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Construction of web-based nutrition education contents and searching engine for usage of healthy menu of children*

Soon-Myung Hong[1§], Tae-Kyong Lee[2], Hea-Jung Chung[3], Hye-Kyung Park[4], Eun-Ju Lee[4], Hye-Seon Nam[4], Soon-Im Jung[1], Jee-Ye Cho[1], Jin-Hee Lee[1], Gon Kim[5] and Min-Chan Kim[5]

[1]*Department of Food and Nutrition, University of Ulsan, Ulsan 680-749, Korea*
[2]*Department of Digital Information Design, University of Ulsan, Ulsan 680-749, Korea*
[3]*Department of Culinary Arts, Woosong University, Daejeon 300-718, Korea*
[4]*Nutritional Evaluation Division, Korea Food and Drug Administration, Seoul 122-704, Korea*
[5]*School of Computer Engineering & Information Technology, University of Ulsan, Ulsan 680-749, Korea*

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Abstract

A diet habit, which is developed in childhood, lasts for a life time. In this sense, nutrition education and early exposure to healthy menus in childhood is important. Children these days have easy access to the internet. Thus, a web-based nutrition education program for children is an effective tool for nutrition education of children. This site provides the material of the nutrition education for children with characters which are personified nutrients. The 151 menus are stored in the site together with video script of the cooking process. The menus are classified by the criteria based on age, menu type and the ethnic origin of the menu. The site provides a search function. There are three kinds of search conditions which are key words, menu type and "between" expression of nutrients such as calorie and other nutrients. The site is developed with the operating system Windows 2003 Server, the web server ZEUS 5, development language JSP, and database management system Oracle 10 g.

Key Words: Web-based nutrition program, healthy menu, nutrition education

Introduction

Childhood is a critical time of human development. The most common nutrition-related problems among children include under-nutrition, iron-deficiency anemia, dental caries, high blood lipid profile, overweight and obesity (Boyle, 2003). In 2003, the Korea president announced the First Year of Children's Safety. Since then, the government has promoted various polices in order to enhance children's health. However, they appear to lack a comprehensive vision or systematic development of action plans. The eating habits which developed in childhood greatly affect one's lifelong habits and health. Besides, the education to provide information on food safety and nutrition has not been adequate. Improper dietary habits and unhealthy life styles may have resulted in a radical increase in producing number of overweight and obese children and teenagers. The Korea National Health & Nutrition Survey 2005 revealed that over the past seven years, there has been a significant 1.5-fold increase in the number of overweight boys and girls under 18 years of age. And dietary intakes of children were deficient in calcium and potassium. In contrast, the intakes of protein and sodium were becoming excessive (Department of Health and Welfare & Korea Health Industry Development Institute, 2006).

Nutrition education for children is valuable in changing dietary behaviors and promoting health, considering that good eating behavior formed in childhood would continue to later life. Some off-line programs on menu planning and nutrition analysis have been developed and used (Han, 1997; Hong, 1989; Hong, 1996; Joni, 1983; Kang *et al.*, 1999; Kolasa & Miller, 1996). The use of internet has become popular in Korea. Those who use internet reached 75% in 2006; of those aged 6-19 years, 98.5% used the internet (National Internet Development Agency of Korea & Ministry of Information Communication Republic of Korea, 2007). So, needs for web-based contents have been rapidly increasing in educational fields. "Diet and meal management" of lecture contents and software system for web-based nutritional assessment and counseling (Youn, 2001) were researched. The Korean Society of Community Nutrition, Nutrition Education Center of Ulsan University, The Korean Food & Nutrition Society and KFDA are running internet-based nutrition education programs. Some web-based programs for nutrition were developed (Han, 2000; Han & Jeong, 2004; Her & Lee, 2002; Her

* This study was supported by Research Funds of Korea Food and Drug Administration.
§ **Corresponding Author:** Soon-Myung Hong, Tel. 82-52-259-2374, Fax. 82-52-259-1496, Email. smhong@ulsan.ac.kr

& Lee, 2003a; Her & Lee, 2003b; Hong & Kim, 2005; Kim & Yoon, 1999; Lee *et al*., 2002) and also a food exchange program (Hong *et al.*, 2004). But it is limited to adults and not easy for an inexperienced person. Those of the program have to be developed for wider groups of people. Needs for nutrition education of children are increasing and related resources are essential (Park *et al*., 2006; Shin *et al*., 2006). Internet could be a useful route for children to provide nutrition information and educational messages. Many kinds of topics or methods might be effectively applied, in designing and planning nutrition web-sites or planning education programs, for example cooking or selecting snacks, flash animation with nutrition messages. Nutrition web-sites for children should be constructed in a way that children find the sites easily and search the contents for fun (Ahn *et al*., 2007; Ahn & Kim, 2007). So, we tried to make kid-friendly web-based nutrition education searching system for healthy menu recipe and easily learned nutrition information with a lot of searching methods.

Materials and Methods

The implementation of the system

This system is on the operating system the Windows 2003 Server, which is Zeus. The languages for the development of this site are Java Server Page and Java Script. It does not make use of ActiveX and only uses HTML because the site with ActiveX functions can be in operation with a particular browser. The meal plan and nutrition evaluation go through complicated procedures and calculation processes. This is why the development procedures are important. The site is based on MVC Model2 (Model View Controller Pattern). The DBMS is Oracle 10 g. The content is shown in Table 1.

Construction of web contents

The web contents contain introductions of a home-page, the menu of three age groups (infants, children and adolescents) and menu search. The contents are menu pictures, cooking methods, macro nutrients and sodium levels, video scripts of cooking courses, close-up of menu pictures, exchange of weight and printing.

The DB structure

The DB (Database) of the system consists of 4 segments. They are healthy menu DB, food nutrient DB, nutrition intake guideline DB and nutrient guideline DB. Healthy menu DB is developed in the sub-project of this research. It is shown in Table 2. Food nutrient DB is based on the 7th food table of 2006 of National Rural Living Science Institute. Nutrition intake guideline DB is based on the data of The Korean Nutrition Society 2005. Nutrient Daily Value guideline DB is based on the data of KFDA 2007.

Table 1. Web server system

Operating system	Windows 2003 server
Web server	Zeus
Language	JSP, JavaScript
Database	Oracle 10g

Menu searching method

Users can search by the title of a menu, ingredients, menu types (main dish, dessert), ethnic food and each nutrient. With those searching conditions, the screen can show recipe, video script, food data of menu and nutrients.

Results

Contents and search function

The site of the department of nutritional evaluation in Korea Food and Drug Administration (http://nutrition.kfda.go.kr) is Fig. 1, which is involved in a banner for children's healthy menus.

The contents of this children's healthy menus site are classified into four groups. The first is introduction of this home page. It explains the overall introduction of this site. The second page contains the information of menus for infants, children and adolescents (Fig. 2). This part contains all information which users want to get by a search function. The third part provides a search function so that users can find the information which they need. The users specify search conditions. Types of the conditions are menu name, raw material of a menu, types of menus such as main dish, side dish and dessert, many kinds of ethnic menu such as Korean food, Chinese food, Japanese food, Western style food, Southeast Asian food, nineteen nutrients and calories and so on. The fourth part, NutriEval, is like this site. The NutriEval is another web-based program for meal plan drafting and nutrition evaluation. It is an independent program itself. It will be discussed in another chance.

Table 2. Healthy menu DB classification

	Healthy menu			
Classification	Infant	Child	Adolescent	Total
Main dish	28	29	28	85
Side dish	15	14	15	44
Dessert	7	8	7	22
Total	50	51	50	151
Menu type	Infant	Child	Adolescent	Total
Korean food	21	18	17	56
Western food	22	22	22	66
Chinese food	5	6	4	15
Japanese food	1	3		4
Asian food	1	2	7	10
Total	50	51	50	151

Fig. 1. Home page of the department of nutritional evaluation, Korea Food and Drug Administration (http://nutrition.kfda.go.kr)

Fig. 3. The introduction of home page

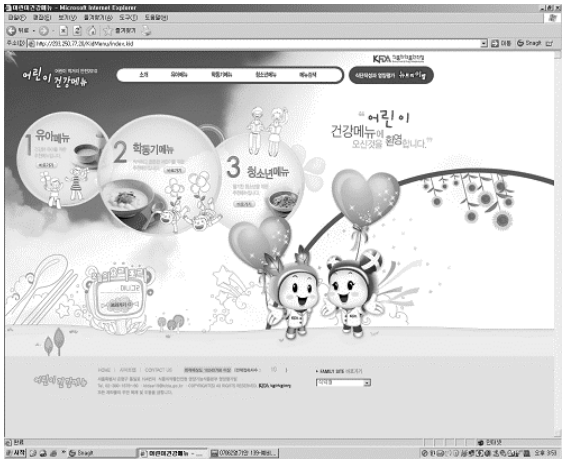

Fig. 2. Page containing the information of menus for infants, children and adolescents

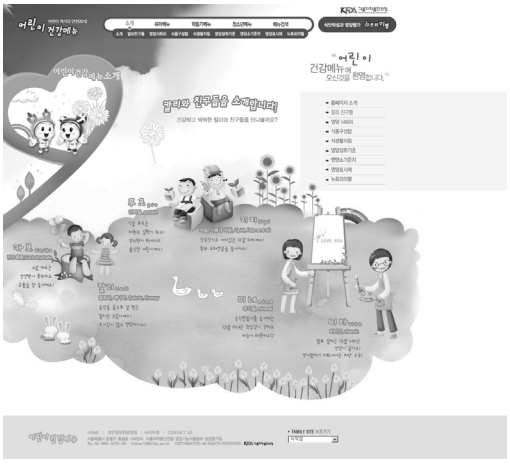

Fig. 4. Cali and Friends page

Introduction of home page

This introduction page summarizes the whole site. Fig. 3 is the technical introduction of the home page. This is the page which has links to the contents classified into eight groups. They are “Cali and Friends”, “Food Pyramid”, “Nutrition Safari”, “Guideline of Diet Plan”, “Guideline of Nutrition Intake”, “Guideline of Nutrition Ingredient”, “Nutrition Manifest” and “NutriEval”.

Cali and friends as nutrient nicknames

“Cali” means Calorie. Because this site is focused on children, the terminology had better be familiar and easy to use and pronounce for children. For this reason, some of the nutrients are given an alias, gender and character. Children learn the nutrients by playing with the alias. The aliases are “Cali”, “Carbo”, “Pro”, “Lipi”, “Mine” and “Vita”. They are associated with “Calorie and Energy”, “Carbohydrate”, “Protein”, “Lipid, Fats and Oil”, “Mineral” and “Vitamin”, correspondingly. Fig. 4 is the “Cali and Friends” page.

Nutrition safari

In this page, children learn the importance of nutrients by a “safari tour”. The contents consist of two parts. One is “nutrition café” and the other is “nutrition villages”. Fig. 5 is the page of the “nutrition safari”.

Nutrition café: Children learn what nutrients do in their bodies. In addition to the functions of nutrients, the children learn the reason why they have to eat well-balanced foods and how to eat healthy foods. Fig. 6 is the page of “Nutrition café”.

Nutrition villages: There are eight villages. They are “Carbohydrate”, “Protein”, “Lipid”, “Mineral”, “Vitamin”, “Fiber”, ‘Water” and “Calorie”. Children learn what nutrients do in their bodies by visiting the villages. They also learn the food in which the nutrients are abundant. Fig. 7 is the page of “Carbohydrate” village, one of the eight villages.

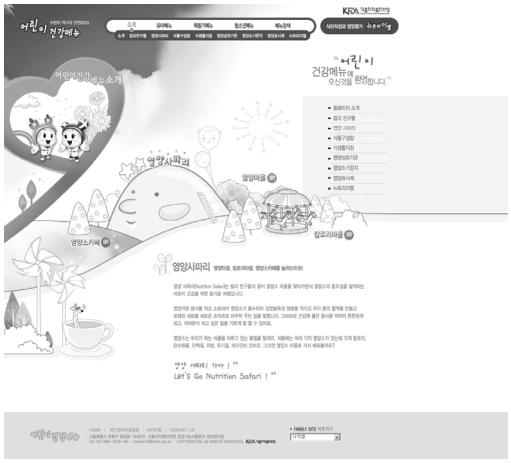

Fig. 5. Nutrition safari page

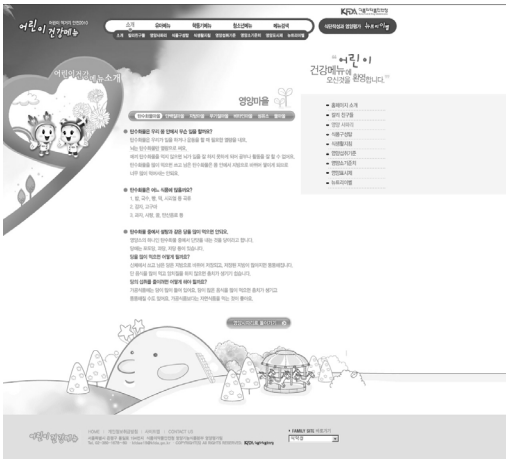

Fig. 7. Nutrition café page of "Protein village"

Fig. 6. Nutrition café page

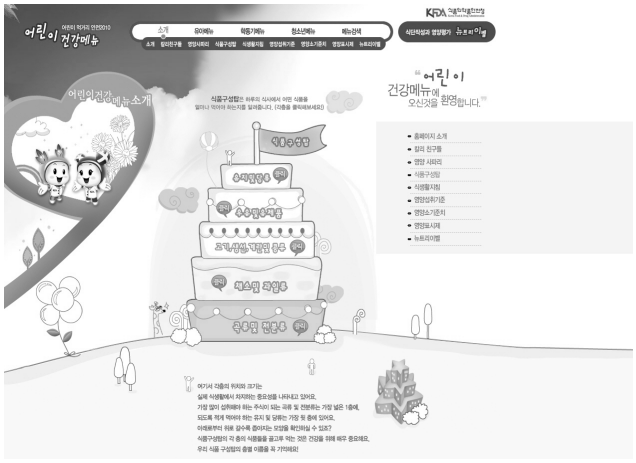

Fig. 8. Food tower page

Food tower

This page provides the amount and types of foods which are consumed in a daily meal (Fig. 8). Each layer of the food guide tower shows in turn to the upper step that nutrients should be taken in lesser amounts. There are four layers. The function of each layer's food type is explained. The symptom is also explained when each layer's nutrition is over-eaten or is deficient in a body.

Guideline of diet plan

This page gives the guidelines of diet plan for the age groups, infants, children and adolescents (Fig. 9). For each age group, there are seven recommendations by their age and critical nutrition education and the characters which are the alias of important nutrients.

Guideline of dietary reference intakes (DRIs) for Koreans

On this page, users will learn why guidelines of a diet plan are so important (Fig. 10). There are four criteria in the guideline, which are average, recommended, sufficient and upper limit amount (DRIs, Korean Nutrition Society 2005). In the nutrition intake table, users can find the most appropriate criteria of the four criteria for them because those kinds of criteria are different by the age, gender and nutrient needs.

Guideline of nutrients daily value (DV)

The guideline of nutrients is the representative value for each ingredient. The value is applied to the all kinds of foods except the group under the age of four, pregnant women and breast feeding women. It is guideline of labeling of nutrient of processed foods in terms of the percentile expression (Fig. 11) and it's getting important for nutrition assessment and health care to prevent an epidemiologic obesity trend.

Guideline of nutrition labeling

This page contains the information on the nutrition label (Fig. 12). The users learn why nutrition labeling is important, how

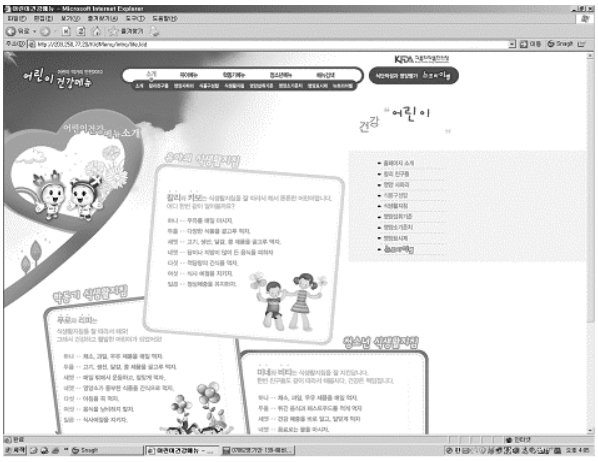

Fig. 9. Guideline page of diet plan

Fig. 11. Guideline of nutrients daily value (DV)

Fig. 10. Guideline page of dietary reference intakes (DRIs)

Fig. 12. Guideline of nutrition labeling

nutrition labeling with each food is interpreted and how the nutrition amount is used for their health.

Menu search classification and recipe contents

This site contains menus for the infants, children and adolescents. The menus are classified into groups by the criteria of age, menu type, and ethnic origin of menu. The items of menu type are main dish, side dish, dessert, etc. The items of ethnic menus are Korean food, Chinese food, Japanese food, Western style food, Southeast Asian food, etc. This information also is searched by the search function. Fig. 13 is the page showing the main dish for infants. There are screen scripts showing the cooking process of a menu (Fig. 14). There is also a transformation program which modifies the weights of raw materials of a menu according to the change of weight of a certain raw material of the menu. Fig. 15 shows a cooking course with video script.

Search function

This site provides the search function which finds a menu under a certain condition. It comes from 151 menus developed by the sub-project in association with this research. The search conditions are classified into three categories based on the contents of the sub-expression.

The first one is the key word expression. The search content expressions of the combination of the name of menu, name of food materials, age group, menu type, menu style and nutrients. The site accommodates the both the Korean and English names. Fig. 16 is the menu search page whose search condition is pumpkin. The second one is the “between” expression of the lower bound and the upper bound of a certain nutrition ingredient such as calorie and other nutrients. The absence of either of the bound expressions means the value higher than the lower bound value or the value lower than the upper bound. Fig. 17 is the result of menu search. If we chose pumpkin as the title of menu, we can the result of pumpkin menu and then, we can click wider picture, recipe, video script, raw material of menu, nutrient and specific capture.

Fig. 13. Page showing main dish list for infants

Fig. 14. Menu recipe sample

Discussion

This research aims to develop healthy menus during childhood and making it available to the public. For this goal, the web-based program is the most familiar and friendly interface to school children. Some web-based programs for nutrition were developed (Han & Jeong, 2004; Her & Lee, 2002; Hong & Kim, 2005; Lee *et al*., 2002), but web-based nutrition education programs for children are very limited. Nutrition web-sites for children should be constructed in a way which children find the sites easily and search the contents while having fun (Ahn *et al*., 2007; Ahn & Kim, 2007).

We developed and composed this website to implement a database program to store contents and search function. This study has been focusing on a standardization of nutrient information. To date, in the domestic environment, it is difficult to

Fig. 15. Menu recipe with Video script

Fig. 16. Menu search page whose search condition is a pumpkin

Fig. 17. Result of search of pumpkin

find any research, organization or homepage that provides the standards of nutrient expression. Therefore, we anticipate that the constructed nutrient database system will make a contribution to save nutrition information and to design criteria for sharing

its information. In the introduction of this site, contents of DRIs and Daily Value (DV) were added. Recently, restaurant nutrition labeling was researched and it would become set in a legal term (Hong & Jeong, 2007) to prevent global tendency of high calorie diet and out-going food.

The home page explains the site as a whole. This page has links to the contents classified into eight nutrient groups. These contents were considered for needs of nutrition education (Park *et al*., 2006; Shin *et al*., 2006). Previous web-based nutrition programs did not include them. So these kinds of trials will be good education tools (Han & Jeong, 2004; Her & Lee, 2002; Hong & Kim, 2005).

This site contains menus for infants, children and adolescents. The menus can be searched by many categories and have screen scripts of the cooking process. There is also a transforming program that modifies the weights of raw materials of menus according to the change of weight of a certain raw material of the menu. This site provides the search function for 151 healthy menus for children in association with this research.

We tried to make the program from the children's viewpoints, but some did not work properly. And the menu for the kids is very limited. So we have to provide easier and a variety of menus having more nutritious ingredients for the kids. This kind of effort was organized for kid's easy access and attribute motive to learn about food and nutrition. It will give better motive for education needs of kids (Park *et al*., 2006; Shin *et al*., 2006). These kinds of trials can be helpful for a future disease preventing program and it could give knowledgeable information to the kids. We hope that these kinds of web-based systems could be widely used for nutrition education for kids and adults.

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