ingredients is extremely important for determining the effectiveness and the safety of the end-product. For quality control of the ingredients, it is necessary to specify the active substances that influence the safety and health-promoting effects. Clarification of these substances will contribute to the development of analytical methods, evaluation of the absorption and metabolism of the substances, manufacturing of end-products with high quality, construction of a quality control system for the commercial end-products, and accumulation and elucidation of experimental data that are obtained at various laboratories. Here, the importance of ingredient quality is introduced based on data that obtained using ginkgo biloba extract, turmeric and tea catechins.

Key words: health food, ingredient quality, ginkgo biloba extract, turmeric and tea catechins.

健康食品（サプリメントを含む）を活用しようとする社会的な要求が高くなっている。このような現象には、食品の機能性研究が進歩してきたこと、食生活がとても豊かになり食品に対して単なる栄養補給以上のものが求められるようになってきたことが関連している。最近の健康食品としては、錠剤やカプセルの形態をしたものが多い。その形状から、健康食品が医薬品と混同され、病気の治療や治癒の目的で利用されている場合も少なくない。食品に分類されている健康食品は、有効性や安全性に関するエビデンスの質と量、安全かつ効果的な利用環境、原材料ならびに最終製品の品質といった点で、医薬品とは明らかに異なっている。特に製品に添加されている素材（原材料）の品質は、製品の有効性・安全性を解釈する上で極めて重要である。すなわち、原材料の有効成分含量が少ない場合、製品としての有益な効果は期待できない。一方、原材料に有害物質が含まれている場合には、有効性を期待する以前に健康被害が危惧される。現状において、健康食品に利用されている素材では、その素材レベルでさえも品質が明確になっていないものが多い。

同じ名称の健康食品素材であっても実験材料が異なれば、多様な結果が出てくることは当然予想できる。食品分野で実施された研究の多くは、原材料の品質が明確になっていないため、その結果から素材の有効性・安全性を総合的に判断することが極めて難しい。特徴的な事例としては天然物素材が挙げられる。天然物の場合、原材料レベルでの含有成分の種類ならびに量は、産地や収穫時期、保存状態によって変動する可能性があり、それらの素材を複数添加した製品では、なおさら含有成分の種類や量が不明確になる。市場に流通している製品の有効性・安全性を評価するとき、素材に関する科学論文情報が参照され

る。しかし、論文中で利用された原材料と評価しようとする製品中に添加された原材料が同等でなければ、科学論文情報が目的とする製品に適用できるとは限らない。以上のような状況を考えると、健康食品の有効性や安全性のエビデンスを収集するとき、またそのエビデンスを製品に適用するとき、少なくとも原材料レベルでの品質が明確になっていることが必須と考えられる。ここでは、健康食品に利用される素材の品質の重要性に焦点を当て、我々が実施した若干の研究結果を紹介する。

1）イチョウ葉エキス（GBE）による肝臓薬物代謝酵素の誘導と医薬品との相互作用に関する検討[1-7]

GBE は記憶障害、耳鳴り、めまいの改善に対する有効性が示唆されている人気のある健康食品素材である。有効成分としてはフラボノイド類とテルペノイド類、有害成分としてはアレルギーを起こすギンコール酸が知られている。現在の一般的な GBE の規格は、フラボノイド類 24-25%、テルペン類 6%以上をそれぞれ含み、ギンコール酸含量が 5ppm 以下となっている。GBE は高齢者が利用する可能性が高く、医薬品との相互作用が危惧される。当初、GBE は肝薬物代謝酵素を誘導しないとの報告がなされていた。しかしその後、投与量によっては肝薬物代謝酵素を誘導し、併用医薬品の薬効に影響を与える可能性が出てきた（図１）。規格化された GBE の摂取量は通常 240mg/日以下であり、この摂取量の範囲内であれば、GBE による薬物代謝酵素の誘導は惹起されないと思われる。しかし、GBE の規格はそれほど厳密でなく、薬物代謝酵素を誘導する成分が特定できなければ、健康食品として販売されている種々の GBE 製品を安全に利用することはできない。そこで GBE 中に含まれる成分中で肝薬物代謝酵素の誘導作用に関連する成分を検索した。その結果、テルペノイド類中のビロバライドが強い薬物代謝酵素の誘導作用を有することを示した。

市販の GBE に添加されている原末中のフラボノイド類とテルペノイド類を分析したところ(図２)、各 GBE 原末中のフラボノイド類とテルペノイド類にはかなりの違いが認められ、肝薬物代謝酵素の誘導に関連するビロバライドでは、素材間で約２倍の違いがあるものも認められた。以上の結果から、GBE を有効かつ安全に利用するためには、現在の GBE の規格基準の中に、特定成分としてビロバライドを加え、その素材中あるいは製品中の含有量を明確にしておく必要性が示唆される。

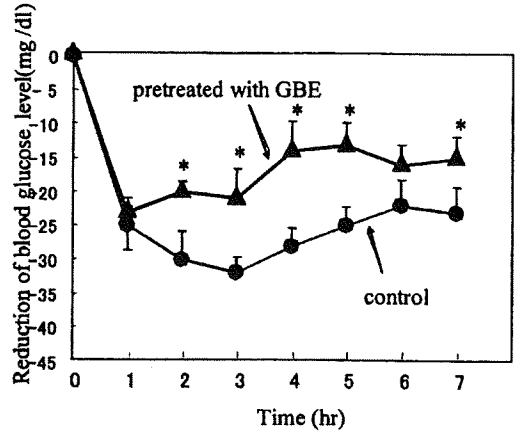

図１トルブタミドで惹起した血糖降下作用に対するイチョウ葉エキス（GBE）投与の影響
老齢ラット（19ヶ月齢）に GBE を５日間前投与(100mg/kg, p.o.)し、その後トルブタミド（40mg/kg, p.o.）した。

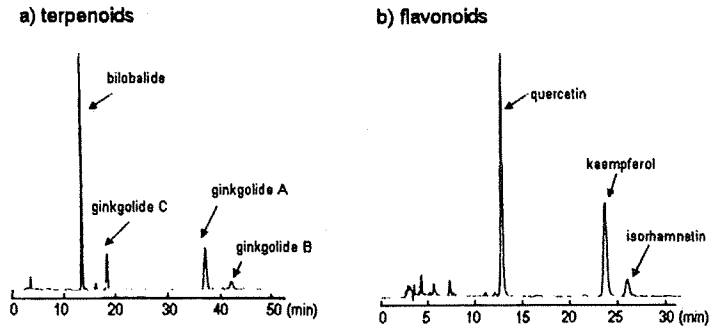

図２　GBE 中のテルペノイド類とフラボノイド類を分析クロマトグラム
テルペノイド類は HPLC-ELSD 法、フラボノイド類は HPLC-UV 法により分析。

２）四塩化炭素による肝薬物代謝酵素の障害とウコン・クルクミンに関する検討[8]

俗に肝臓に良いと言われているウコン（アキウコン）の有効成分はクルクミンと考えられる。そこで四塩化炭素により惹起した肝障害に対するクルクミンの影響をラットの実験系で検討した。その結果、四塩化炭素投与は肝薬物代謝酵素チトクローム P 450(CYP)の含量と活性を低下させ、その低下はクルクミン投与により抑制されるという結果が得られた（図３）。この現象はクルクミンで認められた結果であり、ウコンとして認められた結果ではない。ウコン中のクルクミン含量はわずかに数％であり、産地によっても異なっている。

肝臓によいと言われているウコンが、最近では逆に肝臓障害を悪化させる可能性も示唆されている。それは鉄含量が多いウコン製品が、鉄制限が必要なＣ型慢性肝炎患者の病状を悪化させるという事例が出されたからである（9)。このような事例報告から、一般的にウコン中の鉄含量は高いと考えられた。しかし、天然物であるウコンの成分は、産地や収穫時期によってそのミネラル含量も変動している可能性がある。そこで、ウコンの原末レベルでのミネラル含量を分析した。その結果、鉄含量は各素材で様々であり、また必ずしもウコン中の鉄含量は高いとは言えなかった。この事実は、ウコンとしてではなく、ウコン製品として鉄含量が高い健康食品が流通していることを示し、原材料レベルだけでなく製品として、少なくとも鉄含量は明確にしておく必要性を示唆した。

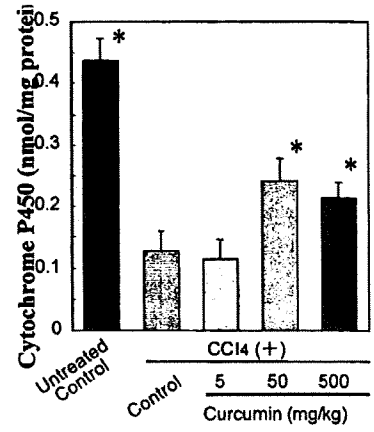

図３四塩化炭素投与ラットの肝臓薬物代謝酵素に対するクルクミン投与の影響
ラットにクルクミン混合飼料（ 5、50、500mg/kg 体重)を７週間摂取させ、この間に CCl4 (0.1mL/100g 体重）を週２回皮下投与。

3）茶カテキンによる染色体損傷作用と活性酸素による染色体損傷の防御作用[10-12]

茶カテキンについては多くの研究がなされ、多くの特定保健用食品の関与成分にもなっている。当初、茶カテキンは含有成分がそれほど特定できていない茶抽出物として利用されていた。しかしその後、含有成分が明確にされ、また品質の一定した素材が提供されてきたことから、分子レベルや細胞レベル、さらにはヒトにおける消化吸収を踏まえた詳細な検討が実施できるようになっている。我々も茶カテキンの安全性・有効性を染色体損傷という視点で検討し、カテキンは非生理的な濃度では染色体損傷を惹起するが、生理的な濃度（数μM 以下）では染色体損傷を惹起せず、むしろ活性酸素により誘発した染色体損傷の抑制作用を示すことを認めた。このような茶カテキンの研究が、詳細かつ広範囲に実施できるようになったのは、含有成分が一定した信頼できる品質の素材が提供されているからである。

食品の機能性の研究開発は国際的にも益々盛んになっていくことが予想される。とりわけ海外から新しい天然物素材が入手され研究されていく場合、研究に利用する原材料素材は、できるだけその含有成分と含量を明確にすることが必要であろう。ただし、全ての成分を特定することは、現実的には困難なことから、有害性ならびに有効性を判断する上で重要な成分が当面は対象になると考えられる。有効成分ならびに有害成分の特定は、その成分の分析方法の開発、生体内における消化吸収の検討、信頼できる製品の製造、市場に流通している製品のチェックシステムの構築、複数の研究機関で実施された科学的なエビデンスの総合的な解析にも大きく貢献することができるであろう。

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巻頭特集

「健康食品」の安全性・有効性情報（http://hfnet.nih.go.jp/）の現状と今後の課題

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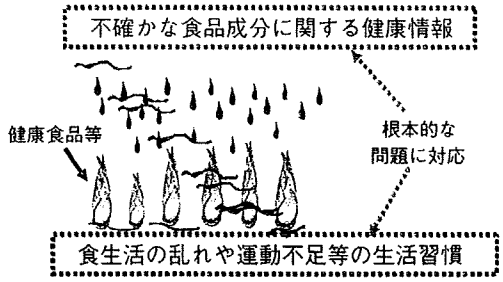
1．はじめに

平成16年7月14日から公開しています「健康食品の安全性・有効性情報（http://hfnet.nih.go.jp/）」のホームページは、その存在が次第に認識されるようになってきました。これまでのページアクセス数も昨年末の時点で550万件を超えています。現在のような状況にできたのは、多くの方々のご支援やご協力があったからと感謝しております。しかし、新しい情報は日々出されており、また消費者の方が「健康食品」を正しく理解できる環境はまだ整っているとはいえません。このように、「健康食品」について対応すべき課題はまだまだ山積しており、そのための役割としてホームページに期待されるところは大きいと思います。そこで、皆様のさらなるご協力がお願いできればと思い、本稿ではホームページ作成のこれまでの経緯、現状ならびに今後の課題について筆者の考えを記載することにします。

2．データベース構築の経緯

このデータベース構築の切っ掛けとなったのは、平成14年の夏に起きた中国製ダイエット食品による健康被害でした。この問題の発生を受けて、厚生労働省は「健康食品・無承認無許可医薬品健康被害防止対応要領」を作成し、健康被害の事例が保健所を介して集まるルートを作成しています。私の所属する研究所でも問題発生後に何とか対応するようにとの当時の理事長の指示がありました。いわゆる健康食品（以下、健康食品と記載します）による健康被害の発生を考えたとき、行政では問題を起こした商品の摘発・公表という措置をとっています。この対応は短期の問題の解決には効果的ですが、根本的な問題の解決にはなっていません。その理由は、先ず消費者が問題の起きた商品を知って一時的には該当商品の購入・利用を控えますが、時間が経てば忘れてしまうこと、また問題を起こした該当商品そのものは市場から消えても、類似した商品が再び出現してしまうという社会的な状況があるからです。おそらく問題を起こした商品は、健康食品のごく一部です。しかし、消費者には、どれが信頼できる商品で、どれが信頼できない商品かを判断することが困難です。さらに、健康食品が安易に利用されるようになっている原因の一つとして、食生活を含めた生活習慣の問題があります。忙しい昨今、私達は分かっていても、なかなかバランスのとれた食事や運動といった望ましい生活習慣を実践できない環境に置かれています。さらに健康に不安を抱かせるような多様な情報も出されています。その受け皿、不安を癒す手段が、健康食品の利用の促進につながっているのです。そこで私達は、健康食品の問題に根本的に対応する方法として、インターネットを介した健康食品の安全性・有効性の情報ネットワークの構築を開始し、雨後の筍という図（図1）を作成してその意義を説明してきました。

図１　健康食品の問題に対する根本的な対応

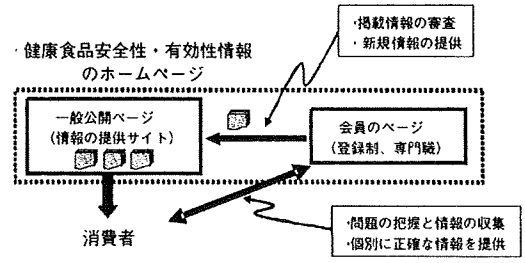


すなわち、雨の量を減らすこと（不確かな情報の氾濫を防止し正しい情報のみとすること）、また土壌を改善すること（生活習慣を改善すること）、この２つの対応により、おかしな筍（悪質な健康食品）は出にくくなり、よい筍（特定保健用食品など）のみが残る環境ができると考えました。ちなみに、これまで行政で行われてきたのは、一つ二つの筍を除去していること（問題を起こした商品の摘発公表）であり、根本的な解決にはならないことが分かると思います。現在は情報化社会になっています。だからこそ、正しい情報の提供が求められていると考えました。

一般消費者の方に情報を伝える方法としては、直接伝える方法、ならびに専門職を介して伝える方法の２つの方法があります。インターネット等を介して直接伝える方法は、迅速かつ効果的に情報が提供できる一方で、提供した情報が誤解されたり、正しく伝わらなかったりするという難点があります。情報の読み方や理解度は人によって異なります。他方、専門職の方を介して消費者の方に個別に情報を伝える方法は、時間がかかるという難点はありますが、最も正確に情報を伝えることができます。そこで私達の研究所では、消費者の方に直接伝える方法と、専門職を介して伝える方法、この２つの情報の伝達方法を考え、特に栄養士等の専門職を介して直接情報を伝達する方法を重視することとしました（図２）。ホームページは誰でもみることができる一般公開サイトと専門家から構成する登録制の会員サイトの２種類を作成し、会員ページでは既に公開している情報ならびに新しく作成した情報に対する加筆・修正の意見が求められるようにし、同時に専門職を介して話題となっている情報の収集ができるようにしました。さらに、専門職間の意見交換ができるようにするための「交流広場」も作成しました。

平成15年始めに作成した予備的なホームページは、基本的なシステムと考え方は現在とほぼ同じでしたが、予算との関係で内容は少なく、デザインも質素なものでした。その後、厚生労働省からの支援があり平成16年７月に現在のデータとデザインに充実することができました。

図２　健康食品の安全性・有効性情報
(http://hfnet.nih.go.jp/) による情報伝達の考え方



３．データベースの現状

「健康食品」の安全性・有効性情報(http://hfnet.nih.go.jp/) を介した情報提供の考え方は、バランスのとれた日常の正しい食生活や運動を含めた生活習慣の推進が、健康の保持増進の基本であるという考え方を踏まえ、氾濫している健康食品の安全性・有効性に関する情報を、科学的根拠に基づいて整理し、同時に国が行っている保健機能食品制度とともに広く国民に認識して頂くこととしています。情報の作成と提供は、消費者の立場を重視し、より安全性にポイントを置いています。

データベースで公開している情報

提供している具体的な内容は、①健康食品の基礎知識、②安全情報・被害関連情報、③話題の食品成分に関する情報、④健康食品素材情報データベースの４項目です。①では、「健康食品」とい