

Review Article

Nutritional standards for energy-dense low-nutrient density foods for children in Korea

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The increasing rate of child obesity has developed into a serious concern in contemporary society. In Korea, additional concerns over unsanitary environments of food establishments near schools led to the enforcement in 2009 of the Special Act on the Safety Management of Children's Dietary Life in order to improve food safety and nutrition. Some of the main policies of the Special Act are the prohibition of Energy-dense Low-Nutrient density Foods (hereinafter referred to as EDLNF) at school canteens and in the outstanding businesses, along with restrictions on television advertisement for EDLNF products. Confectioneries, candies, sweetened-ice products, breads, chocolates, processed milk, fermented milk, ice cream, fish-meat sausages, fruit/vegetable beverages, carbonated beverages, mixed beverages, and lactic acid bacteria beverages are classified as applicable food types of EDLNF. To establish the nutritional standards for EDLNF, the intake proportions and the pattern of nutrients in children's preferred foods in Korea were analyzed, based on the 2005 National Health and Nutrition Survey of Korea. The foods containing more than 250 kcal, more than 17 g of sugar or more than 4 g of saturated fat and less than 2 g of protein per serving are considered EDLNF snacks. The Korean government is concentrating its efforts in promoting healthy environments for children in its research and in food policies. Further studies are necessary to investigate the current state of changes in the children's foods industry.

Key Words: energy-dense low-nutrient density foods, children's preferred foods, obesity, snacks, meal substitutes

INTRODUCTION

Thought to be a result of changes in diet and lifestyle patterns, the increased child obesity rate has become an important concern in contemporary societies. It is surmised that 40% of childhood obesity and 70% of adolescent obesity are associated with adult obesity.¹ As such, a growing need has developed for childhood obesity management protocols.^{2,3} The 2005 National Health & Nutrition Examination Survey of Korea demonstrated that the obesity rate of individuals under the age of 18 has increased 150% from the rate 7-years prior. In 2007, the obesity rate of youths under the age of 18 had grown by 10.9%.^{4,5} In 2009, the Ministry of Education, Science, and Technology in Korea announced the results of students' physicals: the ratio of very-obese students had increased from 0.8% in 2008 to 1.1% in 2009; and the rate of medium-degree obesity and light-degree obesity had increased by 5.2% and 6.9%, respectively, relative to those of 2008. The total obesity rate in 2009 was 13.2%, corresponding to a 2% increase as compared to that of the previous year.⁶

Some of the reasons for the increased child-obesity rates are thought to be changes in diet, with increased consumption of high-sugar, high-fat and high-sodium snacks such as the various bread products, deep-fried in-

stant noodles⁷ and beverages.⁸ In particular, the consumption of sweet processed foods such as carbonated beverages in elementary school students has increased by 1.8 times that of 1998.⁷ The total fat-intake of the 3-6, 7-12 and 13-19 age groups in 2005 increased compared with 2001 intakes, and animal-fat consumption had also evidenced a tendency toward an increase.^{4,9,10} The sodium intake among adolescents was more than double the 2,000 mg WHO daily recommendation.¹¹ In 2005, sodium intake of children evidenced an increasing tendency, relative to the intakes of 1998 and 2001.^{4,9,10}

The rise in the childhood obesity rates have frequently led to serious subsequent health problems including heart disease and diabetes in adults.¹²⁻¹⁴ Moreover, the socio-economic costs of overweight and/or an obese population

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Manuscript received 15 March 2013. Initial review completed 13 May 2013. Revision accepted 8 October 2013.

doi: 10.6133/apjcn.2014.23.1.03

have been estimated to be over 1.8 trillion won (1,500 million US dollars), which include direct health care costs (1.1 trillion won = 917 million US dollars) and overhead costs such as loss of income.¹⁵

Adding to the concerns for child obesity and unbalanced nutritional intake, unsanitary environments in and around food markets near schools, low-priced foods in school areas and the poor quality of food-services for preschool children have led to the Korean government to research for comprehensive measures regarding the safe management of children's dietary habits and health conditions.^{16,17}

The Korea Food and Drug Administration (KFDA) has carried out a survey of 1,000 parents on children's food environments in 2006. The results showed that 54.4% of the participating parents felt the environments to be unsafe, and 96.2% wished for the preparation of comprehensive measures for the management of children's dietary safety. In particular, the parents desired to improve the environmental and distributional conditions of food markets in and around schools.¹⁸

The efforts to control the increasing obesity rate have proven unsuccessful in regards to the strategy of promoting individual health. Planning for the effective prevention and reversal of childhood obesity trends must be coordinated at the local community, regional, national and global levels.¹⁹ Currently, the emphasis is placed on individual choice of food items^{16,20} rather than the total diet,²¹ given that food choice is thought to be an individual decision. However for children, their developing sense of judgment and the absence of control over their environment in schools and the surrounding areas have been related to their choices in the purchasing of unsanitary and low-quality foods. Such poses a global concern for policy-makers regarding children's foods.¹⁶ The food-marketing scheme on children is a central policy issue for governments, and a set of comprehensive regulations are necessary to provide substantive protection for children.²² As based on these issues, with the extensive surveys of the various associated industries including the manufacturers, academia, and consumers, the Comprehensive Measures for Children's Food Safety Management were put in place in Korea.¹⁷ The Special Act on the Safety Management of the Children's Dietary Life (hereinafter referred to as the Special Act) was put into force in 2009 in the Republic of Korea to improve food safety and nutrition for children.

The policies of the Special Act are designed to encourage safe food habits, proper nutrition and health of children and sets the goal of protecting children against pernicious ingredients, food poisoning and obesity by improving the environments of circulation and consumption conditions of foods preferred by children and food services.²¹ The Special Act delineates the following: the designation and management of food Safety and Protection Zones around schools, where children may purchase their own foods (Article 5); management of food preparation facilities and stores of Children's Preferred Foods (Article 6); designation, etc. of outstanding businesses for Children (Article 7); the prohibition of the sale of Energy-dense Low-Nutrient density Foods (hereinafter referred to as EDLNF) at school canteens and the outstanding businesses for children (Article 8); and the restriction on tele-

vision advertisements of EDLNF products (Article 10).²³

The nutrition policies of the Special Act may affect the distribution environment of children's preferred foods for the manufactures, as children's preferred food types and nutrition standards for EDLNF may be limited and/or prohibited in their advertisement. These two factors are of important concerns for the manufacturers and stores carrying the children's preferred foods.

Children's preferred food is defined as, 'the foods determined under the Enforcement Decree to be those frequently consumed by children' in accordance with the Food Sanitation Act or the Livestock Products Sanitary Control Act, which are prescribed by the Presidential Decree.²³

The term EDLNF encompasses the children's preferred foods that are considered likely to cause obesity and/or nutritional imbalance, which are higher in energy and lower in the nutritional content than the standards determined by the commissioner of the KFDA.²³

This paper discusses the processes involved in the selection of EDLNF amongst the various Children's preferred foods including the nutritional standards that were applied, as related to the Special Act of the Korean government.

METHOD

Selection criteria for energy-dense low-nutrient density foods among children's preferred food

In order to designate foods that children prefer more than adults, in managing various policies related to the Special Act on Food Safety Management, analysis on the consumption of nutrients from the children's preferred foods and the patterns of nutrients in children foods were studied.²¹

To investigate the foods among the processed foods that children (7-12 age group) prefer and consume more than adults (30-49 age group), several factors were evaluated as based on the 2005 Korean National Health and Nutrition Examination Survey.

Considerations are: food with an absolute consumption and average consumption per child weight higher than those of adults (more than 0.01 g difference); food with more than double the children's intake proportion than that of adults; the upper 100 most frequently consumed foods by children with more than 100% of children's intake proportion than that of adults; and the upper 101 to 200 most frequently consumed foods by children with more than double the intake proportion compared to that of adults. Using these criteria a point system was applied with 1 point per criteria and foods with the most points categorized as children's preferred food. However, the following were removed from consideration: raw materials which can be the sources of other foods (sauce, jam, ketchup), natural foods (fruits, vegetables), foods provided by parents (dumplings, rice cake, cheese, butter, processed meat products, fish cake, porridge, cereals, noodles (except ready-to-eat containers) milk and low-nutrition contribution foods (gum). Milk is also excluded from consideration because it is a good source of nutrients for growing children.

Nutritional standards for energy-dense low-nutrient

Table 1. The standard criteria of EDLNF as snacks

	Daily Recommend Intake or nutrient reference value	Intake proportion from snacks (%)	Frequency of snack intake (times/day)	Standard criteria [†]	The extreme standard criteria ^{††}
Energy	2,000 kcal	20 %	1.5	250 kcal	500 kcal
Saturated fat	15 g	38 %	1.5	4 g	8 g
Sugar	50 g	50 %	1.5	17 g	34 g
Protein	60 g	-	-	2 g ^{†††}	-

[†] calculation of standard criteria = (daily recommend intake or nutrient reference value × intake proportion from snack) ÷ frequency of snack intake

^{††} extreme standard criteria: double value of standard criteria in energy, sugar or saturated fat

^{†††} standard criteria of protein: based on the standards for the nutrient content claims of the protein source (more than 10% of nutrient reference value per 100g) and one serving size of confectionary (30 g) ($(60 \text{ g} \times 0.1) \div 100 \text{ g}) \times 30 \text{ g} = 2 \text{ g}$

Table 2. The standard criteria of EDLNF as meals

	Daily Recommend Intake or nutrient reference value	Intake proportion from meals (%)	Frequency of snack intake (times/day)	Standard criteria [†]	The extreme standard criteria ^{††}
Energy	2,000 kcal	80 %	3	500 kcal	1000 kcal
Saturated fat	15 g	62 %	3	4 g	8 g
Sodium	2000 mg	95 %	3	600 mg 1000 mg ^{†††}	-
Protein	60 g	-	-	9 g ^{††††}	-

[†] calculation of standard criteria = (daily recommend intake or nutrient reference value × intake proportion from meal) ÷ frequency of meal intake

^{††} extreme standard: double value of standard criteria in energy or saturated fat

^{†††} exceptionally, 1,000 mg for instant noodles

^{††††} standard criteria of protein: based on the standards for the nutrient content claims of the protein source (more than 10% of nutrient reference value per 100g) and mean of one serving size of meal (150 g) ($(60 \text{ g} \times 0.1) \div 100 \text{ g}) \times 150 \text{ g} = 9 \text{ g}$

density foods

To establish the nutritional standards for EDLNF, standards of other countries were researched first and the consumption of nutrients from children's foods as well as the patterns of nutrients in the foods were analyzed. In the second phase, nine basic standards and 3 proposed models as criteria were established through an expert committee.²¹

The nine basic standards are composed of the following: the purpose (restriction of sale and advertisement), target age group (0-19 age group), target food types, target nutrients (energy, saturated fat, sugar, sodium and protein), reference weight criteria (one serving size), daily recommend intake (2,000 kcal; 50 g of sugar; and 2,000 mg of sodium per day) or nutrition reference value (15g of saturated fat/day), the reference basis for values [standard criteria = (daily recommend intake or nutrient reference value × intake proportion of a snack or meal)/frequency of a snack or meal]; application method (across-the-board system) and model types (threshold model).²¹ Tables 1 and 2 show the calculation process for the criteria for EDLNF snacks and meals. In the third phase, a database was established for nutrient information for children's preferred foods, and calculations using the database were carried out. For the last phase, after having extensively surveyed the opinions of relevant academic, industrial and consumer organizations, the Notification of the Nutritional Standards for EDLNF was released in May, 2009.²⁴

RESULTS AND DISCUSSION

As a result of the analysis to select foods that children

prefer more than adults, confectioneries, candies, sweetened-ice products, breads, chocolates, processed milk, fermented milk, ice creams, fish-meat sausages, fruit/vegetable juice, fruit/vegetable beverages, carbonated beverages, mixed beverages and lactic acid bacteria beverages, deep-fried instant noodles (ready-to-eat containers only), ready-to-eat kimbap, ready-to-eat hamburgers, ready-to-eat sandwiches, pre-prepared hamburgers and pre-prepared pizza were included in children's preferred food. There were 19 food-types of processed foods and 12 food-types of pre-prepared food which were classified as children's preferred foods.²³

However, not all food-types of the children's preferred foods were the targets of the EDLNF classification. Fruit/vegetable juice (with the fruit/vegetable content not less than 95% of the juice) are excluded from the food-types of EDLNF. This is because fruit/vegetable juice with over 95% of fruit/vegetable contents are recommended in the preference of the fruits and vegetables intake. The nutritional labels (energy, sugar, saturated fat, sodium and protein per one serving) is essential in evaluating EDLNF; and therefore some prepared-food items with a difficulty in the standardization of one serving are excluded.

As a result, the target food types of EDLNF in the children's preferred food items are divided into the snack and the meal-substitute categories. The confectioneries, candies, sweetened-ice products, breads, chocolates, processed milk, fermented milk, ice creams, fish-meat sausages, fruit/vegetable beverages, carbonated beverages, mixed beverages and lactic acid bacteria beverages are classified as snacks.²⁴ In accordance with the Korean Food Standards Code, the candies include the sweet red-

Table 3. Applicable foods and nutrition standards for EDLNF (Notification No. 2009-86 of the Korea Food and Drug Administration)

Classification	Food types	Details
Applicable foods	Snacks	1) Processed foods: confections (excluding the Korean traditional confectioneries), candies, sweetened-ice products, pastries, chocolates among confectioneries; processed milk/fermented milk (excluding fermented butter milk, fermented milk powder), ice creams among dairy products; fish-meat sausage among processed fish-meat products; fruit/vegetable beverage, carbonated beverage, lactic acid bacteria beverage, mixed beverage among beverages 2) Prepared foods: confectionery, bakery foods and ice creams
	Meal substitutes	1) Processed foods: deep-fried instant noodles/vermicelli (limited to noodles packaged in the ready-to-eat containers), rice rolls in laver (kimbap), hamburger, sandwiches among the ready-to-eat foods 2) Prepared foods: fast foods including hamburgers, pizzas etc.
Nutritional standards for the EDLNF	Snacks†	1) Foods containing more than 250 kcal and less than 2 g of protein per serving 2) Foods containing more than 4 g of saturated fat and less than 2 g of protein per serving 3) Foods containing more than 17 g of sugars and less than 2 g of protein per serving 4) Foods containing more than 500 kcal or 8 g of saturated fat or 34 g of sugars per serving among those foods that do not fall under the category specified above in 1) to 3)
	Meal substitutes	1) Foods containing more than 500 kcal and less than 9 g of protein per serving 2) Foods containing more than 500 kcal and more than 600 mg of sodium per serving. For deep-fried instant noodles/vermicelli (limited to noodles packaged in the ready-to-eat containers), 1000 mg of sodium per serving is applied 3) Foods containing more than 4 g of saturated fat and less than 9g of protein per serving 4) Foods containing more than 4 g of saturated fat and more than 600 mg of sodium per serving. For the deep-fried instant noodles/vermicelli (limited to noodles packaged in the ready-to-eat containers), 1000 mg of sodium per serving is applied 5) Foods containing more than 1,000 kcal or 8 g of saturated fat per serving among those foods that do not fall under the category specified above in 1) to 3)

† in the case that standard one serving size is less than 30 g, the values shall be converted to those based on the serving size of 30 g.

bean jelly and puddings.²⁵ The deep-fried instant noodles (ready-to-eat containers only), ready-to-eat kimbap, ready-to-eat hamburgers, ready-to-eat sandwiches, prepared-foods hamburgers and prepared-foods pizzas were classified as meal substitutes. In the deep-fried instant noodles category, only the food items in the ready-to-eat containers were included. Because the purpose of prohibiting the sale of the EDLNF products is to manage the environments in and around the schools, where the children buy the food items for themselves, the deep-fried instant noodles which are usually cooked at home were excluded.²⁶

Before establishing nutrition standards for EDLNF, the suggested nutrition components that needed to be managed were fat, saturated fat, *trans* fat, cholesterol, sugar, and sodium. However, cholesterol was excluded from this list, because it is a nutrient necessary for growing children, and *trans* fats were excluded because the reducing project has progressed since 2005 in Korea. Fat is a nutrient extremely relevant to the prevention of obesity because caloric rates due to fat is high; thus it is *important* to curb fat consumption. However, fat includes saturated fat and unsaturated fat, and therefore it was decided that only saturated fat needs to be managed for growing children. Moreover, energy management makes possible fat management to a certain degree, because total energy are correlated with fats, and therefore fat can be excluded by caloric restriction. Through this process, the standards for snacks included limits on total energy, sugar, saturated fat and protein, whereas for meal substitute products they included limits on total energy, saturated fat, protein and sodium.^{21,26}

The nutritional standards for the EDLNF are divided into two parts, one for the snacks and the other for meal substitute products (Table 3).

Foods containing more than 250 kcal, more than 17 g of sugar or more than 4 g of saturated fat and less than 2 g of protein per one serving are considered EDLNF. The foods containing more than 500 kcal, more than 34 g of sugar or more than 8 g of saturated fat per one serving are considered EDLNF. In the cases with one standard serving of less than 30 g, the values are converted to those based on the serving size of 30g.²⁴

The standard of EDLNF for the meal substitute products is applied to the deep-fried instant noodles (ready-to-eat containers only), kimbap, hamburger and sandwiches among the ready-to-eat foods and the prepared foods (hamburgers and pizzas). Foods containing more than 500 kcal or more than 4 g of saturated fat and less than 9 g of protein or more than 600 mg of sodium per one serving are considered EDLNF. However, in the case of the deep-fried instant noodles (ready-to-eat containers only), a standard of 1,000 mg of sodium per serving is applied. Foods containing more than 1,000 kcal or more than 8 g of saturated fat per one serving are considered EDLNF.²⁴ The KFDA has developed and distributed for the public's convenience the web-based software programs and the mobile application programs to determine EDLNF using the nutrition labeling.^{21,26}

If a food is considered an EDLNF, it is prohibited from sale at the school canteens and the outstanding businesses for children in Korea with restricted TV advertising.²³ Additionally, when a food is considered to be an EDLNF, it is thought to affect the public sales directly; and as such,

the food industry has made attempts to alter the raw ingredients of the EDLNF products and to change the serving sizes. With these changes, the product designers are gradually considering the nutritional ingredients in the children's preferred food before the manufacturing stage.²⁶

The 2005 Dietary Guidelines for Americans published by the USDA first put forth the term 'nutrient-dense food' which can be interpreted as a recommendation of the low-energy, high-nutrients foods over the high-energy foods. However, the definition and the standard criteria were not particularly clear.²⁷ The US government has also enforced a policy that restricts the competitive foods and beverages in schools, as proposed by the Medical Association at the National Assembly's request. This was in an effort to address the adolescent obesity rate and the increasing use of the high-energy low-nutrient foods in schools. Additionally the policy was meant to encourage the greater intake of fruits, vegetables, whole grains and the fat-free or low-fat milk, restrict saturated fats, salt, added sugar and the total energy intake, and prohibit the sale of the caffeine-containing foods, due to the potential damage caused by caffeine.^{28,29}

Such sales restrictions in schools were also enforced in Europe. The Parliament of France chose to remove all the vending machines with junk foods such as the candies and the carbonated beverages in the private and public schools from September, 2005.³⁰ The United Kingdom and the Scotland regional councils proposed an amendment to the Law for the School Foods, allowing for the regulation of the promotional events and junk food sales in schools, and the Ministry of Labor announced a bill to expel junk food from schools.³¹

Japan has prohibited the ingestion of foods other than the regular meal offerings from schools by the School Lunch Law of 1954. Singapore carried out the 'Trim and Fit' policies regarding the food and beverage sales in schools and sales stands. Malaysia has banned the sale of junk foods in schools by the Directive issued by the Ministry of Education. Iorionopolis, Rio de Janeiro and Sao Paulo in Brazil have banned the sale and distribution of carbonated beverages and confectionaries in schools.

The United Kingdom FSA classified individual food groups by standard criteria of sugar, salt, fat and saturated fat, composed on the research evidencing that food advertising affected the food-choice and the dietary lifestyles of the children. It banned the advertising of the offending food products before 9 PM, beginning in 2007.

In 2010, WHO endorses the set of recommendations on the marketing of foods and non-alcoholic beverages to children, and urges members: to take necessary measures to implement the recommendations on the marketing of foods and non-alcoholic beverages to children, while taking into account existing legislation and policies, as appropriate; to identify the most suitable policy approach in given national circumstances and develop new and/or strengthen existing policies that aim to reduce the impact on children of marketing of foods high in saturated fats, *trans*-fatty acids, free sugars, or salt; to establish a system for monitoring and evaluating the implementation of the recommendations on the marketing of foods and non-alcoholic beverages to children.³²

In the Republic of Korea, the EDLNF products, which are thought to cause the nutritional imbalance and/or obesity in children, are managed and prohibited at the school canteens and the outstanding businesses for children by the Special Act.²³

The main example of EDLNF is carbonated beverages. All carbonated beverages are not EDLNF, but about 79.5% of them are. These are prohibited from sale by schools and outstanding business for children. On the other hand, fermented milk and fish meat sausages have 0% EDLNF and are sold without restriction.²⁶

The designation of EDLNF standards in Korea has led producers of child oriented foods to consider nutritional content in the development of products. Producers, for example, have changed ingredients to reduce sugar content and have begun to use different processing methods to reduce saturated fat. However, there are producers of some products with characteristically high EDLNF content (candy, soda, etc.) who have forcefully opposed these standards. There has also been the suggestion that producers will be tempted to circumvent EDLNF categorization by substituting sugars with artificial sweeteners. In addition, there are calls for more detailed categorization as EDLNF is based on per meal value without consideration for serving characteristics.

There is still little research conducted on the issues of children's preferred foods as related to EDLNF. Further studies are necessary to understand the current state of changes in the food industry and to assess the EDLNF rates in the various food types. The Korean government continues in its efforts to promote the healthy environments for children in its research and regulatory interventions.

AUTHOR DISCLOSURES

The authors have no conflicts of interest in preparing this manuscript. This is a review article on the nutritional standards of EDLNF, and the work described was the outcome of research by the Korea Food and Drug Administration. (Recently the name KFDA was changed to the Ministry of Food and Drug Safety following changes to the organization of the Republic of Korea government).

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韩国儿童的高能量低营养食品之营养标准

儿童肥胖的比例不断增加，已经成为当代社会一个严重的问题。在韩国，学校附近食品摊的卫生环境尤其令人堪忧，所以 2009 年《儿童饮食生活健康管理特殊法》出台实施，旨在增强食品安全，提高食品营养。特殊法的一些主要措施包括禁止学校餐厅和优秀企业出售高能量低营养食品(以下简称 EDLNF)，禁止电视台播放 EDLNF 的广告。蜜饯、糖果、甜味冰制品、面包、巧克力、加工牛奶、发酵乳、冰淇淋、鱼肉香肠、水果/蔬菜饮料、碳酸饮料、复合饮料和乳酸菌饮料均属于 EDLNF 类别。为了制定 EDLNF 的营养标准，以《2005 年韩国国家健康和营养调查》为基础，分析了韩国儿童偏爱食物的摄入比例和营养类别。每份食物如包含超过 250 千卡的热量，超过 17 克的糖或超过 4 克的饱和脂肪和少于 2 克的蛋白质则被视为 EDLNF 零食。韩国政府正集中致力于通过调查研究和食品政策，以提高儿童的健康环境。需要更多的研究著手调查目前儿童食品行业状态的改变。

关键词：高能量低营养食物、儿童偏爱食物、肥胖、零食、代餐