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Analysis of dietary insoluble and soluble fiber contents in school meal

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Abstract

The objective of this study was to estimate the contents of dietary insoluble and soluble fiber in school meal. Samples of the school meals were collected from May to June in 2008. Three elementary schools and three middle schools around Masan area were selected for analysis. Dietary soluble and insoluble fibers in the school meals were analyzed directly by the AOAC method. From the initial experiment phase, we used cellulose and pectin as a standard of dietary fiber, and average recovery rate of insoluble fiber and soluble fiber was calculated. The recovery rate was observed, the cellulose 109.7±11.7% (range 90~150%) and pectin 77.8±10.8% (range 64.7~96.7%), respectively. The amounts of insoluble fiber and soluble fiber were analyzed in the total of 66 dishes, which included 7 kinds of cooked rice (bab) made with some cereal products and vegetables, 19 kinds of soup (guk) made with meats or vegetables, 11 kinds of kimchi, 21 kinds of entrées or side dishes, and 8 special dishes. Conclusively the school meal, per serving size, would provide above 75% KDRI of total dietary fibers through mainly soups and special menu, with the exception to fruits. In addition, it might be expected that children could consume more soluble fiber from the meals with the special dishes than from the regular ones.

Key Words: Dietary fiber, insoluble fiber, soluble fiber, school meal

Introduction

The health benefit of dietary fiber, as a kind of phytochemical, is no longer an issue any more. In recent, the dietary fiber is considered to be the most important nutrient, especially in preventing obesity, which is a worldwide epidemic disease [1]. Further, the intake of dietary fiber five or six times a day is also believed to prevent chronic diseases, like cancer, cardiovascular disease and diabetes mellitus. Dietary fiber is food's component that are rich in whole grain, various vegetables, and some fruits and seaweeds.

In fact, the main physiological function of dietary fiber is that it expands the stomach to provide a powerful satiety signal, allowing the feeling of being full and satisfied [2]. The other functions of dietary fiber are supporting the fermentation of bacteria and the increment of the fecal volumes, mainly in the large intestine which stimulate peristaltic contraction and thus, allowing the excretion of the feces more easily [3]. This effectiveness of dietary fiber is the key point of treatment for metabolic syndromes, especially obesity. Recently, one of the critical public health problems is the increasing prevalence of obesity in younger population in Korea, as similarly observed many developed countries [4]. Therefore, their consumption of dietary fiber is recommended in school meal in addition to at home.

According to KDRIs [5], the adequate intake (AI) for dietary fiber in all groups over the age of 12 years is determined as 25 g for male, 20 g for female, while AI of the age group between 6 and 11 years is 20 g for boys, and 15 g for girls. It means that each school meal has to provide dietary fiber approximately, from 5 g to 8 g. DRI of dietary fiber was determined by AI of total fiber only, without the differentiation of insoluble and soluble fiber.

Total dietary fiber (TDF) are determined independently, or are obtained from the amount of insoluble dietary fiber (IDF), plus the amount of soluble dietary fiber (SDF) by enzymatic procedures of AOAC method [6]. However, in some samples, soluble fiber determination often has the problem of filtration, so the two methods mentioned above can't reach the same values of dietary total fiber. Therefore, the recovery rate of soluble fiber should be considered to obtain an accurate analysis.

The main objective of this study was to quantify dietary fibers in each school menu, through direct analysis and to figure out the providing amounts of insoluble and soluble fiber from the school meals.

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Materials and Methods

Sample collection and pretreatment

Total of 130 school-lunch dishes were collected randomly from primary and middle schools around the Masan area in Changwon city. The amount of insoluble fiber and soluble fiber were analyzed in 66 dishes, which included 7 kinds of cooked rice (bab) made with some cereal products and vegetables, 19 kinds of soup (guk) made with various meats or vegetables, 11 kinds of kimchi, 21 kinds of entrées and side dishes and 8 special dishes. The samples were stored -80℃ before analysis was conducted.

Analysis of dietary fiber

The fiber was extracted enzymatically by AOAC method from fat-extracted samples, using Soxlet's method [6]. Dry sample was homogenized with 40 ml MES/TRIS (pH 8.2) solution and α-amylase solution was added. Then heating with 95℃ water bath was carried out. After which, the reactants was cooled at room temperature and washed with distilled water, adding protease solution in 60℃ water bath. It was mixed with 5 ml of 0.56 N HCl solution, adjusted at pH 4.0. After then, 300 ul of amyloglucosidase solution was added and stirred at 60℃ hot plate. To extract the insoluble fiber, the solution was filtered using glass filter, with 1 g celite, and the filtrate was washed with 78% ethanol, 95% ethanol and acetone in turn. After overnight, the residue in the glass filter was weighed for the insoluble fiber. The filtrate collected was added 95% ethanol and distilled water. For extract of soluble fiber, the solution was filtered using a glass filter with celite and the filtrate was washed with 15 ml of 78% ethanol, 95% ethanol and acetone, in turn. After overnight, the residue in the glass filter was weighed for the soluble fiber. All chemicals were bought as HPLC grade (Sigma, St. Louis, MO, USA).

Recovery rate of fiber analysis

For the recovery rate of fiber analysis, cellulose and pectin were used as standard materials for insoluble and soluble fiber, respectively. And the relationship, between the amount of fiber analyzed and the eluted amount, was expressed as an equation for the recovery rate. The recovery rate of standard dietary fibers was conducted to sustain the reliability and the reproducibility of the experimental data.

Statistical analysis

Dietary fiber contents per 100 g of each dish were attained by duplication of the experimental analysis and the average values were calculated. The serving amount and intake of the dietary fiber were obtained by multiplying fiber concentration of each dish, by serving size of the meals. All data were managed automatically by using SPSS v.14. The graphs were drawn by Microsoft Excel.

Results

Recovery rate of dietary fibers

As shown in Fig. 1, the recovery rate was obtained quite differently between the insoluble fiber and the soluble fiber. The recovery rate of the cellulose was 109.7 ± 11.7% (range 90-150%) and that of pectin was 77.8 ± 10.8% (range 64.7-96.7%), respectively. There are various soluble fibers in the foods and it is difficult to correctly adjust the recovery rate of the data. However, it could provide the reliability and reprodutivity of all data.

Total, insoluble and soluble dietary fiber content per serving size in each dish

Table 1-Table 5 shows the content of total, insoluble and soluble dietary fiber per serving size in each dish. These values were calculated from the data analyzed, per 100 g in the laboratory, and actual serving amount of the school meals.

The content range of total dietary fibers for the cooked rice, entrée & side dish, soup, and kimchi per serving size were 0.6-5.5 g (average 3.1 g), 0.0-12.7 g (average 3.3 g), 2.8-15.2 g (average

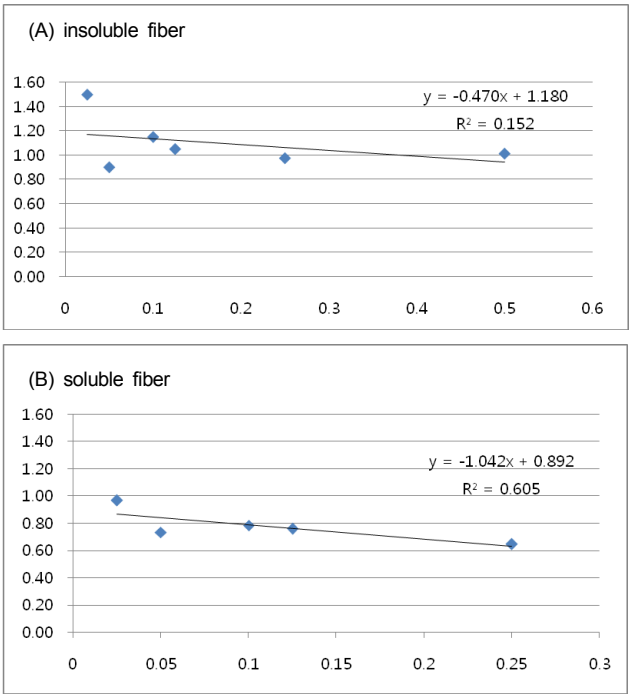

Fig. 1. Recovery rates of insoluble fiber (cellulose, A) and soluble fiber (pectin, B). In Fig. 1A & 1B, the X axis represents the existent amounts (unit; g) of two fibers and Y axis represents the recovery rate through standard experiment.

Table 1. Dietary fiber contents in cooked rice

Menu Category	Korean Name	Description	g/100 g			g/serving size			
			TDF	IDF	SDF	Wt.	TDF	IDF	SDF
Cooked rice	Ssalbab	Cooked paddy rice	0.56	0.56	0.00	113.98	0.64	0.64	0.00
	Yulmubab	Cooked rice w/ Jobis tears	1.66	1.66	0.00	147.85	2.45	2.45	0.00
	Chajobab	Cooked rice w/ glutinous millet	2.03	1.69	0.34	137.25	2.79	2.32	0.47
	Okgokbab	Cooked rice w/ various cereals	2.57	2.42	0.14	135.85	3.49	3.28	0.19
	Tongmilsalbab	Cooked rice w/ whole-wheat	2.61	2.33	0.28	129.10	3.37	3.08	0.36
	Gangnamkongbab	Cooked rice w/ kidney bean & millet	2.62	2.05	0.57	133.82	3.51	2.74	0.76
	Wandukongbab	Cooked rice w/ green peas	3.16	2.85	0.31	175.45	5.54	5.00	0.54
	Average ± SD		2.17 ± 0.86	1.94 ± 0.74	0.23 ± 0.20	139.04 ± 19.02	3.11 ± 1.47	2.78 ± 1.30	0.33 ± 0.29

Table 2. Dietary fiber contents in entrees or side-dishes

Menu Category	Korean Name	Description	g/100 g			g/serving size			
			TDF	IDF	SDF	Wt.	TDF	IDF	SDF
Entrees & side dishes	Hobagnamul	Zucchini, cooked	1.32	1.17	0.16	16.21	0.21	0.19	0.03
	Modumyachae	Vegetable salad	2.35	1.82	0.53	21.55	0.51	0.39	0.11
	Saengkuail & kiwidressing	Raw fruit salad & kiwi dressing	2.77	1.98	0.79	78.56	2.18	1.56	0.62
	Kodarimujorim	Braised fish paste	3.13	2.53	0.60	76.06	2.38	1.92	0.46
	Pangibuseot-paprikasalad	Mushroom salad w/ paprica	3.92	3.81	0.11	34.20	1.34	1.30	0.04
	Sigeumchinamul	Seasoned spinach w/ Flammulina velutipes	3.82	3.72	0.10	12.83	0.49	0.48	0.01
	Mugeunkimchidotori mukmuchim	Seasoned acorn starch jelly w/ kimchi	3.99	3.52	0.47	83.38	3.33	2.94	0.39
	Dagdarijorim	Baraied chicken leg	4.16	3.80	0.37	42.55	1.77	1.61	0.16
	Dubuyangnyum-jorim	Brasied tofu w/ seasoning	4.59	4.30	0.28	35.90	1.65	1.54	0.10
	Jogiyangnyumgui	Grilled yellow croaker w/ seasoning	6.79	6.49	0.30	56.00	3.80	3.64	0.16
	Bulnagbokkum	Stir-fried beef w/ small octopus	7.20	5.94	1.26	60.16	4.33	3.57	0.76
	Nokchasamgyub-salgui	Grilled pork w/ greentea	7.94	7.78	0.16	51.60	4.09	4.01	0.08
	Samgyubsaljukkumi-bokkum	Stir-fried pork w/ small octopus	8.01	7.54	0.47	34.30	2.75	2.59	0.16
	Gogumajulgi-galchijorim	Braised stalk of sweet potato w/ hair tail	8.29	7.86	0.43	89.78	7.44	7.06	0.38
	Yimyunsoogui	Grilled alabesque greenling	8.38	7.96	0.42	27.40	2.30	2.18	0.12
	Geumunkong-yangnyeumgui	Grilled black bean	8.61	8.14	0.47	50.15	4.32	4.08	0.24
	Gangnangkongjorim	Braised kidney bean	9.90	7.86	2.03	18.65	1.85	1.47	0.38
	Gochumechurial-jorim	Braised green pepper & chichen egg	9.78	9.38	0.40	44.90	4.39	4.21	0.18
	Gochujangbulgogi	Stir-fried pork w/ red pepper paste	9.99	9.99	0.00	127.35	12.72	12.72	0.00
	Haebalagissi-myelchibokkum	Stir-fried anchovy, dried & sunflower dry roasted	10.19	9.99	0.19	12.30	1.25	1.23	0.02
	Dongas	Pork cutlet w/ vegetables	16.16	15.55	0.61	52.56	8.49	8.17	0.32
	Average ± SD		6.73 ± 3.57	6.24 ± 3.52	0.48 ± 0.45	48.88 ± 29.43	3.25 ± 3.02	3.18 ± 2.99	0.23 ± 0.21

8.5 g), 0.3-6.7 g (average 1.2 g), respectively, and in the special dishes 1.1-24.1 g (average 7.6 g). The content range of insoluble dietary fiber in cooked rice, entrees & side dishes, soup and kimchi per serving size were 0.6-5.0 g (average 2.8 g), 0.2-12.7 g (average 3.2 g), 2.3-14.3 g (average 8.0 g), 0.2-5.6 g (average 1.0 g), respectively, and in the special dishes 0.8-21.0 g (average 6.2 g). Further, the content range of soluble dietary fiber in cooked rice, entrees & side dishes, soup, and kimchi per serving size were 0.0-0.7 g (average 0.3 g), 0.0-0.8 g (average 0.2 g), 0.0-1.1 g (average 0.5 g), 0.0-1.1 g (average 0.2 g), respectively, and in special the dishes provided 0.0-5.2 g (average 1.4 g).

In Table 6, the regular meal, per serving size, provided the

Table 3. Dietary fiber in soup

Menu Category	Korean Name	Description	g/100 g			g/serving size		
			TDF	IDF	SDF	Wt.	TDF	IDF	SDF
Soup	Kimchidubuchijigae	Stew w/ kimchi & unpressed tofu	2.61	2.39	0.22	140.03	3.66	3.35	0.31
	Shoegogiguk I	Beef soup I	2.28	1.87	0.42	122.97	2.81	2.30	0.51
	Shoegogiguk II	Beef soup II	4.03	3.58	0.45	146.83	5.92	5.26	0.66
	Shoegogimuguk	Soup w/ beef & radish	3.67	3.39	0.27	138.25	5.07	4.69	0.37
	Doejigogikimchijigae	Hot stew w/ pork & kimchi	3.88	3.88	0.00	162.32	6.30	6.30	0.00
	Sullungtang	Soup w/ beef & bone	4.03	3.88	0.16	274.85	11.08	10.66	0.44
	Yubumuguk	Fried soybean curd soup w/ radish	4.80	4.56	0.24	158.80	7.62	7.24	0.38
	Dubudoenjangguk	Soybean paste soup w/ tofu	4.61	4.33	0.29	117.05	5.40	5.07	0.34
	Kimchikongnamulguk	Soup w/ kimchi & beansprout	4.44	3.96	0.48	149.85	6.65	5.93	0.72
	Sonmanduguk	Soup w/ mandu	5.06	4.56	0.51	219.80	11.12	10.02	1.12
	Gamjatang	Soup w/ potato & bone	5.20	5.13	0.07	145.91	7.59	7.49	0.10
	Shoegogimiyeukguk	Soup w/ / beef & sea mustard	5.94	5.31	0.63	128.15	7.61	6.80	0.81
	Miyeukguk	Soup w/ sea mustard	6.60	6.03	0.57	165.05	10.89	9.95	0.94
	Gunsawusigeumchiguk	Soup w/ dried small shrimps & spinach	6.90	6.44	0.47	110.35	7.61	7.11	0.52
	Yukgaejang	Beef soup w/ seasoned red pepper sauce	7.13	6.83	0.30	167.54	11.94	11.44	0.50
	Samgaetang	Chicken soup	7.13	7.13	0.00	138.10	9.85	9.85	0.00
	Urukmaewuntang	Hot soup w/ soft shell clam	7.88	7.54	0.34	180.00	14.18	13.57	0.61
	Gunsaewuawugguk	Soybean paste soup w/ dried small shrimps & mallow	7.75	7.68	0.08	129.75	10.05	9.95	0.10
	Yundubudoenjangguk	Soybean paste soup w/ soft tofu	15.27	14.31	0.95	99.76	15.23	14.28	0.95
	Average ± SD		5.75 ± 2.84	5.41 ± 2.73	0.34 ± 0.24	152.39 ± 40.29	8.45 ± 3.40	7.96 ± 3.30	0.49 ± 0.32

Table 4. Dietary fiber contents in kimchi

Menu Category	Korean Name	Description	g/100 g			g/serving size		
			TDF	IDF	SDF	Wt.	TDF	IDF	SDF
Kimchi	Bakkimchi	Chinese cabbage & radish kimchi	1.63	1.05	0.58	28.35	0.46	0.30	0.16
	Gakdugi I	Cubed radish kimchi I	3.54	2.64	0.90	26.75	0.95	0.71	0.24
	Gakdugi II	Cubed radish kimchi II	2.78	1.79	1.00	12.59	0.35	0.23	0.13
	Oisobaegi	Cucumber kimchi	2.80	2.28	0.52	36.51	1.02	0.83	0.19
	Buchukimchi	Leek kimchi	3.14	2.47	0.67	10.26	0.32	0.25	0.07
	Yulmukimchi I	Radish leaves kimchi I	4.29	3.57	0.72	12.18	0.52	0.43	0.09
	YeulmukimchiII	Radish leaves kimchi II	3.56	2.76	0.80	12.18	0.43	0.33	0.10
	Kaenipgymchi	Perilla-leaf kimchi	3.90	3.44	0.46	13.90	0.54	0.48	0.06
	Baechukimchi I	Chinese cabbage kimchi I	4.06	3.22	0.83	24.24	0.98	0.78	0.20
	Baechukimchi II	Chinese cabbage kimchi II	4.14	3.03	1.12	20.20	0.84	0.61	0.23
	Mugeunkimchi-bokkum	Stir-fried kimchi fermented long-term	15.86	13.21	2.64	42.31	6.71	5.59	1.12
	Average ± SD		4.52 ± 3.84	3.59 ± 3.28	0.93 ± 0.60	21.77 ± 10.86	1.19 ± 1.85	0.96 ± 1.55	0.24 ± 0.30

total fiber of approximately, 16.0 g, while meal with the special dishes provided 17.2 g, including the soup and kimchi. In addition, the regular meal per serving size provided the soluble fiber of approximately 1.3 g, while meal with the special dishes provided 2.1 g. Considering of actual intake of soluble fiber, it might be expected that children could be provided total fiber of above 75% RDA, except the consumption of fruits, and the meal with the special dishes contains more fiber than the regular meal.

The soup and the special dishes were the important for providing sufficient dietary fiber in the school meals. The high-fiber containing items with above 10 g per serving size were only a few in the menu category of entrées & side dishes and not found in the cooked rice. In contrast, there were a total of seven items in the soup category. For example, soup containing beef & bone, mandu, seamustard, seasoned red pepper, and hot soup with shell clam, dried small shrimps & mallow, soft tofu. Moreover when providing the special dishes, the cooked rice with radish leaf kimchi and noodles with black bean paste were the

Table 5. Dietary fiber contents in special dishes

Menu Category	Korean Name	Description	g/100 g			g/serving size			
			TDF	IDF	SDF	Wt.	TDF	IDF	SDF
Special dishes	Kongnamulbab	Cooked rice w/ seasoned bean sprout	1.23	1.23	0.00	188.4	2.32	2.32	0.00
	Youlmubibimbab	Cooked rice w/ radish leaf kimchi	6.82	5.93	0.89	354.10	24.14	20.99	3.15
	Ddubokki	Pan-boiled dduk & vegetables seasoned w/ red pepper paste	2.21	1.60	0.62	51.98	1.15	0.83	0.32
	Shoegogijangguk	Beef gruel	2.41	1.69	0.72	139.56	3.36	2.36	1.00
	Gungjung-ddukbokkijabche	Mixed dish of dduk & vegetables	4.03	3.07	0.95	79.70	3.21	2.45	0.76
	Zazangmyen	Noodles w/ black bean paste	4.07	3.05	1.02	506.80	20.63	15.47	5.17
	Bibimmandu	Seasoned mandu	5.18	3.70	1.48	52.25	2.71	1.93	0.77
	Gamjabumbuk	Potato salad	12.64	12.64	0.00	23.54	2.98	2.98	0.00
	Average ± SD		4.82 ± 3.62	4.11 ± 3.76	0.71 ± 0.51	174.54 ± 171.47	7.56 ± 9.22	6.17 ± 7.62	1.40 ± 1.83

Table 6. Dietary fiber contents in school meal

	Menu Category	g/100 g sample				g/serving size			
		Average Wt.	TDF	IDF	SDF	Average Wt.	TDF	IDF	SDF
Regular	Cooked rice	100.0	2.17	1.94	0.23	139.04	3.11	2.78	0.33
	Entrees & side dishes	100.0	6.73	6.24	0.48	48.88	3.25	3.18	0.23
	Soup	100.0	5.75	5.41	0.34	152.39	8.45	7.96	0.49
	Kimchi	100.0	4.52	3.59	0.93	21.77	1.19	0.96	0.23
	Sum	400.0	19.17	17.18	1.99	362.08	16.01	14.88	1.29
Special	Special dishes	100.0	4.82	4.11	0.71	174.54	7.56	6.16	1.40
	Soup	100.0	5.75	5.41	0.34	152.39	8.45	7.96	0.49
	Kimchi	100.0	4.52	3.59	0.93	21.77	1.19	0.96	0.24
	Sum	300.0	15.09	13.11	1.98	348.70	17.21	15.09	2.12

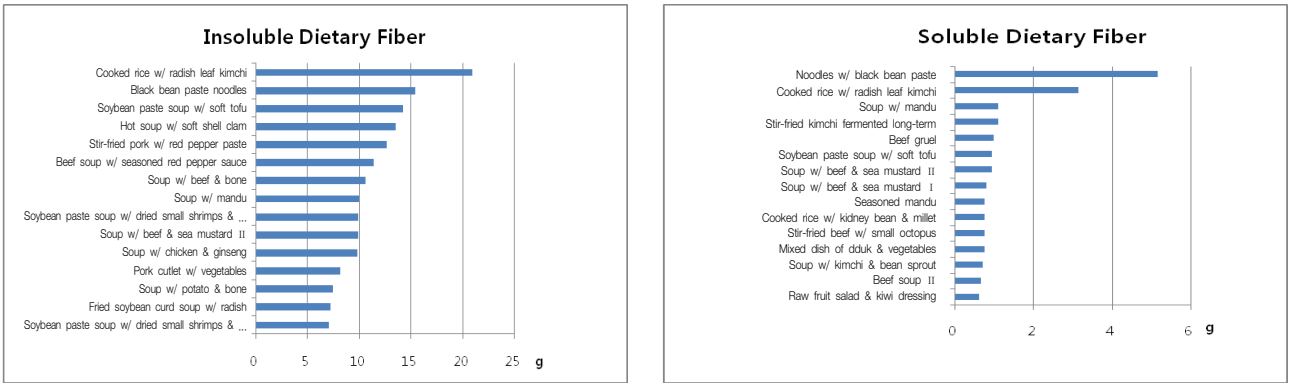

Fig. 2. The list of high-fiber containing menu in the school meals

highest items. Fig. 2 shows the list of 15 high-fiber containing menu in the school meals.

Discussion

These data suggest that the school meals, per serving size, would provide above 75% KDRI of total dietary fibers, through mainly the soups and the special dishes conclusively. In addition, it might be expected that children could consume more soluble fiber from the meal with special dishes rather than the regular meals.

Nowadays, it is well-known that a high fat, low carbohydrate diet might be one of the more important factors to cause metabolic imbalance that underlies for the problem of obesity, cardiovascular disease and several cancers. In western society, where fat consumption has been relatively higher than in the Asian countries, it is recommended that fat intake of less than 30% of total energy will lower the risk of such related diseases [7]. However, some researchers suggested that there is no evidence of increased risk with the increased fat intake through the national survey in about 13,000 persons [8-9].

Traditionally for Koreans, most energy comes from carbohydrates, and fat has only contributed approximately 15%-20%. However, the food consumption pattern has been changed, gradually for over the past three decades. People tend to consume more animal foods and less plants, and the prevalence of obesity, cardiovascular diseases, diabetes mellitus, along with prostate cancer and breast cancer have increased during that time [10,11]. In the same period, fat intake increased three times as much, according to the steady increase of animal food intake. According to KNHANES IV, in general, food intakes of Koreans showed to reach the peak in 2001-2005, and after which, mainly the intake of plant foods reduced, except potatoes and sweet products. However, animal foods such as meats, milk & milk products or eggs showed an increasing trend [11].

Therefore, interest in the source of dietary fiber has been growing dramatically. Thus, consumption of vegetables and fruits, as well as seaweeds has been on the rise for the average consumers. These foods are nutrient-rich sources, such as fiber, vitamins or minerals and/or phytochemicals. However, the consumption of seaweeds and vegetables, which are fiber-rich foods, has been reduced since 2001 for ten years. The range of dietary fiber intake were 6.4-7.2 g/d, which was approximately 30% of AI for KDRIs [10,11].

In school, foods need to provide the children with sufficient overall nutritional dietary intake and to teach them about nutrition, as well as, social aspects of eating. Recently, children have been enjoying chips, burgers and other high-fat content dishes, such as cakes and soft drinks; with only a very select few opting for fruits and vegetables [12]. As a result, the nutritional quality of school meal has been blamed for having too much saturated fat and non-milk extrinsic sugar or salt, and not enough fruits and vegetables etc. [13,14]. In school meal, the detrimental factor of total dietary fiber intake was the menu selection and the preference for entrees and side-dishes or special dishes. It is much needed to enhance both the interest in food, while improving the variety and the quality of food provided in schools, which will be an effort to reverse some of the deterioration in the dietary habits of school children. Ultimately, halt the increase in obesity and associated health problems [15,16]. The range of carbohydrates consumed provides the body, not only with glucose to maintain blood levels for central and peripheral nervous system function, but also as a dietary fiber. It is also a food source for colon health [17-19].

The main dietary fiber definition, in current use, highlights the benefit to the physiological functionality. Dietary fiber consists of the plant cell wall-associated fibers, naturally occurring in fruits, vegetables, and cereal products, in addition to the isolated fibers that are added to processed foods [7]. Dietary fiber has been frequently classified as soluble and insoluble. The distinction is due to the chemical properties of fiber sources and analytical quantification; it does not necessarily reflect the physiological effects [20,21]. The fiber definition also includes lignin and other associated compounds that are intrinsic and intact in the plant cell wall. Insoluble fiber reaches the colon, largely unchanged, and is not fermented by bacteria. The water-holding characteristics of the insoluble fiber meant that together, with the large bacterial mass, the total intra-colonic mass is greater and thereby, leads to an increased peristaltic action, which increases the speed of movement of the contents in the colon. This action reduces overall transit time through the gastrointestinal tract, and contributes to the overall laxation effect [22,23]. In the large intestine, soluble fiber is acted upon by the bacterial flora. This process of fermentation releases a number of SCFA: propionic acid and acetic acid are metabolized in the liver, but butyric acid is used locally by the gut colonocytes, as an essential source of energy. The multiplication of the bacterial flora increases the bulk and the water content of the stools. Besides, diets that are rich in fiber encourages chewing, which both slows the process of eating and increases saliva flow, which contributes to the satiation and promoting dental health, as well. As dietary fiber travels through the small intestine, bile acid and divalent cations, such as calcium, zinc and iron, are bound to the surface of the fiber, which may reduce their availability for absorption [24-28].

Traditionally, fiber has been analyzed using the AOAC Official Method of Analysis 985.29, or with other AOAC methods. This method is a generally accepted method of analysis for the quantification of dietary fiber. However, there is no consensus of the definition regarding whether the non-digestible polymers with a degree of polymerization in the range of three to nine should be defined as fiber. In the EU definition, these are included, but the Codex definition leaves it up to the national authorities to decide about their inclusion. The European Union and the Codex Committee on Nutrition and Foods for Special Dietary Uses (CCNFSDU) and the Codex Executive Committee Definitions, as well as that of AACC International (formerly the American Association of Cereal Chemists), include isolated fibers and synthetic polymers, but with the condition that they possess beneficial physiological effects [21,29-31].

Now, the discussion regarding dietary fiber is not an easy task. The chemical heterogeneity may often cause the confusion of as to the definition and the physiological function. Moreover, their physicochemical properties can change during cooking or digestion. Therefore, dietary fiber is continuously needed to develop the analytical methods and epidemiological research for the accurate analysis of specific fiber quantitatively and qualitatively [21].

Nevertheless, considering the above mentioned facts, these results might be used as a nutritional assessment for the dietary intakes of insoluble fiber, as well as, soluble fiber in children via school meal in the near future.

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