

REVIEW

[Scientific Statement]

Report of the Salt Reduction Committee of the Japanese Society of Hypertension

(2) Goal and strategies of dietary salt reduction in the management of hypertension

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In this section of the Report of the Salt Reduction Committee of the Japanese Society of Hypertension, the target level of dietary salt reduction and its scientific evidence, present status of salt consumption in Japan, salt-reducing measures/guidance methods in individuals and population strategies to reduce salt intake are introduced. In the Dietary Reference Intake for the general population in Japan (2010 version), the target levels of salt restriction in men and women were established as less than 9.0 g per day and 7.5 g per day, respectively. The Japanese Society of Hypertension Guidelines for the Management of Hypertension 2009 recommended the target level of dietary salt restriction in patients with hypertension as less than 6 g per day. However, the National Health and Nutrition Survey of Japan in 2010 reported that the mean salt intake in adults was 10.6 g per day (men: 11.4 g per day and women: 9.8 g per day). To effectively decrease salt intake in Japan, it is necessary to reduce the consumption of high-salt foods (especially traditional foods) and replace high-salt seasonings (soy sauce and so on) with low-salt alternatives. Health-care professionals must effectively perform salt-reduction guidance for hypertensive patients in hospitals/administrative organizations. To promote population strategies for salt reduction in the whole society of Japan, social strategies, such as administrative policies, companies' cooperation and educational staff's cooperation, are necessary.

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INTRODUCTION

Many studies have shown that almost all people in the modern world consume an excess level of sodium and that excessive salt intake is one of the most important etiological factors for hypertension and the onset of cardiovascular diseases. Evidence on a reduction in blood pressure (BP) and the risk of cardiovascular diseases by dietary salt restriction has been accumulated. Consequently, a tendency to establish a stricter target level of salt intake in nutrient intake standards and dietary guidelines has become marked in the world. On the other hand, salt intake markedly differs among regional diets. Previously, salt intake in Japan was the highest in the world, and it is still relatively high; therefore, establishment of effective dietary salt-

reducing measures is needed in our modern dietary habits. Moreover, it is also necessary to promote salt-intake reduction in the whole society as a population strategy.

In this section, we introduce the target level of dietary salt reduction and its scientific evidence, present status of salt consumption in Japan, salt-reducing measures/guidance methods in individuals and population strategies to reduce salt intake.

TARGET LEVEL OF DIETARY SALT RESTRICTION

Sodium loss unavoidable in adults without massive sweating is 500 mg per day or less. Considering inter-individual variation (coefficient of variation: 10%), it is 600 mg per day (volume

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corresponding to salt: 1.5 g per day). On the basis of this evidence, the estimated average requirement of sodium in adults (both sexes) is established as 600 mg per day in the 'Dietary Reference Intake in Japanese (2010).¹ However, salt intake in ordinary Japanese diet is very rarely lower than 1.5 g per day.

The INTERSALT study showed that the mean systolic BP was 90–100 mm Hg in Yanomamo Indians living in the Amazon area, in whom the urinary excretion of sodium was very close to zero, and there was no hypertensive patient. Furthermore, their BP did not increase with age.² A strict feeding trial in the United States, the DASH (Dietary Approaches to Stop Hypertension)-Sodium trial, showed that sodium restriction at 2300 mg (volume corresponding to salt: 5.8 g per day) decreased BP, and that the attainment of sodium restriction at 1500 mg (volume corresponding to salt: 3.8 g/ per day) further reduced BP safely.³ On the basis of the results of many other intervention studies to confirm a salt reduction-related BP decrease, the Institute of Medicine in the United States established an adequate intake of sodium in adults as 1500 mg and a tolerable upper intake level as 300 mg in the Dietary Reference Intake in 2005.⁴ The US Dietary Guidelines and the American Heart Association Guidelines further recommended that the target sodium intake should be less than 2300 mg for healthy adults and less than 1500 mg for high-risk individuals (hypertensives, Blacks, middle-aged to elderly).^{5–7} According to the American Heart Association Guidelines, the high-risk individuals account for 69% of the total population in the United States. The World Health Organization/Food and Agriculture Organization (WHO/FAO) Report on diet, Nutrition and the Prevention of Chronic Diseases, which was published in 2003, described that salt intake should be restricted to less than 5 g to decrease BP, and that sodium ingestion from sodium glutamate should also be considered.⁸

In 2007, the European Society of Hypertension-European Society of Cardiology (ESH-ESC) established a target salt intake of less than 5 g per day, although salt intake of less than 3.8 g/day was considered to be ideal.⁹ In the first version (2000) of the Japanese Society of Hypertension Guidelines for the Management of Hypertension, the target level of dietary salt restriction in patients with hypertension was established as less than 7 g per day. However, considering the subsequent scientific evidence and target levels of

dietary salt restriction established in the world, the target value was tightened to less than 6 g per day in the 2004 and 2009 versions¹⁰ (Table 1).

On the other hand, in the Dietary Reference Intake for the general population in Japan (2010 version), the target levels of salt restriction to be achieved within coming 5 years in men and women were established as less than 9.0 g per day and 7.5 g per day, respectively, being lower than those previously established (men: less than 10 g per day and women: less than 8 g per day).¹ These were established as targets that can be achieved, because the median salt intake in men aged 50–69 years in the National Health and Nutrition Surveys in 2005 and 2006 was 12.2 g per day, and because the intermediate value between this value and 6 g per day, which was recommended by the Japanese Society of Hypertension, was 9.1 g per day (value for women 1.5 g per day lower than for men). The target values for children aged 1–11 years were established through extrapolation with the body-surface area ratio, regarding the values for adults (18–29 years) as references. The same values as established for adults were used for children aged 12–17 years.

CURRENT STATUS OF SALT CONSUMPTION IN JAPAN

The National Health and Nutrition Survey in 2010 reported that the mean salt intake in adults was 10.6 g per day (men: 11.4 g per day and women: 9.8 g per day) (Figure 1).¹¹ There was an ~4 g decrease in comparison with that in 1972 (14.5 g), when salt intake was investigated for the first time in the National Nutrition Survey. According to surveys in the 1950s, the mean salt intake was 27 g per day in the Tohoku district and 17 g per day in the Kinki district; therefore, it may have more markedly decreased during the past 60 years.¹² This was possibly associated with improvement in salt-free food processing/storage technologies, extended-area fresh food transportation related to the development of transport facilities, the widespread use of refrigerators and a Western-style diet in addition to the effects of salt-reduction strategies/policies developed throughout Japan.

However, the National Health and Nutrition Survey in 2009 showed that, in ~70% of both men and women, salt consumption exceeded the target level described in the Dietary Reference Intake (men: less than 9 g per day and women: less than 7.5 g

Table 1 Recommendations of salt/sodium intake established by Japanese/overseas/international societies/organizations

<i>Society/organization (year)</i>	<i>Target population (name of recommendation)</i>	<i>Recommendation</i>
Japanese Society of Hypertension (2009)	Hypertensives (target of salt reduction)	Salt: less than 6 g per day
Dietary Reference Intake, Japan (2010)	Adults (estimated average requirement)	Sodium: 600 mg per day (salt: 1.5 g per day)
	Adult men (dietary goal)	Salt: less than 9 g per day
	Adult women (dietary goal)	Salt: less than 7.5 g per day
WHO/FAO (2003)	Adults (dietary goal)	Salt: less than 5 g per day
Dietary Reference Intake, IOM, USA (2005)	Adults (adequate intake)	Sodium: 1500 mg per day (salt: 3.8 g per day)
	Adults (tolerable upper intake level)	Sodium: 2300 mg per day (salt: 5.8 g per day)
US Dietary Guidelines (2005)/American Heart Association (AHA) Dietary Recommendations (2006)	Adults (dietary goal)	Sodium: less than 2300 mg per day (salt: less than 5.8 g per day)
	High-risk persons (hypertensives, Blacks, middle-aged and elderly) (dietary goal)	Sodium: less than 1500 mg per day (salt: less than 3.8 g per day)
European Society of Hypertension-European Society of Cardiology (ESH-ESC) (2007)	Hypertensives (dietary goal)	Salt: less than 5 g per day
JNC7, USA (2003)	Hypertensives (dietary goal)	Sodium: less than 2400 mg per day (salt: less than 6 g per day)

Abbreviations: IOM, Institute of Medicine; WHO/FAO, World Health Organization/Food and Agriculture Organization.

per day). Furthermore, salt intake was the highest in both men and women aged 60–69 years (men: 12.4 g per day and women: 10.5 g per day).

In the INTERMAP study, two-timed 24-h urine collection and a 4-day nutritional survey by the 24-h recall method were conducted in 4680 participants (men and women) aged 40–59 years in 17 populations (8 in the USA, 2 in the UK, 3 in China and 4 in Japan) between 1996 and 1999.^{13,14} Mean salt intake, which was evaluated based on the 24-h urinary sodium excretion, among the 4 countries,

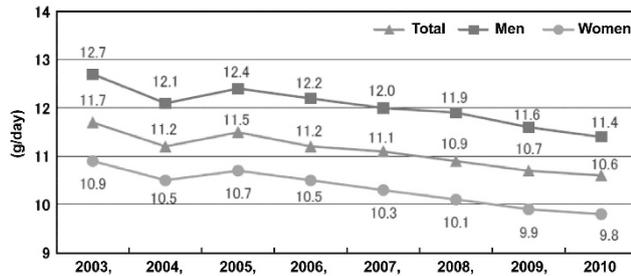
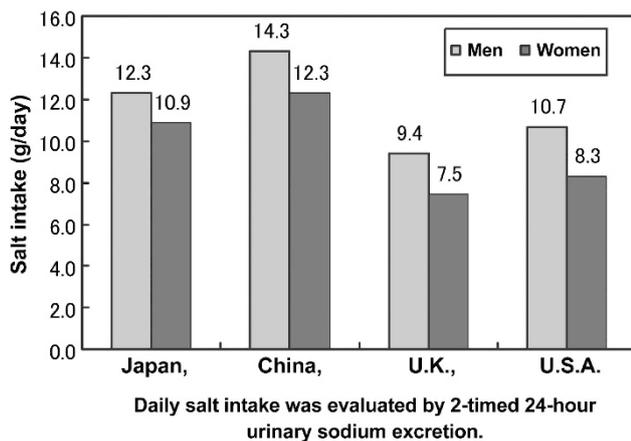


Figure 1 Changes in the mean salt intake of Japanese (20 years or older) (National Health and Nutrition Surveys in 2003–2010).



Prepared from Reference 13.

Figure 2 Comparison of salt intake among four countries (INTERMAP study, men and women aged 40–59 years, 1996–1999).

was 12.3 g per day and 10.9 g per day in Japanese men and women, respectively, being 2–3 g per day higher than in the USA and the UK (Figure 2). On the basis of the results of 24-h recall dietary survey, the sources of salt consumption in Japan consisted of soy sauce (20%), pickled vegetables (10%), *miso* soup (10%), fish (including salted, dried fish) (9%), salt as a seasoning (9%) and soup (7%). These six foods accounted for more than 60% (Figure 3).¹⁵ Regarding soy sauce and *miso* paste as processed foods, ~90% of salt was estimated to be ingested from processed foods in Japan.

Gender difference in salt intake disappears when corrected with the body weight; therefore, this may reflect differences in dietary intake related to differences in body size.¹⁶

SALT-REDUCTION STRATEGIES IN INDIVIDUALS

Techniques to reduce salt intake

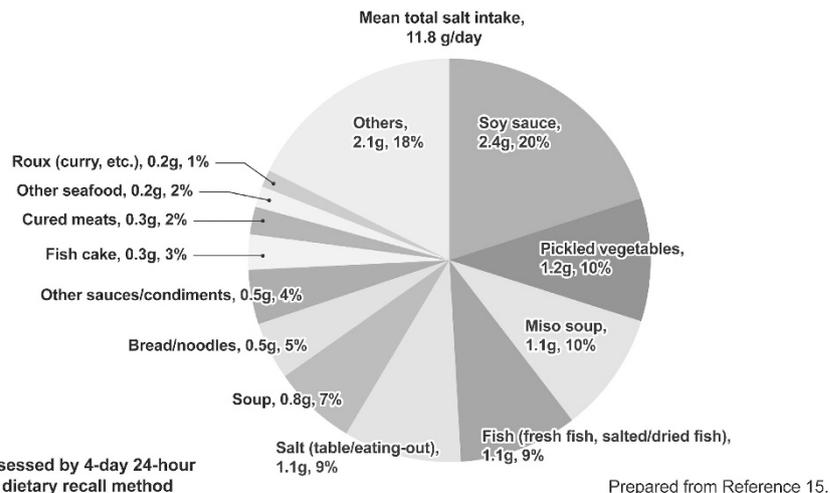
As described above, there is a Japan-specific traditional diet-related source of salt consumption. On the other hand, the new sources of salt consumption related to the introduction of a Western diet and an increase in processed foods/eating-out/daily dishes appeared. To effectively decrease salt intake, it is necessary to reduce the consumption of high-salt foods and replace seasonings with low-salt alternatives.

High-salt foods, as sources of salt consumption important in the Japanese diet, are presented in Table 2.¹⁷ Many processed foods derived from marine products and meat contain high-level salt. Furthermore, eating-out menus such as a bowl of rice with food on top/noodles also contain high-level salt. When eating noodles with soup, 5 g or more of salt per meal is ingested. Eight dietary behaviors effective for salt reduction, ‘techniques for dietary salt restriction’, are shown in Table 3¹⁷: leaving the soup of noodles; and the utilization of low-salt seasonings, vinegar and spices instead of soy sauce or salt. Dietary salt restriction may be effectively achieved by performing these dietary behaviors and techniques.

In Japan, the sodium content (mg) is labeled as a nutrient composition in most processed foods. In some products, the volume corresponding to salt (g) is simultaneously described. When only the sodium content is presented, it must be converted using the following formula:

Volume corresponding to salt (g) = sodium content (mg) × 2.54/1000.

However, this can be used as a reference when selecting low-salt foods.



Prepared from Reference 15.

Figure 3 Sources of salt consumption in Japan and their proportions (INTERMAP Japan, 1145 men and women aged 40–59 years, 1996–1999).

Table 2 Representative high-salt foods/dishes in Japan

Food/dish	Standard volume	Salt content
Yellow pickled radish	Two pieces (20 g)	1.5 g
Pickled plum	One plum (10 g)	2.0 g
Potage	One cup	1.2 g
Miso soup	One cup	1.5 g
Horse mackerel	Small, one slice (60 g)	1.2 g
Ham	Three slices (60 g)	1.5 g
Salted salmon	One slice (40 g)	3.5 g
Curry rice	Dish for one person	3.3 g
Bowl of rice with tempura on top	Dish for one person	4.1 g
Hand-rolled <i>sushi</i>	Dish for one person (including soy sauce)	5.0 g
Udon with deep-fried <i>tofu</i>	Dish for one person (including soup)	5.3 g
Cup noodle	Dish for one person (including soup)	5.5 g

The salt content is expressed as an approximate value. It differs among products or cooking methods.
Cited from Ueshima.¹⁷

Table 3 Representative dietary behaviors effective for salt reduction: '8 techniques to reduce salt intake'

1. Avoid pickled vegetables.	(Eat a small amount of lightly pickled vegetables, if you want.)
2. Leave the soup of noodles.	(2–3 g of salt can be restricted by leaving the whole volume of soup.)
3. Use fresh food materials.	(Enjoy the tastes of food materials by light-taste cooking.)
4. Prepare <i>Miso</i> soup containing a lot of vegetables.	(Salt reduction can be achieved with the same taste.)
5. Use seasonings carefully.	(They should be used after confirming the taste.)
6. Use low-salt seasonings.	(Vinegar, tomato ketchup, mayonnaise, and dressing should be effectively utilized.)
7. Use spices, spicy vegetables, and fruit acidity.	(Combination of pepper, spices, ginger, and citrus fruit acidity can be a good choice.)
8. Avoid eating-out and processed foods.	(A large volume of invisible salt is contained.)

Cited from Ueshima.¹⁷

On the other hand, several studies reported that the use of dietary salt in which a portion of sodium chloride was substituted for potassium chloride (potassium salt) led to a BP fall related to a decrease in sodium intake and increase in potassium intake.^{18,19} In persons in whom the kidney function is normal, the utilization of potassium salt is also effective.

It is necessary to educate the nation with correct knowledge on foods and techniques to reduce salt consumption.

Guidance/support for salt reduction

In the Guidelines for the Management of Hypertension, it is described that guidance for lifestyle modification to decrease BP is essential for all patients with hypertension, and that grade I hypertension patients without risk factors should be guided before the start of drug therapy.¹⁰ In patients with hypertension, nutritional guidance to restrict dietary salt intake to less than 6 g per day is necessary. In 'the Specific Health Guidance' started from 2008 in Japan, guidance for salt restriction must also be conducted when BP level is 'high-normal'

level or higher. On an initial interview of this guidance, a physician, public health nurse and dietitian assist clients to set their goals.²⁰ As there are few cases in which salt intake from ordinary Japanese diet is less than 6 g per day, guidance for salt restriction may be necessary in all persons.

When guiding/supporting dietary correction, behavioral scientific procedures to achieve behavioral changes in daily living are necessary.¹⁷ Personal interview, group assistance and communication support should be repeatedly conducted using procedures/teaching materials such as goal-setting, behavioral-change stage theory, self-monitoring, operant intensification and group dynamics. In addition in 'the Specific Health Guidance' in Japan, standard programs for 6 months are prepared.²⁰

Furthermore, individual goal-setting can be established by conducting a survey regarding the present status of diet habits/salt intake before the start of guidance and clarifying dietary problems. A detailed survey on diet or objective salt-intake assessment with urine is useful for guidance (Refer to the Scientific Statement (3)).

POPULATION STRATEGIES FOR SALT REDUCTION

Since the 1990s, the entity of the population strategy whereby dietary salt reduction is necessary in a population consisting of hyper- and normotensive persons has been emphasized in the guidelines for the prevention of hypertension in the USA.^{21,22} This entity was initially proposed by Rose.²³ The hypotensive effects of salt intake reduction are observed in both hyper- and normotensive persons. Therefore, when salt reduction is conducted in the whole population, BP distribution in the population shifts to the left and the mean BP decreases. Consequently, the prevalence of hypertension also reduces. Stamler *et al.*²⁴ estimated that, when the mean salt intake in a population is decreased by 5.8 g (100 mmol) per day, the mean systolic BP in the population decreases by 2.2 mm Hg. A recent study in the USA estimated that the mean systolic BP reduces by 3.6 mm Hg in hypertensive/elderly persons and by 1.8 mm Hg overall with a 3 g per day decrease in salt intake in the nation, and that, with this, the number of ischemic heart disease patients would decrease by 60 000–120 000 persons per year and annual health expenditure would decrease by 100–240 hundred million dollars.²⁵ In Japan, it was also estimated that a 3 mmHg decrease in the mean systolic BP in the nation might lead to a 10% reduction in the stroke mortality rate, and that a 5 mm Hg decrease might lead to a 16% reduction in the stroke mortality rate, using the NIPPON DATA80 data set on the preparation of the 'Kenko Nippon 21 (Health Japan 21)'.²⁶

As population strategies for the primary prevention of hypertension, including salt reduction, the following methods were proposed²¹ (Table 4). One of these is education for the general public. The mass media has an important role: to widely disseminate accurate, simple messages regarding the influence of salt on health using various broadcast and print media. The second method is to promote salt reduction in processed foods to food manufacturers. It is also necessary to obligate them to label the salt content of a processed food and conduct legal actions/administrative guidance regarding the salt-content limit. The third method is to promote salt reduction in meals provided at school, work sites, hospitals and when eating out, such as restaurants. It is necessary to achieve dietary salt reduction and allow individual persons to be able to select their meals by indicating the level of salt and establishing salt-restricted menus. The fourth method is to obtain all health/medical specialists' (physicians'/nurses'/health nurses'/school nurses'/dietitians'/pharmacists') co-operation. In health/medical practice, it is necessary to instruct all persons to reduce salt intake, as described for guidance regarding

Table 4 Population strategies for salt reduction (US High Blood Pressure Education Program Working Group, 1993)

1. Mass media-mediated education for the general public	> Providing accurate, simple messages regarding the influence of salt on health widely using various broadcast and print media
2. Salt reduction in processed foods by food manufacturers	> Spontaneous promotion of salt reduction by food manufacturers > Enforced labeling of the salt content of a processed food/legal actions regarding the salt-content limit/administrative guidance
3. Salt reduction on cooking in lunch-providing/eating-out industries	> Promotion of salt restriction in schools/work sites/hospitals > Promotion of salt restriction in the eating-out industry such as restaurants > Indication of salt content in menus > Establishment of salt-reduced menus
4. Guidance/education by health/medical specialists	> All health/medical specialists' (physicians'/nurses'/health nurses'/school nurses'/dietitians'/pharmacists') cooperation > Guidance for salt reduction in all persons in health/medical practice > Dietary/health education in the field of education

Prepared from National High Blood Pressure Education Program Working Group.²¹

body weight management/physical activities/smoking cessation. In the USA, more detailed strategies were announced in 2010.²⁷

MacGregor *et al.*²⁸ indicated commercial reasons why food and eating-out industries have a negative view of salt reduction in processed foods. First, there is a dependence on salty taste, and desires to eat more salty foods lead to an increase in profits. Secondly, high-salt diet-related thirst results in an increase in the consumption of beverages, elevating profits. Third, an increase in the water content related to the high osmotic pressure of high-salt products leads to a low-cost increase in the weight, again elevating the profits. Therefore, to correct this, legal actions and administrative guidance are required.

The nationwide salt reduction movement from the 1960s in Japan is a population-based strategy to be internationally introduced.²⁹ The establishment of the 'Kenko Nippon 21', health-promoting laws and basic laws for dietary education after 2000 have further promoted this. The HIPOP-OHP study developed procedures for population strategies including salt reduction in work sites.^{30,31} On the other hand, the sodium content (unit: mg) is expressed in the food composition label in Japan. However, as described above, the indication of the volume corresponding to salt is voluntary; the calculation of volume from the sodium content is difficult for individual persons. In 2010, the Japanese Society of Hypertension submitted a request to force manufacturers to express the volume corresponding to salt in the food composition table, to relevant agencies including the Consumer Affairs Agency, with 55 groups agreeing to this, so that individual persons might utilize the food composition label for the prevention and management of hypertension.

CONCLUSION

Internationally, the target of salt reduction is being established to further lower the level. As salt intake in Japanese is still higher than the international level, the target level is established as a slightly higher value. However, it is necessary to continuously make efforts to reduce salt intake not only in hypertensive patients but also in the whole nation. In addition to education for the widespread use of salt-reducing techniques for Japanese, health-care professionals must effectively perform salt-reduction guidance for hypertensive patients in hospitals/administrative organizations. To promote population strategies for salt reduction, social strategies, such as administrative policies, companies' cooperation and educational staff's cooperation, are necessary.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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