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GUIDELINES (JSH 2009)

Chapter 4. Lifestyle modifications

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POINT 4

1. ***Salt restriction*: The target of salt restriction is $<6\,g\,day^{-1}$, but an even lower salt intake is better. Salt intake can be safely restricted to $3.8\,g\,day^{-1}$. At general medical facilities, it is practical to evaluate salt intake using spot urine samples (with correction for creatinine). As salt content in many processed foods is indicated in terms of the sodium (Na) content, Na content should be converted to salt content by the equation (Na content [g]$\times$2.5=salt content [g]) for salt restriction guidance.**
2. ***Nutrients other than salt*: The intake of fruit and vegetables should be increased, and that of cholesterol and saturated fatty acids should be reduced. Fish (fish oil) intake should also be increased.**
3. ***Maintaining an appropriate body weight*: The target body mass index (BMI: body weight [kg]$\div${height [m]}^{2}) is $<25\,kg\,m^{-2}$, but a significant decrease in blood pressure can be achieved by reducing body weight by 4–5 kg. Waist circumference should also be maintained at an appropriate level.**
4. ***Exercise*: Exercise, primarily periodic (30 min or longer daily if possible) aerobic exercise, at a moderate intensity, should be practiced. This applies to hypertensive patients with no cardiovascular disorders. In high-risk patients, medical checks must be performed in advance and the necessary measures taken.**
5. ***Restriction of alcohol intake*: Alcohol intake should be restricted to $\leqslant$20–30 ml ethanol day^{-1} in men and $\leqslant$10–20 ml ethanol day^{-1} in women.**
6. ***Quitting smoking*: Smoking (including passive smoking) should be avoided as it is a strong risk factor for cardiovascular disease and has been suggested to affect blood pressure levels.**
7. ***Others*: Exposure to cold should be avoided. Emotional stress should be managed.**
8. **In combination lifestyle modifications are more effective in reducing blood pressure levels and preventing hypertension.**

Genetic and environmental factors are involved in the development of hypertension, and environmental factors are affected by lifestyle. Lifestyle modifications can lead to a mild decrease in blood pressure and so allow a reduction in the dose of antihypertensive drugs. All hypertensive patients should get education and guidance regarding lifestyle modifications to prevent the concurrence of cardiovascular disease and risk factors other than hypertension. Table 4-1 lists lifestyle modifications, and Figure 4-1 shows the reduction in blood pressure expected from the modification of each item.

1) SALT RESTRICTION

An excessive salt intake has been suggested to be related to high blood pressure by observational studies including the INTERSALT.[30] The hypotensive effect of salt restriction has also been shown by many large-scale intervention studies in Western countries,[224,225] such as the DASH-Sodium.[34] According to the results of these clinical studies, blood pressure was not significantly decreased without reducing salt intake to $6\,g\,day^{-1}$. On the basis of these results, Western guidelines recommend a salt intake of $<6\,g\,day^{-1}$. Similarly, these Guidelines also set a target restricting salt intake to $<6\,g\,day$.[224] The Working Group for Dietary Salt Reduction of The Japanese Society of Hypertension provides useful recipes as a reference to achieve a daily diet containing $6\,g\,day^{-1}$.[226]

According to the relationship between mean salt intake and blood pressure shown in the INTERSALT,[30] blood pressure decreased slightly with a salt intake of approximately $\geqslant 3\,g\,day^{-1}$, but sharply when the intake was $<3\,g\,day^{-1}$. It is reported that salt intake was originally $0.5–3\,g\,day^{-1}$ in precivilized humans, so a very low salt intake is likely to be appropriate. However, as intervention studies have confirmed that salt intake can be safely reduced to as little as $3.8\,g\,day^{-1}$,[34] the recommendations of the American Heart Association (AHA) in 2006[227,228] and the European Society of Hypertension-European Society of Cardiology (ESH-ESC) in 2007[66] are that optimal salt intake should be $3.8\,g\,day^{-1}$.

The target of restricting salt intake to $<6\,g\,day^{-1}$ is very strict in Japan, because mean salt intake still exceeds $10\,g\,day^{-1}$. Consequently, a greater effort is necessary in Japan to achieve this target than it is in Western countries, where salt intake is lower. Whereas salt intake varies widely among individual patients, it is $<6\,g\,day^{-1}$ in about 20% of patients who are making conscious efforts to reduce their salt intake,[229] and so it is important to propose a strict target of salt reduction. However, it is difficult for many patients to achieve this target. As the effectiveness of salt restriction is considered to depend on its strictness (meta-analysis indicated a decrease in systolic blood pressure of about 1 mmHg with a decrease in salt intake of $1\,g\,day^{-1}$ [225]), guidance should be given to gradually reduce salt intake over a long period. Recently, a follow-up study of the TOHP reported that salt restriction reduces the long-term risk of cardiovascular disease.[230]

Presently, the Na rather than salt content is required to be included in the nutritional information of processed foods, but dietary guidance is made in terms of salt content (g). Therefore, patients must be taught to convert the Na content (indicated in grams) into the salt content by multiplying it by 2.5. Salt sold as 'natural salt' is made up mostly of NaCl, with very low amounts of other minerals, and its alternative use has little benefit compared with the use of common salt. The components of some natural salts are indicated in terms of

Na content, which, therefore, must be multiplied by 2.5 to calculate salt (NaCl) content. The evaluation of salt intake is indispensable in salt restriction guidance, and using spot urine samples (Na/creatinine [Cr] ratio) is practical at general medical facilities (Table 4-2).[231] The reliability of findings should be improved using a calculation formula incorporating the estimated 24-h urinary Cr excretion based on age, height, and body weight.[231]

It is extremely difficult to practice a very strict and optimal salt restriction regimen in the present social environment, and public health activities are necessary to achieve low salt intake in patients. Also, as it is possible that salt restriction in childhood suppresses blood pressure elevations over a long term period,[232] education and guidance for children are also needed in order to establish healthy dietary habits.

Table 4-1 Items of lifestyle modifications

1. Salt restriction to $<6\,g\,day^{-1}$
2. Increased intake of fruits and vegetables*
   Reduced intake of cholesterol and saturated fatty acids
   Increased intake of fish (fish oil)
3. Maintaining an appropriate body weight: BMI (body weight [kg] ÷ {height [m]}^{2}) $<25\,kg\,m^{-2}$
4. Exercise: In hypertensive patients with no cardiovascular disease, exercise, which is primarily a moderate aerobic exercise, should be performed periodically (for $\geqslant$30 min daily if possible)
5. Restriction of alcohol intake: $\leqslant$20–30 ml per day in men and $\leqslant$10–20 ml per day in women as ethanol
6. Quitting smoking

Abbreviation: BMI, body mass index.
Comprehensive lifestyle modifications are more effective.
*An increased intake of fruit and vegetables is not recommended for patients with severe renal dysfunction because of the risk of hyperkalemia. An excessive intake of fruit with a high fructose content is not recommended in patients who need to undergo a restricted energy intake, such as obese and diabetic patients.

2) FRUITS, VEGETABLES, FISH, CHOLESTEROL, SATURATED FATTY ACIDS, AND SO ON

The DASH clinical trial [34,189] employed a diet rich in fruit, vegetables, and low-fat dairy products (low in saturated fatty acids and

Table 4-2 Guidelines for evaluation of salt intake

Evaluation method	*Recommendability*	*Primary users*
Measurement of the Na content in 24-h pooled urine, or weighting or a questionnaire survey by a nutritionist	These methods are highly reliable and recommendable, but are complicated. Recommended if the cooperation of patients and ability of facilities are secured	Special facilities for hypertension treatment
Estimation as Na/Cr ratio based on measurement of the Na and Cr in spot urine samples[a]	Although the reliability is relatively low, the method is simple and is recommended as a practical evaluation procedure	Medical facilities in general
Estimation in early morning urine (nighttime urine) using an electronic salt sensor installed with calculation formula[b]	Although the reliability is low, the method is recommendable. It is convenient and can be performed by the patients themselves	Patients themselves

Abbreviation: Cr, creatinine.
[a]Early-morning urine (nighttime urine) may also be used; the reliability is increased by the use of the calculation formula incorporating the estimated 24-h Cr excretion:
24-h Na excretion ($mEq\,day^{-1}$)=$\{21.98\times(Na_s/Cr_s)\times Pr.UCr_{24}\}^{0.392}$.
Na_s: Na concentration in a spot urine sample ($mEq\,l^{-1}$).
Cr_s: Cr concentration in a spot urine sample ($mg\,l^{-1}$).
$Pr.UCr_{24}$: Estimated 24-h urinary Cr excretion ($mg\,day^{-1}$). $Pr.UCr_{24}$= $-2.04\times$age+$14.89\times$body weight (kg)+$16.14\times$height (cm)–2244.45.
In addition, Na content indicated in $mEq\,day^{-1}$ is converted to the salt or Na content indicated in $g\,day^{-1}$.
Estimated salt intake ($g\,day^{-1}$) : estimated urinary Na ($mEq\,day^{-1}$)$\times$0.0585.
Estimated Na intake ($g\,day^{-1}$) : estimated urinary Na ($mEq\,day^{-1}$)$\times$0.023.
[b]Methods using a test paper or a simple salt sensor are convenient but unreliable, so that quantitative evaluation is difficult.
Source: Turnbull *et al.*[256]

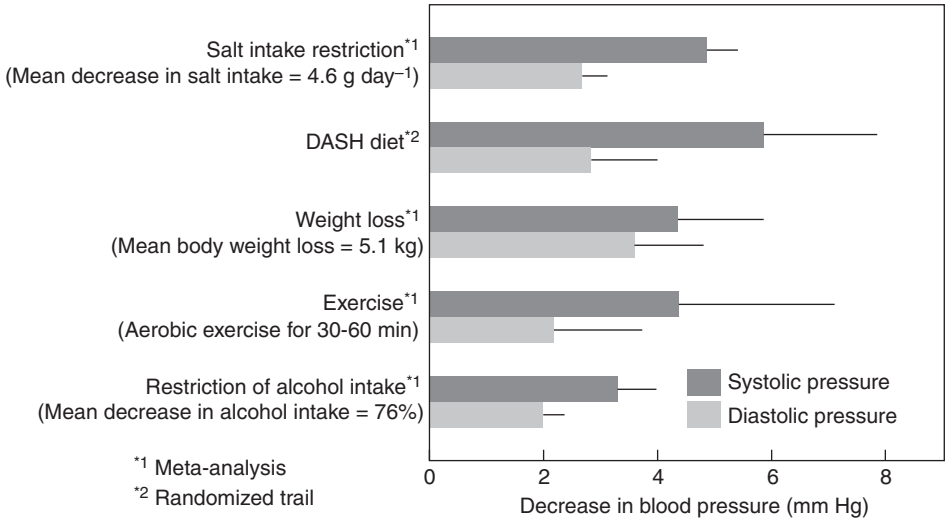

Figure 4-1 Decreases in blood pressure levels through lifestyle modifications. References: The results of He *et al.*[225] (salt intake restriction), Sacks *et al.*[34] (DASH diet), Neter *et al.*[239] (weight loss), Dickinson *et al.*[240] (exercise) and Xin *et al.*[247] (restriction of alcohol intake) were used. The results above were cited from papers in Western countries. Concerning the data from meta-analyses, the lifestyle modification is shown in parentheses. However, as the effects of lifestyle modifications are also affected by the lifestyle of patients before modification, their genetic background, and so on, this figure cannot be applied directly to the Japanese. Data concerning the DASH diet were cited from a original paper, because there was no meta-analysis. It is not guaranteed that a similar reduction in blood pressure is observed in Japanese hypertensive patients in the long-term, because the study was performed on a small number of subjects (n=412) and over a short period (30 days).

cholesterol and high in calcium [Ca], potassium [K], magnesium [Mg], and dietary fiber) in Western countries, and this diet was shown to have a significant hypotensive effect. Ca and Mg were expected to exhibit hypotensive effects because of the findings of epidemiological studies that blood pressure is low in people who drink hard water, but, in a small-scale intervention study blood pressure was only slightly decreased with Ca or Mg loading. Na is known to be added, and K to be lost, in food processing, and K deficiency as well as an excessive salt intake has been suggested to be a cause of hypertension in industrialized countries. In its reports on dietary therapy, the AHA has discussed K supplementation as a useful antihypertensive treatment,[228] but its effect is limited. However, as treatments with mild hypotensive effects may produce a sufficient effect if they are combined, an increased intake of fruit and vegetables in combination with a restriction of cholesterol and saturated fatty acids should be included in antihypertensive dietary therapy. Although there are few recommendable references of the DASH diet in Japan, the 'Japanese Food Guide Spinning Top' may be useful (although it was prepared for healthy people).[233] This guide counts foods according to the DASH diet plan, and recommends 5–6 servings (SVs) of vegetables and 2 SVs of fruit daily. This does not require complicated calculation and is useful for the approximate evaluation of food intake. However, an increased intake of fruit and vegetables is not recommended for patients with severe renal dysfunction because of the risk of hyperkalemia. Also, an excessive intake of fruit with a high fructose content is inadvisable for people who need to restrict their energy intake, such as obese and diabetic patients. A restriction of the intake of cholesterol and saturated fatty acids is also useful for the prevention of abnormalities of lipid metabolism. The DASH diet has been suggested to have a natriuretic and a metabolic risk factor-reducing effect.[234] As a recent epidemiological study reported that metabolic syndrome was less common in people with a high Mg intake, Mg may play an important role in the latter effect of the DASH diet.

According to the results of the INTERMAP study, blood pressure tends to be lower in people with a high intake of ω3 polyunsaturated fatty acids (rich in fish oil).[235] A meta-analysis of intervention studies showed that an increase in the intake of fish oil causes a decrease in blood pressure in hypertensive patients,[236] although a relatively high dose ($\geqslant 3\,g\,day^{-1}$) is necessary to achieve a significant hypotensive effect. The AHA[227] and ESH-ESC Guidelines[66] also recommend a high fish intake in hypertensive patients. Incidentally, the 'Japanese Food Guide Spinning Top'[233] recommends 2 SVs of fish daily. Moreover, a cohort study in Japan (JPHC Study)[237] reported a lower incidence of myocardial infarction in people with a higher fish intake. However, fish consumption involves the risk of mercury contamination,[227] although the degree varies among species. Tuna, yellowtail, and bonito, which have been reported to show high mercury levels, are not recommended for children, pregnant women, and women who may become pregnant.

Regarding the effects of an increased intake of antioxidant foods and dietary fiber or a decreased intake of carbohydrates on blood pressure, there is no evidence worth mentioning in these Guidelines.

3) MAINTAINING A PROPER BODY WEIGHT

As obesity is an important risk factor for hypertension, obese individuals should aim to reduce their BMI to $<25\,kg/m^2$, and non-obese individuals should maintain this level. Visceral obesity, in particular, induces not only hypertension but also abnormalities of glucose and lipid metabolism and is closely related to metabolic syndrome.[126] According to the Framingham Study,[238] blood pressure increases with the amount of visceral fat even in people with a similar BMI. Therefore, waist circumference should also be considered when practising weight control (<85 cm in men, <90 cm in women).[126]

The hypotensive effect of weight loss has been established, and blood pressure is significantly decreased by a weight loss of 4–5 kg.[239] Abnormalities of metabolic indices are also corrected by weight loss. In addition, weight loss has been reported to alleviate the enhancement of inflammatory reactions and abnormalities of vascular endothelial function, which are observed under conditions including metabolic syndrome. Obese hypertensive patients should first practice weight control, but should follow this with a stress-free, long-term weight-loss plan.

4) EXERCISE

The hypotensive effect of exercise has been established.[240] Aerobic exercise of a moderate intensity has been shown to reduce blood pressure, decrease body weight, body fat, and waist circumference, and improve insulin sensitivity and HDL-cholesterol level. Furthermore, a low physical activity level is an independent risk factor for cardiovascular death. Therefore, exercise is an important part of lifestyle modification for hypertensive patients.

Aerobic exercise such as walking (fast walking that mildly increases the heart rate) is suitable for the prevention and treatment of lifestyle-related diseases, including hypertension. This should be supplemented by mild resistance exercise, which is effective for increasing lean body mass and preventing osteoporosis and lower back pain, and stretching exercise, which improves the motion range and function of joints. There are also reports that the cardiovascular protective effect increases with the intensity of exercise, and the American College of Sports Medicine (ACSM)/AHA recommends mixing high- with moderate-intensity exercise for the general public.[241] In hypertensive patients, however, blood pressure increases during exercise if intensity is too high,[242] and high-intensity exercise has been reported to exacerbate the prognosis, unlike that in normotensive individuals.[243] Therefore, strenuous exercise is not recommended for hypertensive patients. Exercise should be performed periodically, that is, for $\geqslant 30$ min daily if possible, but this goal is considered to have been achieved if exercise of at least 10-min duration has been repeated to achieve a daily total of $\geqslant 30$ min.[241] 'The Exercise Guide 2006' (http://www.mhlw.go.jp/bunya/kenkou/undou01/pdf/data.pdf) classified physical activities into exercise and activities of daily living, and proposed an approach to increase the physical activity level primarily by increasing the latter. In patient education, also, it is considered more practical to advise patients to increase the physical activity level of their daily lives.

Candidates for exercise therapy are moderately or mildly hypertensive patients with no cardiovascular disease. In high-risk patients, a medical check must be performed in advance, and exercise should be restricted or advised against if necessary. As aerobic exercise has been reported to induce a decrease in blood pressure without complications even in elderly patients,[244] exercise should not be restricted owing to old age alone, but a prior medical check is necessary.

5) RESTRICTION OF ALCOHOL INTAKE

Alcohol consumption over a long period can lead to an increase in blood pressure.[245] Heavy drinking induces hypertension, and can also cause stroke and alcoholic cardiomyopathy as well as cancer, resulting in an increased mortality rate. On the other hand, moderate drinking has been reported to decrease mortality rate.[246] However, objections have been raised to the view that there is a U-shaped (or J-shaped) relationship between drinking and mortality rate;[66] further evaluation is therefore needed before a conclusion can

be reached regarding the protective cardiovascular effect of moderate drinking.

A bolus administration of alcohol causes a decrease in blood pressure that is sustained for several hours, but blood pressure increases thereafter. Therefore, a restriction of alcohol consumption reduces blood pressure.[247] It has been reported that about an 80% reduction in alcohol intake is followed by a decrease in blood pressure in 1–2 weeks. In heavy drinkers, blood pressure is increased after an abrupt restriction of drinking, but it can be reduced if the restriction is continued. Drinking, in terms of ethanol intake, should be restricted to 20–30 ml (equivalent to 180 ml of *sake*, 500 ml of beer, $<$90 ml of *shochu*, a double whisky or brandy, and 2 glasses of wine) day^{-1} in men and 10–20 ml day^{-1} in women.

6) SMOKING CESSATION

Smoking transiently increases the blood pressure. As the duration of high blood pressure after smoking a cigarette is reported to be $\geqslant$15 min,[248] it may persist during the daytime in heavy smokers. In fact, there are reports that daytime ambulatory blood pressure is increased in smokers[249] and that smoking often causes masked hypertension.[250] However, mean BMI and blood pressure are generally lower in smokers than in non-smokers. Therefore, despite recent reports on the effect of smoking on the development of hypertension, the overall effect of smoking on blood pressure has not been established.[228] However, smoking is known to be a risk factor for renovascular hypertension.

Smoking is a strong risk factor for not only non-cardiovascular diseases including cancer but also ischemic heart disease and stroke. Moreover, smoking is reportedly related to metabolic syndrome.[251] Non-smokers are harmed through passive smoking as well as the smokers themselves. Not only hypertensive patients with cardiovascular risks but also healthy people should quit smoking. The World Health Organization (WHO) adopted a framework anti-smoking treaty, which Japan ratified in 2004. This prompted countries and various organizations to go forward in anti-smoking activities. The Japanese Society of Hypertension also announced its anti-smoking declaration in 2007 and is making efforts toward its implementation (http://www.jpnsh.org/news/tobaccocontrol.pdf). Smokers should be repeatedly advised and encouraged to quit smoking, and the use of drugs to assist quitting should also be considered if necessary.

7) OTHER LIFESTYLE MODIFICATIONS

It is well known that exposure to cold elevates the blood pressure, which, consequently, is increased during winter. The cardiovascular mortality rate during winter is greater as protective measures against the cold are inadequate.[252] Therefore, the homes of hypertensive patients should be adequately heated in winter, with particular attention to heating of the toilet, bathroom, and dressing room, which is often disregarded.

Reports on the relationship between emotional stress and blood pressure are contradictory, but a recent meta-analysis indicated the effectiveness of stress management.[246] Therefore, techniques such as biofeedback and relaxation may be worth attempting in some hypertensive patients.

When bathing, the water should not be too hot. Blood pressure has been reported to show little increase when bathroom temperature is $\geqslant$20 °C and water temperature is $\leqslant$40 °C. A water temperature of 38–42 °C and a duration of 5–10 min are advisable when taking a bath. The water temperature of *sento* (Japanese bathhouses) is often too high. Hypertensive patients should avoid bathing in cold water and saunas.

As straining to defecate increases the blood pressure, guidance for the prevention of constipation should be given, and, if necessary, laxatives should be administered.

Sexual intercourse also raises the blood pressure, but hypertension poses few problems to the sex life. However, hypertensive patients with cardiovascular diseases should refrain from vigorous sexual activity.

8) COMPREHENSIVE LIFESTYLE MODIFICATIONS

The DASH[189] and DASH-Sodium[34] studies suggested that comprehensive improvements in diet facilitate a marked decrease in blood pressure. Also, the TONE[253] study showed that a combination of restricting salt intake and weight loss is more likely to reduce blood pressure and prevent cardiovascular diseases even when they are practiced less rigorously. A more marked decrease in blood pressure has been reported to be achieved by a combination of salt intake restriction, weight loss, exercise, restriction of alcohol intake, and a DASH diet.[254] Therefore, comprehensive lifestyle modifications are recommended.

Lifestyle modifications should be started in childhood to prevent lifestyle-related diseases, including hypertension.

9) FOOD FOR SPECIFIED HEALTH USES (FOSHU)

FOSHU are foods that are supplemented with components exhibiting physical-conditioning effects, have been demonstrated medically and nutritionally to have a health-protecting effect, and have been approved by the Ministry of Health, Labour, and Welfare. They are labeled with information including 'health-protecting effects' and 'functions of nutritional components'. The hypotensive effects of foods considered effective for blood pressure control are often based on an ACE-inhibiting activity, but the indicated 'recommended daily intake' should be strictly observed. Patients must also be informed that the intake of FOSHU cannot be a substitute for antihypertensive medication. A warning to consult a physician should be given to patients already on antihypertensive medication if they wish to use such foods. Information on FOSHU is available at the homepages of the National Institute of Health and Nutrition (http://hfnet.nih.go.jp/contents/sp_health_listA008.html) and the Ministry of Health, Labour and Welfare (http://www-bm.mhlw.go.jp/topics/bukyoku/iyaku/syoku-anzen/hokenkinou/hyouziseido.html).

Citation Information

We recommend that any citations to information in the Guidelines are presented in the following format:

The Japanese Society of Hypertension Guidelines for the Management of Hypertension (JSH 2009). *Hypertens Res* 2009; **32**: 3–107.

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