Nutrition Research and Practice (2009), 3(4), 328-333
DOI: 10.4162/nrp.2009.3.4.328

Short Communication

Workers intake too much salt from dishes of eating out and food service cafeterias; direct chemical analysis of sodium content*

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Abstract

The average sodium intake of Koreans was reported to be 5,279.9 mg/day, which is one of the highest intake levels worldwide. The average Koreans intake 19.6% of sodium from kimchi, showing kimchi as the main contributor of sodium in this country (Ministry of Health and Welfare, 2005). The sodium content of dishes that are frequently chosen by workers, and which were served by foodservice cafeterias were chemically analyzed. The average sodium content of one meal provided by 10 foodservice cafeterias was 2,777.7 mg. Twenty-one, one-dish-meals, frequently chosen by workers for a lunch menu, were collected at 4 different restaurants for each menu by one male, aged in the twenties and analyzed chemically also. Workers who eat lunch at a workplace cafeteria everyday could intake about 8 g of salt at a one-time meal and those who eat out for a one-dish-meal would intake 3-8 g of salt without counting sodium content from the side dishes. From these study results, one could estimate that over 10 g of salt could be possible for a single meal for workers who eat out everyday. A nationwide nutrition campaign and education for low salt diets for restaurant owners and foodservice providers should be seriously considered.

Key Words: Chemical analysis, sodium content, eating out menu

Introduction

Most of the sodium consumed by Koreans comes from salt. Sodium is the mineral that causes high blood pressure and is also related to various chronic diseases (Dumier, 2009; Lee *et al*., 2002; Moon *et al*., 2009; Ritz *et al*., 2009; Son, 2007). The INTERSALT study for the subjects of 10,079 among 32 countries found a strong relationship between the amount of salt intake and prevalence of high blood pressure (Stamler, 1991).

Korea shows the highest salt consumption in the world. While the sodium consumed by people from Western countries mainly comes from processed foods, most Koreans consume nearly half of the total sodium through their traditional diet (Lee, 2009; Moon *et al*., 2009; The Korean Nutrition Society, 2005), including kimchi. According to the National Health and Nutrition Survey results in 2005, the average daily sodium intake of Koreans was reported to be 5,279.9 mg and that of Seoul citizens was 4,891.2 mg (Ministry of Health and Welfare, 2005). This amount is even higher than Japan's 4,212.6 mg, the U.S.'s 3,375 mg, and even more than double the amount recommended by WHO/FAO, 2,000 mg. This means that Koreans are consuming excessive amounts of sodium everyday. The World Health Organization recommends daily salt intake of 5.0 g (sodium 2,000 mg). The Korean Nutrition Society set the daily intake goal of salt 5.0 g in 2005 (The Korean Nutrition Society, 2005). Furthermore, the Ministry for Health, Welfare and Family Affairs, which sets dietary goals and guidelines for Koreans, argues for the salt intake level of less than 10 g per day. Looking overseas, the USA, USDA, which is responsible for setting dietary guidelines for Americans, set less than 5.75 g of salt for the general public and 3.75 g for hypertensive patients. Additionally, the British Department of Health in 2004 recomm-

* This study was supported by the 2009 Seoul City Food Hygiene Promotion Fund.
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Received: October 9, 2009, Revised: November 17, 2009, Accepted: December 17, 2009

ended 6 g. Meanwhile, Health Japan 21 of the Ministry of Health, Labor and Welfare recommends less than 10 g of salt per day in 2000, and in 2005, a tentative target intake of less than 10 g for male adults and 8 g for female adults were recommended as the nutrition intake standards (Ministry of Health and Welfare, 2005; Park *et al*., 2008; The Korean Nutrition Society, 2005).

The absorption of salt, which consists of sodium and chlorine, causes water retention from the kidneys, which is normally discharged as urine. Water retainded with sodium in the body increases the amount of body fluid, burdening the heart and artery and causes various chronic diseases such as cancer, cardiovascular diseases, hypertension, hyperlipidemia, obesity, etc (Kim & Choi, 2007; Lee *et al*., 2002; Moon *et al*., 2009; Ritz *et al*., 2009). In fact, when sodium consumption is higher than 4,331 mg (salt 11.8 g), the risk of high blood pressure is known to be 1.5 times higher.

It is believed that the higher rate of strokes in Korea, despite the lower levels of obesity, is a result of high sodium intake (Kim & Choi, 2007). Park (2007) reported that when the sodium intake was reduced by 7 g, the blood pressure decreased by 9 mmHg accordingly among the subjects of Gyeonggi-Do province, Nutrition Intervention Project for Gyeonggi-Do low salt diet life. There was another report showing that reducing salt intake by 5.8 g caused a decrease in blood pressure by 1.5-3.5 mmHg among Koreans (Son *et al*., 2007).

Therefore this study analyzing sodium content of dishes for which workers frequently choose as eating out lunch menus or worksite cafeterias serve will provide the basic idea for further research in preventing lifestyle diseases.

Subjects and Methods

Subjects and study period

Eighty-four restaurants and 10 foodservice cafeterias were chosen for the study as the convenience sample. First of all, the purpose of the research was explained to provisional target worksite cafeterias. After this process, 10 sites of worksite cafeterias agreed to cooperate, as did 5 sites in the Gangnam areas and 5 sites in Gangbuk areas. Fifty-eight dishes altogether from these 10 foodservice cafeteria menus were collected and chemically analyzed. And twenty-one one-dish-meals, which are frequently chosen by workers as a lunch menu, were collected. For each menu, 4 different restaurants, for a total of 84 restaurants were chosen and 84 dishes of one portion size were collected by one male aged in his twenties and they chemically analyzed. For each popular menu two restaurants from the Gangbuk area (Gwangjin-gu, Seongdong-gu), and other two restaurants from the Gangnam area of Seoul (Gangnam-gu, Seocho-gu) were chosen. Food sample collection was carried out from the 12th of January to the 23rd of January 2009 and sodium contents were decided by the direct chemical analysis method (*Korea Food and Drug Administration*, 2009).

Method

The research team consisted of one male in his 20s, who did not know the purpose of the research, and one pre-rained researcher collected the food samples manually. The man responsible for collecting foods at the worksite cafeterias collected in exactly the same way as he would eat normally, which means the portion size would not be changed. At worksite cafeterias all of the menus were served buffet style, except the soup, or *jjigae*, which were served by cafeteria staff. Most of the meals consisted of rice, soup and 2 or 3 side dishes and kimchi. Collected dishes at the food service cafeteria by the researcher were weighed, serially numbered and recorded.

Popular eating out lunch menus, mostly one-dish-meals for workers also were bought for takeout, weighed, numbered and chemically analyzed for deciding sodium contents. The 21 eating out lunch menus were selected from referring several previous studies. firstly, by referring to eating out menus of "smart meals in one's pocket" (KHIDI & MIHWAF, 2006), developed by the Ministry for Health, Welfare and Family Affairs, secondly, people's frequently chosen menus based on the National Health and Nutrition survey results in 2005, and finally, considering seasonal foods, price and convenience characteristics. Among the collected lunch menus were rice dishes such as fried rice, bibimbap, japchaebap, curry rice, squid over rice, rice topped with spicy stir-fried pork, and wheat dishes such as mandu soup, wheat noodles, jjambbong, jajangmyun, and soups such as kimchi jjigae, soybeen paste stew, mixed-sausage stew, soft soybean curd stew, dambuk stew, kalbitang, seolleongtang, Korean sausage soup, yookgaejang, etc were included. The amount of sodium added to served soups such as Korean sausage soup, seolleongtang, which were served without salt, was decided according to the food collector's preference using table salt.

All of the collected foods were analyzed by the direct chemical analysis method and inductively coupled plasma mass spectrometry (ICP-MS, varian, USA) at the Korea Food and Drug Administration-certified lnstitute and translated to 100 g of each menu.

Results

Sodium contents of served meals from foodservice cafeterias

Table 1 shows sodium contents of served meals as lunch menu for male aged in the twenties from 10 foodservice cafeterias. The sodium content of cafeteria meals varied between minimum of 2,122.9 mg and maximum of 3,518.4 mg for one meal. The meals from the Gangbuk areas showed higher average amount of sodium compared to those of the Gangnam areas. However this tendency could not be generalized because this report was based on a small sample size study and our study did not employ the random sampling method. The average sodium content of served meals from foodservice cafeterias was 2,777.7 mg

Table 1. Sodium contents of served meals from foodservice cafeterias

Section	Gangnam Areas				Gangbuk Areas			
	menus	Sodium contents (mg) /100 g	Amount of foods (g)	Sodium (mg) portion (g)	menus	Sodium contents (mg) /100 g	Amount of foods (g)	Sodium (mg) portion (g)
1	Rice	28	210	59.0	Rice	28	210	59.0
	Seolleongtang+	299.1	475	1,420.7	Ducks stew	1,027.2	281	2,886.3
	Seasoned squid & vegetables	610.4	58.5	357.1	Seasoned egg apple	299.7	72.5	217.3
	Pickled pepper	1,046.4	13	136.0	Fried sweet potato	41.1	86.5	35.6
	Kimchi	842.4	49	412.8	Kotchori Kimchi	719.5	44.5	320.2
	The total			2,385.6	The total			3,518.4
2	Rice	28	210	59.0	Rice	28	210	59.0
	Soybean paste soup w/mallow	410.8	190.5	782.6	Gamgatang	346.8	373	1,293.4
	Grilled pacific saury	697.9	107	746.7	Steamed egg	422.1	89	375.6
	Boiled potato	288.5	82.5	238.0	Picked radish	2,048.3	44.5	911.5
	Seasoned bean sprouts	243.0	33	80.2	Seaweeds + vinegared red pepper paste	386.3	52.5	202.8
	Kimchi	627.3	34.5	216.4	Diced radish Kimchi	688.5	74.5	512.9
	The total			2,122.9	The total			3,355.2
3	Rice	28	210	59.0	Rice	28	210	59.0
	Soybean paste soup w/shepherd´s purse	337.7	210	709.2	Bean-curd stew	378.1	255.5	966.0
	Seasoned squid & vinegared red pepper paste	271.4	61	165.6	Steamed ribs of pork	750.6	149	1,118.3
	Pancakes buckwheat	350.6	93.5	327.8	Seasoned squid & radish	612.7	48.5	297.2
	Seasoned deo-deog w/red pepper paste	1,395.5	71	990.8	Filleted leek	591.7	50.5	123.3
	Kimchi	740.0	52	384.9	Eolgari Kimchi	244.2	53.5	316.5
	The total			2,637.3	The total			2,862.3
4	Rice	28	210	59.0	Jajangbap	290.9	357	1,038.4
	Beef & radish soup	345.3	236	814.8	Egg soup	480.5	180	865.0
	Fish cutlet + sauce	519.9	84	436.7	Boiled mandu	192.9	53	102.3
	Seasoned chard	424.4	77.5	328.9	Pasta & vegetable salad (Dressing of mayonnaise)	127.1	75	95.4
	Seasoned green bean sprouts	559.4	57.5	321.6	Seasoned green bean sprouts	631.3	38.5	243.1
	Kimchi	920.9	86	792.0	Kimchi	1,039.3	63.5	660.0
	The total			2,753.0	The total			3,004.3
5	Rice	28	210	59.0	Rice	28	210	59.0
	Soybean paste soup w/mallow	357.0	266.5	951.4	Soybean paste soup w/chard	245.0	229	561.1
	Boiled mackerel & Kimchi	491.7	99	486.8	Boiled pork & egg	1,499.5	63	944.7
	Stir-fried hams & vegetables	655.3	44.5	291.6	Boiled anchovy & peanut	538.5	28	150.8
	Seasoned dried radish leaves	626.6	71	444.9	Seasoned spinach	465.5	43	200.2
	Kimchi	928.4	39.5	366.7	Whole radish Kimchi	474.6	131	621.7
	The total			2,600.4	The total			2,537.5
Average 2,499.8 ± 249.1					Average 3,055.5 ± 391.3			
Total Average 2,777.69 ± 461.56								

+Salt was added into the dish by the researcher.
* $P < 0.05$ by t-test

(Gangnam area, 2,499.8 mg; Gangbuk area, 3,055.5 mg, respectively). When compared with the Korean's average daily sodium intake, 5,279.9 mg by the 2005 National Health and Nutrition Examination Survey (Ministry of Health and Welfare, 2005), the sodium content of the served one meal in our study showed a rather higher amount which was 52.6% of Korean's average daily sodium intake and 56.7% of the average Seoul citizen's daily sodium intake, 4891.2 mg. This amount was approximately 1.4 times of 2,000 mg, the WHO/FAO recommended daily intake. (Ministry of Health and Welfare, 2005; The Korean Nutrition Society, 2005).

Using the 24-hr dietary recall method, Moon *et al*. (2009) reported that the most contributing foods for sodium intake for her Korean subjects were kimchies 28.3%, soups and hot soups 22.9%, stews and casseroles 9.8%, and seasonings 8.2%, respectively. Another study by Son & Huh (2002) reported that

Table 2. Sodium contents of frequently chosen dine out menus by workers

Ranking	Name of food	Average sodium (mg)	Gangnam Region					Gangbuk Region				
			Restaurant 1		Restaurant 2		Average sodium contents (mg)	Restaurant 1		Restaurant 2		Average sodium contents (mg)
			Sodium contents (mg)	Amount of foods (g)	Sodium contents (mg)	Amount of foods (g)		Sodium contents (mg)	Amount of foods (g)	Sodium contents (mg)	Amount of foods (g)	
1	Jjambbong	3,553.0 ± 132.2	3,836.7	1,005.0	2,381.1	1,104.0	3,108.9 ± 1,029.3	3,176.2	828.0	4,818.0	908.0	3,997.1 ± 1,160.9
2	Soybean paste stew	3,005.3 ± 1,587.5	4,729.6	526.5	3,881.2	546.0	4,305.4 ± 599.9	1,236.4	283.5	2,174.1	680.0	1,705.3 ± 663.1
3	Japchaebap	2,669.5 ± 950.7	2,529.3	799.0	3,761.6	696.5	3,145.5 ± 871.4	2,916.5	860.0	1,470.4	536.0	2,193.4 ± 1,022.6
4	Korean sausage soup	2,624.4 ± 1,116.0	2,812.0	734.5	3,558.2	1,083.0	3,185.1 ± 527.6	1,014.8	727.0	3,112.4	890.0	2,063.6 ± 1,483.2
5	Kimch stew	2,315.8 ± 864.8	2,209.7	537.0	1,874.8	537.5	2,042.2 ± 236.8	1,617.8	481.0	3,561.0	677.5	2,589.4 ± 1,374.1
6	Yookgaejang	2,260.7 ± 656.2	1,897.2	539.0	2,789.6	651.0	2,343.4 ± 631.0	1,519.9	512.0	2,836.0	657.0	2,178.0 ± 930.6
7	Mandu soup	2,189.7 ± 959.2	1,953.6	721.5	3,564.4	840.5	2,759.0 ± 1,139.0	1,908.4	534.5	1,332.2	555.5	1,620.3 ± 407.4
8	Mixed-sausage stew	2,017.4 ± 709.2	2,867.5	514.5	2,312.3	556.0	2,589.9 ± 392.6	1,592.5	700.0	1,297.2	381.0	1,444.9 ± 208.8
9	Jajangmyon	2,015.5 ± 179.8	2,137.9	650.5	1,847.8	662.5	1,992.8 ± 205.1	1,875.6	395.0	2,200.8	792.0	2,038.2 ± 230.0
10	Kalbitang	1,955.8 ± 782.9	2,900.1	1,250.0	1,012.3	604.5	1,956.2 ± 1,334.9	2,123.8	995.5	1,786.8	690.0	1,955.3 ± 238.3
11	Wheat noodles	1,802.2 ± 464.9	1,246.2	875.5	2,368.7	826.0	1,807.5 ± 793.7	1,701.5	1,237.5	1,892.5	852.0	1,797.0 ± 135.1
12	Dambuk stew	1,752.1 ± 806.1	2,876.8	695.0	1,507.5	450.0	2,192.1 ± 968.2	1,656.7	460.0	967.5	480.0	1,312.1 ± 487.3
13	Fried-rice	1,718.1 ± 767.2	1,165.1	488.5	2,512.3	461.0	1,838.7 ± 952.6	2,230.1	517.0	965.1	273.0	1,597.6 ± 894.5
14	Seolleongtang*	1,704.0 ± 846.3	1,743.3	728.0	2,740.9	1,015.5	2,242.1 ± 705.4	1,662.6	740.5	669.4	740.5	1,166.0 ± 702.3
15	Soft soybean curd stew	1,583.9 ± 806.9	1,291.0	423.5	2,784.5	529.0	2,037.7 ± 1,056.1	1,045.4	359.5	1,214.8	520.0	1,130.1 ± 119.8
16	Rice topped with spicy stir-fried pork	1,561.3 ± 557.0	2,368.5	708.0	1,328.3	543.0	1,848.4 ± 735.5	1,101.2	572.0	1,446.9	668.0	1,274.1 ± 244.5
17	squid over rice	1,396.5 ± 126.3	1,496.7	484.0	1,497.2	590.0	1,496.9 ± 0.4	1,357.3	611.0	1,234.9	481.5	1,296.1 ± 86.6
18	Curry rice	1,354.3 ± 267.0	1,150.9	497.0	1,228.6	609.0	1,189.8 ± 54.9	1,745.3	613.0	1,292.4	746.5	1,518.8 ± 320.3
19	Bibimbap	1,283.3 ± 110.4	1,340.7	440.0	1,119.6	358.0	1,230.2 ± 156.3	1,356.7	357.0	1,316.1	450.0	1,336.4 ± 28.7
20	Sweet-and -sour pork	794.6 ± 331.8	438.5	598.5	1,236.0	798.5	837.3 ± 563.9	801.9	450.0	701.9	416.5	751.9 ± 70.7
21	Kimbap	640.0 ± 312.2	897.6	246.5	913.0	241.5	905.3 ± 10.9	447.7	184.0	301.5	167.0	374.6 ± 103.4

*Salt was added by the researcher using table salt.

the contributing factors of daily sodium intake among certain Korean subjects was kimchies 30%, soups & stews 20%, fish foods 12%, etc. Son (2007) also reported kimchi 27.1%, soup, stew 21.8%, and fish 12.2%. The 2005 Korea National Health & Nutrition Examination Survey reported that kimchi (Ministry of Health and Welfare, 2005) was responsible for 23.1% of daily sodium intake. Son (2007) concluded that kimchi was the highest contributor of sodium consumption for Koreans.

However, our study results showed that kimchi was responsible for the average sodium intake of 460.5 mg, which was 16.6% of the total daily sodium intake of the served meals. This result showed a big difference with the above referred study results, especially Son and Huh (2002). These differences among studies of sodium contributing rates could be caused by the differences in the employed analysis method. All of the above mentioned studies were the results of the 24-hr dietary recall method or food frequency method, which could underestimate the amount of condiments and seasonings, especially the sodium contents, of meals. When employed, the 24-hr dietary recall method, the amounts and kinds of eaten meals are dependent on respondent's

memory and could vary according to one's memory lapse (Seo *et al*., 2008). The success of the 24-hr recall depends on the subject's memory, the ability of the respondent to convey accurate estimates of portion sizes consumed, the degree of motivation of the respondent, and the persistence of the interviewer (Acheson *et al*., 1980). Therefore, the amount of condiments and seasonings, which mainly affect the one's sodium intake, is likely to be inaccurately measured, mostly underestimated. Our study used the weighing method and the direct chemical analysis method. However in our adopted method, it is more likely that one would not eat all of the foods or sauces that were taken by an individual diner and the sodium intake level would be overestimated to some extent.

However, even after all these factors have been taken into consideration, it is clear that the sodium content of the average of one meal from food service cafeterias was very high. When one dines out, kimchi would not be the main contributor of the high sodium intake. Restaurant owners or cooks, usually use higher amounts of salt compared to homemade dishes to make food more tasty. This tendency is not exceptional for foodservice cafeterias of worksites.

Foods collected at Gangbuk showed higher amounts of sodium compared to those of Gangnam ($P < 0.05$). However since foods were not collected based on the random sampling method but on the convenience sampling method and did not collect enough numbers of cases, those selected cafeterias would not represent the different two areas. Consequently one cannot insist that the tastes of Gangbuk residents are more salty compared to Gangnam residents and these results cannot be generalized.

Sodium contents of frequently chosen dining out menus by workers

A total 21 menus were analyzed employing ICP-MS, varian, USA. The selected menus included 11 kinds of rice applied menus, 9 kinds of soups, stews and hot soups, etc. The frequently chosen dishes by workers as lunch menus were collected at 4 different restaurants for each menu, which totaled 84 dishes. For each popular lunch menu for workers, two restaurants from the Gangbuk areas (Gwangjin-gu, Seongdong-gu) and two other restaurants from the Gangnam areas of Seoul (Gangnam-gu and Seocho-gu) were chosen.

The amounts of a served meal and the sodium content are shown in Table 2. Jjambbong had the highest sodium content (3,553.0 mg) followed by soy bean paste stew (3,005.3 mg), then japchaebap (2,669.5 mg). Kimbap had the lowest sodium content (640.0 mg). It is presumed that in the case of jjambbong with 8.9 g of salt consumed at one meal and when jjambbong was eaten with pickled radish, over 10 g of salt consumption would be possible.

In the case of eating foods such as jjambbong or soybeen paste stew with side dishes, the amount of sodium included in rice (about 59 mg) and kimchi (about 458 mg) will be added to the amount of the main dish and one can intake sodium of 4,070 mg from one meal, which is over 10 g of salt.

Depending on the composition of meals, soup, stew type meals reach the highest sodium content and the next highest were pickles, then boiled foods and steamed foods. So when dining out, choosing menus with lower sodium contents is the healthy way of reducing sodium intake. However, Koreans, especially males and middle-aged males were not aware of the 29 kinds of typical salty dishes as being salty (Park *et al*., 2008), And this kind of information should be delivered to workers via nutrition education.

Discussion

The average sodium content of served dishes for one meal from foodservice cafeterias was 2,777.7 mg, which was about 7 g of salt. The average salt intake from restaurant dishes for one meal was about 8 g. These amounts of salt were much higher than those of typical home made meals. The menu for one meal with the largest amount of sodium was jjambbong (3,553.0 mg), then soybean paste stew (3,005. 3mg) followed by japchaebap (2,669.5 mg), and kimbap (640.0 mg) which showed the least.

Workers should choose menus with less amounts of salt in order to control one's sodium intake. The average salt contents of dishes which are popular and convenient for workers ranges from 3 g to 8 g and when salt from side dishes such as kimchi were added, the salt intake could increase to over 10 g for one meal. To reduce the amount of salt intake, Son insisted to reduce serving size of soup, to eat raw vegetables instead of kimchi, and to develop low sodium recipes for restaurant owners, etc (Son, 2007). The study results imply that kimchi would not be the primary contributor of high sodium intake for workers who frequently eat out.

Considering this study results of nutrition education for restaurant owners and for food service providers is needed to achieve healthy eating environments. Low salt diet campaign and promotion are also needed for workers who mostly eat out at the same time. For this purpose, an appropriate nutrition policy should be established and delivered to people to prevent life style diseases.

References

Acheson KJ, Campbell IT, Edholm OG, Miller DS & Stock MJ (1980). The measurement of food and energy intake in man-an evaluation of some techniques. *Am J Clin Nutr* 33:1147-1154.

Dumier F (2009). Dietary sodium intake and arterial blood pressure. *J Ren Nutr* 19:57-60.

KHIDI & MIHWAF (Korea Health Industry Development Institute & Ministry for Health, Welfare and Family Affairs) (2006). Food Dictionary for Obesity Prevention. http://www.khidi.or.kr/kplace/releaseview.do?no=416. Accessed on 9/27/2006.

Kim JH & Choi MK (2007). Salt intake behavior and blood pressure: the effect of taste sensitivity and preference. *The Korean Journal of Human Ecology* 16:837-848.

Korea Food and Drug Administration (2009). *Korean Food Standards Codex*, 2009, *Korea Food and Drug Administration.* Seoul. Republic of Korea

Lee SL (2009). The status of development and utilization of low-salt kimchi. *J Nutr Diet* 32:14-21.

Lee YK, Sung CJ, Choi MK & Lee YS (2002). Effects of sodium intakes on blood pressure and blood parameters in Korean normal adult women. *The Korean Journal of Nutrition* 35:754-762.

Ministry of Health and Welfare (2005). *The Third Korean National Health and Nutrition Examination Survey (KNHANES Ⅲ), 2005, Korea Centers for Disease Control and Prevention.* Republic of Korea

Moon HK, Choi SO & Kim JE (2009). Dishes contributing to sodium intake of elderly living in rural areas. *Korean Journal of Community Nutrition* 14:123-136.

Park HR (2007). Nutrition Intervention Project Report. *Low-salt diet education for health promotion of residents in Kyunggi-do,* p.60-61. Seoul. Republic of Korea

Park YS, Son SM, Lim WJ, Kim SB & Chung YS (2008). Comparison of dietary behaviors related to sodium intake by gender and age. *Korean Journal of Community Nutrition* 13:1-12.

Ritz E, Koleganova N & Piecha G (2009). Role of sodium intake in the progression of chronic kidney disease. *J Ren Nutr* 19:61-62.

Seo JS, Lee JY, Yoon JS, Jo SH & Choi YS (2008). *Nutritional assessment,* p.101-135. PowerBook, Seoul. Republic of Korea

Son SM (2007). Koreans' problems in salt intakes and the role of dietitians for low-salt diet. *J Nutr Diet* 30:10-14.

Son SM & Huh KY (2002). Salt intake and nutritional problems in Korean. *Korean Journal of Community Nutrition* 7:381-390.

Son SM, Park YS, Lim HJ, Kim SB & Jeong YS (2007). Sodium intakes of Korean adults with 24-hour urine analysis and meal frequency questionnaire and comparison of sodium intakes according to the regional area and meal group. *Korean Journal of Community Nutrition* 12:545-558.

Stamler R (1991). Implictions of the INTERSALT study. *Hypertention* 17:16-20.

The Korean Nutrition Society (2005). *Dietary reference intakes of Koreans,* p.214-223. The Korean Nutrition Society, Seoul. Republic of Korea