

Letter to the Editor



Dietary Sodium Intake and Its Impact Factors in Adults of Shandong Province*

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Dietary sodium intake and its impact factors in 2 140 adults aged 18-69 years were analyzed. The mean daily sodium intake was 5 745.0 (5 427.6-6 062.5) mg per day, which was higher in males than in females ($P<0.01$). After having been adjusted for gender, age and urban/city areas, the mean daily sodium intake was significantly higher in participants with a lower education level, drinkers and smokers than in those with a higher education level, nondrinkers and nonsmokers ($P<0.01$). The dietary sodium intake in adults of Shandong Province is higher than the recommended standards.

The dietary salt (NaCl) intake is a worldwide public health concern because high dietary sodium intake (consumed as common salt, sodium chloride) is associated with high blood pressure (BP) and cardiovascular disorders^[1]. It has been shown that high sodium intake is associated with the increased risk of high BP and coronary heart disease (CHD), stroke and non-cardiovascular disease^[2].

The incidence of cardio-cerebral vascular diseases is high in Shandong Province. The prevalence of hypertension was 25.1% in 2002 and the mortality of cardio-cerebral vascular diseases was 188.2/100 000 in 2004-2005. The economic burden of hypertension due to high salt intake in Shandong Province has exceeded more than 1 billion RMB^[3]. In the present study, the dietary sodium intake and its impact factors in Shandong Province were investigated and analyzed.

The samples used in this study were from the project of 2011 Shandong-Ministry of Health Action on Salt and Hypertension (SRHC). A total of 2 140 participants aged 18-69 years were asked to complete questionnaire and dietary survey. Their dietary sodium intake was calculated with the methods of 24-h recall for 3 consecutive days (containing 1 day weekend) and weighing as

previously described^[4]. The mean dietary sodium intake from foods and condiments was estimated according to the Chinese food composition tables in 2002. The study was approved by The Ethical Committee of Shandong Center for Disease Control and Prevention.

The mean daily sodium intake (95% CI) was 5 745.0 (5 427.6-6 062.5) mg per day. The mean daily sodium intake was higher in males than in females ($P<0.01$) and lower in those aged 55-69 years than in those aged ≤ 55 -69 years; however, the difference of the latter was not significant (Table 1).

The percentage quantiles of dietary sodium intake in Shandong Province are listed in Table 2. The dietary sodium intake in the participants was 1 191.3-16 578.1 mg/d. The factors influencing dietary sodium intake in the study population are presented in Table 3. After adjusted for gender, age, and urban/city areas, the mean daily sodium intake was significantly higher in participants with a lower education level, drinkers and smokers than in those with a higher education level, nondrinkers and nonsmokers ($P<0.05$). The mean daily sodium intake increased with the increasing physical activity level ($P<0.05$). No significant difference was found in dietary sodium intake between the participants with different incomes.

Excess dietary sodium intake is a major contributor to hypertension. A low dietary sodium intake plays an important role in reducing the incidence of hypertension. It was reported that a reduction of 100 mmol/d in sodium intake predicted a reduction of 3.6 mmHg in systolic blood pressure and a reduction of 1.7 mmHg in diastolic blood pressure in normotensive persons, a reduction of 7.1 mmHg in systolic blood pressure and a reduction of 3.9 mmHg in diastolic blood pressure in hypertensive persons^[5].

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Table 1. Mean Dietary Sodium Intake in Participants of Different Ages, Genders, and Regions (mg/d)

Mean Dietary Sodium Intake (mg/d)	Age Group (Years)			
	18-35	35-55	55-69	Total
Total				
Total	5 737.7 (5 372.4-6 103.0)	5 770.3 (5 421.1-6 119.4)	5 699.3 (5 418.6-5 979.9)	5 745.0 (5 427.6-6 062.5)
Male	6 118.3 (5 767.4-6 469.2)	6 190.9 (5 785.7-6 596.2)	6 098.8 (5 760.3-6 437.3)	6 147.4 (5 823.8-6 471.0)
Female	5 352.8 (4 907.8-5 797.9)	5 346.6 (5 034.4-5 658.9)	5 297.0 (4 934.3-5 659.8)	5 339.3 ^a (5 005.8-5 672.8)
Urban				
Total	5 391.9 (5 024.3-5 759.5)	5 379.4 (4 910.8-5 847.9)	5 132.7 (4 684.1-5 581.4)	5 341.6 (5 007.0-5 676.1)
Male	5 647.6 (5 039.9-6 255.3)	5 875.2 (5 287.7-6 462.7)	5 546.3 (4 934.7-6 157.9)	5 737.3 (5 241.0-6 233.7)
Female	5 121.8 (4 756.4-5 487.2)	4 918.6 (4 582.1-5 255.1)	4 701.2 (4 220.4-5 181.9)	4 949.7 (4 674.9-5 224.6)
Rural				
Total	5 871.5 (5 348.7-6 394.2)	5 948.2 (5 451.8-6 444.6)	5 896.3 (5 495.3-6 297.3)	5 910.1 ^b (5 449.3-6 370.8)
Male	6 305.9 (5 833.6-6 778.2)	6 326.4 (5 758.6-6 894.3)	6 295.6 (5 810.2-6 780.9)	6 313.0 (5 859.4-6 766.5)
Female	5 439.5 (4 803.9-6 075.1)	5 553.2 (5 091.0-6 015.3)	5 499.3 (5 006.3-5 992.3)	5 500.7 (5 013.9-5 987.5)

Note. ^aSignificant difference between males and females ($P<0.01$); ^bSignificant difference between urban and rural areas ($P<0.05$).

Table 2. Percentile of Dietary Sodium Intake (mg/d)

Items	5th	10th	25th	50th	75th	90th	95th
Gender							
Male	3 219.8	3 577.2	4 552.4	5 798.0	7 284.4	9 037.4	10 414.0
Female	2 657.9	3 225.9	3 985.8	5 112.8	6 355.3	7 839.3	8 926.5
Age Group (Years)							
18-35	2 924.9	3 358.6	4 179.9	5 490.7	6 774.5	8 487.4	9 654.1
35-55	2 959.9	3 458.6	4 219.9	5 527.4	6 843.2	8 532.9	9 524.4
55-69	2 611.1	3 334.1	4 181.8	5 502.9	6 830.2	8 521.4	9 859.5
Area							
Urban	2 611.1	3 150.6	3 896.5	5 020.7	6 385.5	8 130.1	9 501.7
Rural	3 098.4	3 542.8	4 377.9	5 655.1	7 004.6	8 747.7	9 671.4
Total	2 914.9	3 373.4	4 188.0	5 520.5	6 806.7	8 528.4	9 658.9

Table 3. Factors Influencing Dietary Sodium Intake

Variable	N	Sodium Intake (mg/d) Mean (95% CI)	F	P
Education				
Elementary School and Below	709	5 776.9 (5 442.1-6 111.7)		
Junior and Senior High School	1 244	5 811.9 (5 441.2-6 182.6)	4.05	<0.05
Junior College and Above	187	5 158.2 (4 782.1-5 534.3)		
Physical Activity				
Light Level	800	5 381.0 (5 071.2-5 690.9)		
Moderate Level	478	5 710.4 (5 281.4-6 139.5)	6.18	<0.05
High Level	862	6 108.8 (5 624.2-6 593.4)		
Income				
<10 000 Yuan/year	501	5 790.8 (5 449.7-6 131.8)		
10 000-20 000 Yuan/year	523	5 808.9 (5 295.4-6 322.5)	0.61	>0.05
20 000-30 000 Yuan/year	441	5 836.7 (5 403.1-6 270.3)		
≥30 000 Yuan/year	675	5 609.0 (5 357.8-5 860.3)		
Drinking Status				
No Drinker	1 246	5 551.8 (5 218.8-5 884.8)	12.99	<0.01
Drinker	894	6 052.2 (5 655.8-6 448.5)		
Smoking Status				
No Smoker	1 579	5 593.7 (5 270.9-5 916.5)	30.62	<0.01
Smoker	561	6 173.7 (5 802.6-6 544.7)		

Note. Significant difference in different influencing factors was analyzed after adjusted for gender, age, urban and city areas.

Dietary sodium consumption is rather high in developed countries. The average daily sodium consumption is 3 120 mg/d in France, 3 300 mg/d in Finland, 3 400 mg/d in Canada, 3 435 mg/d in USA, 3 460 mg/d in UK, and 4 500 mg/d in Brazil, exceeding the tolerable upper intake level recommended by the US Institute of Medicine^[6]. Although the dietary sodium intake in China has reduced from 7 116.4 mg/d in 1992 to 6 268.2 mg/d in 2002^[4], it is still higher than that in developed countries. In this study, the mean dietary sodium intake was 5 745.0 (5 427.6-6 062.5) mg/d, which is higher than that in developed countries.

Most sodium in developed countries comes from sodium added to restaurant and processed foods before purchase, whereas only 5%-6% is added at home during cooking and 5%-6% at the table^[7]. In some developing countries including China, sodium in the diet comes mainly from salt added during cooking and from sauces. It may be one of the reasons why dietary sodium intake is higher in China than in developed countries.

In the present study, the sodium intake was higher in males than in females, which is consistent with the findings in other studies^[8,4]. In this study, the sodium intake was positively related with the education level, and higher in smokers or drinkers than in nonsmokers or nondrinkers, which is consistent with the findings in previous studies^[9-10].

In conclusion, the mean sodium intake in Shandong Province is higher than the recommended standards.

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