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ORIGINAL ARTICLE

Comparison of a salt check sheet with 24-h urinary salt excretion measurement in local residents

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The salt check sheet developed by Tsuchihashi *et al.* is widely used in general practice to assess salt intake and the associated diets. However, its appropriateness for the general population has not been assessed alongside 24-h urinary salt excretion monitoring. Therefore, in local residents, we analyzed the correlation between check-sheet scores and 24-h urinary salt excretion levels to determine the appropriateness of the check sheet. We asked 176 local residents to complete the salt check sheet and provide urinary samples; the latter were obtained using a proportional sampling method over a 24-h period. One hundred and forty subjects completed the study (men/women: 23/117, mean ± s.d. age: 52.7 ± 19.6 years, blood pressure: 122.3 ± 18.0/74.3 ± 11.1 mm Hg), of whom 51 (36.4%) had hypertension. The total salt check-sheet scores were widely distributed (mean ± s.d.: 11.1 ± 4.2 points, range: 0–22 points), and the subjects were divided into the following groups on the basis of salt levels: 29.3% were 'low' (0–8 points), 42.8% were 'medium' (9–13 points), 23.6% were 'high' (14–19 points) and 4.3% were 'very high' (>20 points). The mean 24-h urinary salt excretion level was 8.5 ± 3.3 g. The subjects with higher salt-intake levels tended to have increased 24-h urinary salt excretion levels, with significant differences between the three groups ('low' *vs.* 'medium' *vs.* 'high to very high' salt levels: 7.6 ± 2.9 g *vs.* 8.4 ± 2.8 g *vs.* 9.6 ± 4.2 g, respectively; $P = 0.03$). The total salt check-sheet scores significantly correlated with the 24-h urinary salt excretion levels ($r = 0.27$; $P < 0.01$). Thus, the salt check sheet is applicable for the general population.
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Keywords: salt check sheet; salt intake; salt restriction; screening tool; urinary salt excretion

INTRODUCTION

At the UN High Level meeting on Non-communicable Diseases in 2011, five priority interventions were identified, and salt reduction was selected as the second most important.[1] This decision was based on the rate at which low salt intake decreases blood pressure, which in turn attenuates cerebral vascular disease and myocardial infarction.[2] In the Japanese population, the death rate related to various risk factors shows that smoking is the most important risk factor, followed by hypertension; excessive salt intake ranks fifth on this scale.[3] This shows that low salt intake is an extremely important aspect of health. However, the salt intake of Japanese people is higher than that of the populations of other countries.[4] Moreover, even though patients with hypertension or cardiovascular disease should severely restrict their salt intake, they consume more salt on average than those without these conditions,[5] and this excessive salt intake has not lessened over time.[6]

In the effort to lower salt intake nationwide, advertisements and mass media campaigns are an effective strategy. Nonetheless, it remains difficult to motivate people toward this desired end on a national scale.[1] In addition, consumers often confuse the terms 'sodium content' and 'salt content' on food packages,[7] and are thus ill informed to make decisions regarding their salt intake. The salt content of many processed foods and ready-made dishes in Japan is not evident in their taste, making it difficult for individuals to determine how much salt they consume daily. In 2013, Tsuchihashi *et al.*[8] developed a salt check sheet (Table 1), whereby examinees and examiners can easily evaluate salt intake, as well as identify the foods responsible for this intake. The evaluation can be carried out routinely at local clinics. The salt checklist comprises a single A4 sheet with 13 questions about daily salt intake. It takes 3–5 min to complete, making it practical to use. Furthermore, a previous study involving 270 outpatients with hypertension found a significant correlation between the check-sheet scores and urinary salt levels assessed using on-the-spot urine tests; the correlation was calculated using the Tanaka equation[9] ($r = 0.30$; $P < 0.01$).[8] However, this report only examined outpatients with hypertension. Therefore, it is unclear

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Table 1 Salt check sheet. Your salt check sheet, circle what fits you and write the total score at the end

		3 points	2 points	1 point	0
Frequency of eating these foods	*miso* (fermented soybean paste) soup, soup, etc.	more than 2 bowls a day	about 1 bowl a day	two-three bowls a week	hardly eat
	pickles, pickled plums, etc.	more than twice a day	about once a day	two-three times a week	hardly eat
	fish-paste products such as *chikuwa* (tubular fish sausage) and *kamaboko* (steamed fish paste)		eat frequently	two-three times a week	hardly eat
	horse mackerel cut open lengthwise and dried, dried fish seasoned with mirin (sweetened alcohol for use in cooking), salted salmon, etc.		eat frequently	two-three times a week	hardly eat
	ham or sausage		eat frequently	two-three times a week	hardly eat
	noodles such as *udon* (Japanese wheat noodles) and *ramen* (Japanese-style Chinese noodles)	almost every day	2 or 3 bowls a week	less than once a week	don't eat
	senbei (Japanese crackers), *okaki* (thinly-cut and dried rice cakes), potato chips, etc.		frequently	two-three times a week	hardly eat
How frequent do you season with soy sauce or other sauces?		season frequently (almost every meal)	once a day	season sometimes	don't season
How much *udon*, *ramen*, or other soups do you consume?		entire bowl	about half	some	little
Do you eat out or have convenience-store-bought *bento* (lunch plate) for lunch?		almost every day	about 3 times a week	about once a week	no
Do you eat out or have ready-made side dishes for dinner?		almost every day	about 3 times a week	about once a week	no
How salty are your home-made dishes compared with those you eat out?		heavy	same		light
Do you think you eat a lot?		more than others		same as others	less than others

total score of the items you circled	3 points × ___	2 points × ___	1 point × ___	0 point × ___
subtotal	___ points	___ points	___ points	___ points
total points				___ points

check below ☑	total points	evaluation
☐	0–8	You are not taking excess salt. Maintain this diet for salt restriction.
☐	9–13	Your salt intake is average. Start a little stricter salt restriction.
☐	14–19	You have excessive salt intake. You need to lower your salt intake by changing your diet salt content and eating behavior.
☐	20以上	You have too much salt intake. You need to totally change your diet salt content and eating behavior.

whether the results can be applied to the general population; furthermore, the study did not assess the usefulness of measuring urinary salt excretion in 24-h urine samples. The aim of this study was to evaluate the validity of the salt check sheet by analyzing the correlation between the total salt check-sheet scores and 24-h urinary salt excretion levels in the local general population.

METHODS

Subjects

One hundred and seventy-six participants (men/women: 27/149) were selected from among 222 applicants on the basis of the following inclusion criteria: (1) residence in the Saga or Fukuoka prefectures (local), (2) age between 20 and 80 years, (3) attendance at the research briefing and (4) agreement to participate in the study. The exclusion criteria were (1) physical, psychological or social difficulties that burdened the daily life of the applicant, (2) lack of personal autonomy and (3) kidney disease that was currently being treated with diuretics. The study protocol adhered to the ethical guidelines of the 1975 Declaration of Helsinki and was approved by Nishikyushu University, and written informed consent for voluntary participation was obtained from each subject (Nishikyushu University H24-4).

Intervention schedule

This study was conducted in the Saga prefecture in March and April 2014, and in the Fukuoka prefecture in October and November 2015. The subjects were asked to complete the salt check sheet on the day they gave consent. Within 2 weeks, on a convenient day, the subjects 24-h urine salt levels were measured. In women, this measurement was conducted on a non-menstrual day. The participants measured their own blood pressure on the first and last days of urine collection. The subjects were asked to maintain their usual diet during the urine collection period, without special restrictions.

Salt check sheet

The salt check sheet is a single A4 sheet with 13 questions that take 3–5 min to answer (Table 1). The 13 questions can be categorized as follows: seven items evaluate the intake of salty meals, such as miso soup, pickles and noodles; four evaluate the use of salty sauces (that is, soy sauce), eating out, and home-meal replacement; and two evaluate the seasoning content and size of homemade meals. Each question is scored up to three points for a total of 35 points, and salt content is characterized as low (0–8 points), medium (9–13 points), high (14–19 points) or very high (>20 points).[8] The check sheet was designed on the basis of the relationship between salt intake (estimated using a BDHQ (brief-type, self-administered, diet history questionnaire))[10,11] and 24-h urinary salt excretion in outpatients with hypertension in Fukuoka prefecture.[12]

Twenty-four-hour urine collection

Twenty-four-hour urine was collected via a proportional sampling method using a partition cup, which collects 1/50 of the total 24-h urine volume.[13] One previous study showed a high correlation between the partition cup and total-volume methods in terms of both urine volume ($r=0.97$) and salt excretion ($r=0.98$).[13] Twenty-four-hour urine was defined as the total volume

of urine starting with the second morning urine (after discarding the first one at 0600 hours) and ending with the first morning urine of the next day. The precise start and end times for the urine collections were reported by each subject.[14,15] The collected urine sample was recovered thereafter for analysis. The total urine volume, as well as urine creatinine, sodium and potassium levels, was analyzed by SRL (Tokyo, Japan). Creatinine levels were analyzed using an enzyme-based method, and sodium and potassium levels were analyzed using an electrode-based method. When the 24-h urinary creatinine levels were within ± 30% of the predicted value, urine collection was considered successful; all other samples were excluded.[14–17]

Blood pressure

The participants measured their blood pressure, after resting for 5 min, using a digital, upper arm, automatic blood pressure-measuring instrument (HEM-7080 IC; Omron, Kyoto, Japan). They did so at the beginning and end of the 24-h urine collection period—immediately after the early morning urination. The average of two consecutive measurements was recorded. We diagnosed patients as having high blood pressure if (1) they had been prescribed antihypertensive drugs or (2) they had a systolic blood pressure of >135 mm Hg or a diastolic blood pressure of >85 mm Hg.

Table 2 Characteristics of the study subjects

Number	140
Sex (male/female)	23/117
Age (years)	52.7 ± 19.6
BMI	22.5 ± 3.2
SBP	122.3 ± 18.0
DBP	74.3 ± 11.1
Obesity	24 (17.1%)
Hypertension	51 (36.4%)
Antihypertensive drugs (other than diuretics)	25 (17.8%)
Smoker/past smoker/nonsmoker	6/17/117 (4.3%/12.1%/83.6%)

Abbreviations: BMI, body mass index; DBP, diastolic blood pressure; SBP, systolic blood pressure
Data expressed as number (%) or mean ± s.d.

Statistical analysis

Statistical data were presented as the mean ± s.d. The paired *t*-test was used to compare two groups, and a variance analysis was used to compare three or more groups. When the results were significant, the Tukey–Kramer test was used for *post hoc* analysis. The Pearson product-moment correlation coefficient was used to analyze the correlation between groups. The significance level was set at $P<0.05$. Finally, JMP10 statistical software (SAS Institute, Cary, NC, USA) was used for the statistical analyses.

RESULTS

Of the 176 original participants, 140 subjects were ultimately included in the study; five were excluded because they withdrew their consent and 31 failed to collect the 24-h urine samples. The subjects characteristics were as follows: the number of men/women was 23/117, mean age was 52.7 ± 19.6 years, mean body mass index (BMI) was 22.5 ± 3.2 kg m^{-2} and mean self-measured blood pressure was 122.3 ± 18.0/74.3 ± 11.1 mm Hg; 17.1% of the subjects were obese (BMI >25 kg m^{-2}). Fifty-one subjects (36.4%) had hypertension, 25 (17.8%) of whom were taking antihypertensive drugs other than diuretics (Table 2).

The mean total salt check-sheet score was 11.1 ± 4.2 points (range: 0–22 points), and the scores were widely distributed among the subjects, from 'low' to 'very high' (Figure 1a). We assigned 41 subjects (29.3%) to the 'low salt' group (0–8 points), 60 (42.8%) to the 'medium salt' group (9–13 points), 33 (23.6%) to the 'high salt' group (14–19 points) and 6 (4.3%) to the 'very high salt' group (>20 points). Meanwhile, the 24-h urine collection showed a mean daily urinary salt excretion level of 8.5 ± 3.3 g (Figure 1b).

We compared the 'low,' 'medium' and 'high-to-very high' salt groups in terms of urinary salt excretion levels, and found that the 24-h urinary salt excretion level tended to increase as salt intake increased; there was a significant difference between the three groups in this regard ('low' *vs.* 'medium' *vs.* 'high-to-very high' groups: 7.6 ± 2.9 g *vs.* 8.4 ± 2.8 g *vs.* 9.6 ± 4.2 g; $P=0.03$).

Furthermore, the *post hoc* test showed a significant difference between the 'low' and 'high-to-very high' groups ($P=0.02$; Figure 2). Notably, no significant difference was observed between

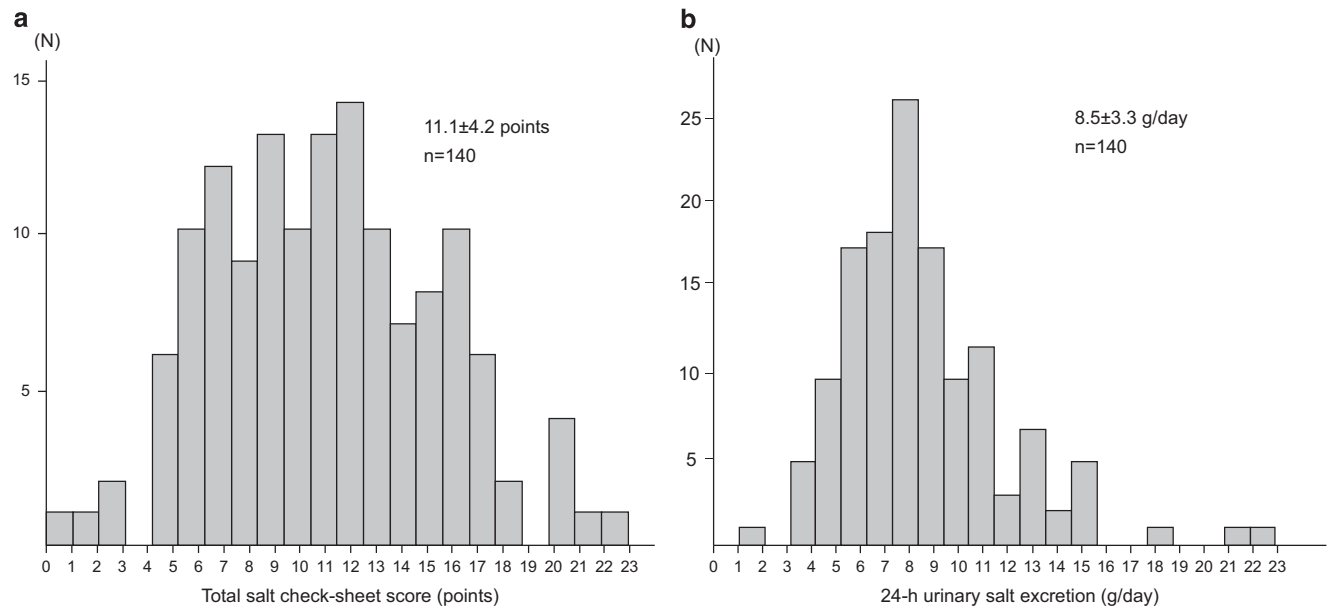

Figure 1 (**a**) Distribution of total salt check-sheet scores. (**b**) Distribution of 24-h salt excretion.

subjects with hypertension and those without ('non-hypertensive' *vs.* 'hypertensive' groups: 8.4 ± 3.0 g per day ($n=89$) *vs.* 8.7 ± 3.8 g per day ($n=51$); $P=0.71$).

The salt check-sheet score was significantly positively correlated with the 24-h urinary salt excretion level ($r=0.27$; $P<0.01$; Figure 3). In addition, the total salt check-sheet score was significantly correlated with 24-h urinary salt excretion levels, in both the '$\leqslant 65$ years old' age group ($r=0.22$; $P=0.04$; $n=88$) and the '>65 years old' age group ($r=0.34$; $P=0.02$; $n=48$). The correlation was also significant in both the 'non-hypertensive' group ($r=0.22$; $P=0.04$; $n=89$) and the 'hypertensive' group ($r=0.34$; $P=0.01$; $n=51$). A sex-based analysis revealed a significant positive correlation between the total salt check-sheet score and 24-h urinary salt excretion levels in women ($r=0.19$; $P=0.04$; $n=113$), but not in men ($r=0.30$; $P=0.16$; $n=23$). A significant positive correlation occurred in the obese group ($r=0.42$; $P=0.04$; $n=24$), but not in the nonobese group ($r=0.15$; $P=0.11$; $n=116$) between the total salt check-sheet score and 24-h urinary salt excretion level.

We compared the total salt check-sheet scores within various descriptive categories: sex, age ($\leqslant 65$ years or >65 years), obesity (with or without) and hypertension (with or without). Concerning sex, the total salt check-sheet score was higher in men than in women (13.3 ± 4.1 *vs.* 8.1 ± 3.1; $P=0.01$). An especially significant difference was found between the sexes regarding the intake of salty food ($P=0.01$), as well as seasoning of homemade meals and eating out/home-meal replacement ($P=0.01$). With regard to age, the total salt check-sheet scores were significantly higher in the '$\leqslant 65$ years old' group than in the '>65 years old' group (11.8 ± 4.2 *vs.* 9.8 ± 4.1; $P=0.01$). An especially significant difference was found between the age groups in terms of seasoning home meals ($P=0.00$), eating out/home-meal replacement, and seasoning and meal amount of food ($P=0.00$). The total salt check-sheet score was higher in obese subjects than in nonobese subjects (10.6 ± 4.2 *vs.* 13.6 ± 3.5; $P=0.00$). This difference was especially pronounced with regard to the frequency with which high-salt foods were consumed ($P=0.01$), as well as to the seasoning and size of homemade dishes ($P=0.01$). Conversely, subjects with hypertension did not differ from those without in terms of the total salt check-sheet score or the aforementioned descriptive categories (Table 3).

DISCUSSION

This study validated the salt check sheet by comparing it with 24-h urinary salt excretion levels in local residents. A significant correlation was found between the total salt check-sheet score and the 24-h urinary salt excretion level (Figures 2 and 3), suggesting that the salt intake of the general population can be screened using the salt check sheet. Moreover, the check sheet not only screens for salt-intake level, but also identifies the food and diet types that lead to the salt intake. Indeed, our results identified the food types that led to salt intake in terms of sex, age and obesity (Table 3).

However, three points must be considered at this stage. First, in our study, the mean 24-h urinary salt excretion levels were 8.5 ± 3.3 g, which is lower than the mean salt intake of the general Japanese population.[4,6] This might have influenced the results such that subjects with hypertension did not differ from those without in terms of either 24-h urinary salt excretion levels or salt check-sheet scores. However, previous research into the validity of the salt check sheet in hypertensive cases yielded a daily salt excretion level of 8.9 g,[8] which is comparable with that of our population, and generated similar results.

Second, when analyzed on the basis of sex, the total check-sheet scores and 24-h urinary salt excretion levels did not show any significant correlation, perhaps because of the low number of men. A significant correlation between check-sheet score and 24-h urinary salt excretion levels was shown in obese subjects, but not in nonobese subjects. Perhaps the result in nonobese subjects was derived from over or understatement of salt intake. Over and understatement is common in dietary questionnaires, and BMI is the factor most associated with statement error.[18] Murakami *et al.*[19] reported that, even in the nonobese ($\mathrm{BMI}<25\ \mathrm{kg\,m^{-2}}$) group, subjects with lower BMI tended to state intakes that were higher than reality, and those with higher BMI tended to do the opposite. Therefore, in regard to BMI, the possibility of over and understatements should be considered in the context of the salt check sheet.

Third, with regard to the comparison of the 'low,' 'medium' and 'high-to-very high' salt groups, which were divided on the basis of the salt check-sheet scores, there were no significant differences in 24-h

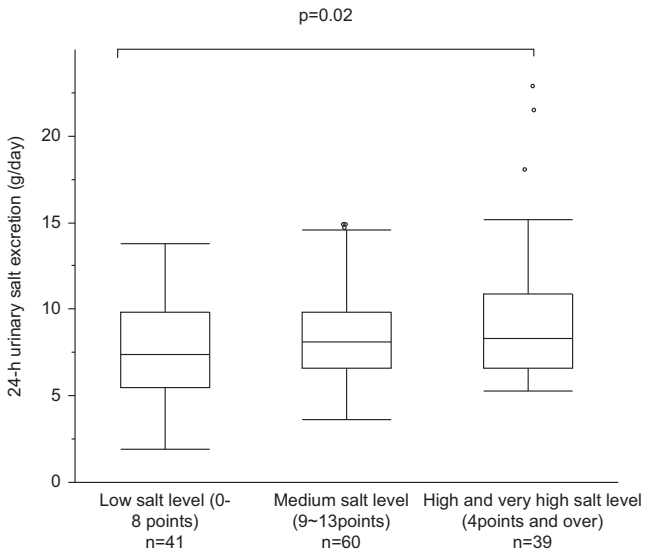

Figure 2 Relationship between salt-intake levels evaluated using the salt check sheet and 24-h salt excretion level.

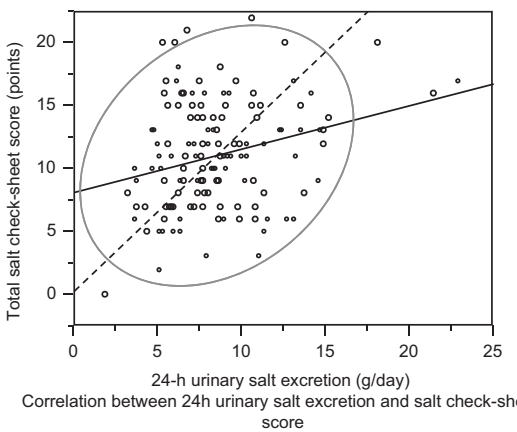

Figure 3 Significant positive correlation between salt check-sheet scores and 24-h salt excretion levels. The dashed line is the identity line, and the solid line is the regression line (total salt check-sheet scores = 8.157662 +0.3438676 × 24-h urinary salt excretion). The circle is a normal density ellipse ($P=0.95$) enclosing the two variables.

Table 3 Comparison of the scores in the salt check-sheet items on sex, age, obesity and diagnosis of hypertension

Sex	*Male* (n = *23*)	*Female* (n = *117*)	
Frequency of high-salt diet intake (seven items: 0–17 points)	7.2 ± 2.3	5.7 ± 2.4	0.01
Miso soup, soup and so on	2.0 ± 0.9	1.6 ± 0.8	0.08
Pickles, pickled plums and so on	1.2 ± 1.0	0.9 ± 0.9	0.22
Fish-paste products such as *chikuwa* and *kamaboko*	0.8 ± 0.7	0.4 ± 0.6	0.04
Opened dry horse mackerel, *mirin*-seasoned dried fish, salted salmon and so on	0.6 ± 0.6	0.4 ± 0.6	0.16
Ham or sausage	0.8 ± 0.7	0.6 ± 0.7	0.14
Noodles such as *udon* and *ramen*	1.2 ± 0.4	1.1 ± 0.7	0.24
Senbei, *okaki*, potato chips and so on	0.6 ± 0.7	0.6 ± 0.7	0.76
Additional seasoning, frequency of eating out and home-meal replacement (four items: 0–12 points)	4.4 ± 2.1	3.1 ± 1.8	0.01
Frequency of seasoning with soy sauce, sauce and so on	1.3 ± 0.8	1.1 ± 0.9	0.20
Do you consume *udon*, *ramen* or other soups?	1.7 ± 0.8	0.8 ± 0.8	0.00
Eating out or having convenience-store-bought *bento* (lunch plate) for lunch	0.7 ± 1.1	0.6 ± 0.7	0.71
Eating out or having ready-made side dishes for dinner	0.7 ± 0.7	0.6 ± 0.6	0.29
Taste of your homemade dishes, amount of food (two items: 0–6 points)	1.7 ± 1.2	1.9 ± 1.5	0.69
Taste of your homemade dishes: comparison with those you eat out	0.4 ± 0.8	0.7 ± 1.1	0.15
Amount of food	1.3 ± 0.8	1.1 ± 0.8	0.33
Total	13.3 ± 4.1	10.6 ± 4.1	0.01
Age	*< 65 years* (n = *89*)	*⩾ 65 years* (n = *51*)	P-*value*
Frequency of high-salt diet intake (seven items: 0–17 points)	6.0 ± 2.4	5.8 ± 2.4	0.65
Miso soup, soup and so on	1.6 ± 0.8	1.7 ± 0.8	0.44
Pickles, pickled plums and so on	0.9 ± 0.9	1.1 ± 1.0	0.24
Fish-paste products such as *chikuwa* and *kamaboko*	0.5 ± 0.6	0.4 ± 0.6	0.28
Opened dry horse mackerel, *mirin*-seasoned dried fish, salted salmon and so on	0.4 ± 0.6	0.5 ± 0.7	0.46
Ham or sausage	0.7 ± 0.7	0.5 ± 0.6	0.14
Noodles such as *udon* and *ramen*	1.1 ± 0.6	1.1 ± 0.8	0.55
Senbei, *okaki*, potato chips and so on	0.7 ± 0.7	0.5 ± 0.6	0.07
Additional seasoning, frequency of eating out and home-meal replacement (four items: 0–12 points)	3.7 ± 2.1	2.7 ± 1.5	0.00
Frequency of seasoning with soy sauce, sauce and so on	1.2 ± 0.9	1.0 ± 0.8	0.24
Do you consume *udon*, *ramen* or other soups?	1.1 ± 0.8	0.7 ± 0.8	0.01
Eating out or having convenience-store-bought *bento* (lunch plate) for lunch	0.7 ± 0.9	0.4 ± 0.6	0.08
Eating out or having ready-made side dishes for dinner	0.7 ± 0.7	0.5 ± 0.6	0.06
Taste of your homemade dishes, amount of food (four items: 0–6 points)	2.1 ± 1.5	1.3 ± 1.2	0.00
Taste of your homemade dishes: comparison with those you eat out	0.8 ± 1.1	0.4 ± 0.9	0.02
Amount of food	1.3 ± 0.8	0.9 ± 0.7	0.00
Total	11.8 ± 4.2	9.8 ± 4.0	0.01
Obesity	*Without* (n = *116*)	*With* (n = *24*)	
Frequency of high-salt diet intake (seven items: 0–17 points)	5.7 ± 2.4	7.0 ± 1.9	0.01
Miso soup, soup and so on	1.6 ± 0.8	1.8 ± 0.7	0.53
Pickles, pickled plums and so on	0.9 ± 0.9	1.2 ± 0.9	0.21
Fish-paste products such as *chikuwa* and *kamaboko*	0.4 ± 0.6	0.7 ± 0.7	0.09
Opened dry horse mackerel, *mirin*-seasoned dried fish, salted salmon and so on	0.4 ± 0.6	0.5 ± 0.6	0.63
Ham or sausage	0.6 ± 0.7	0.9 ± 0.6	0.05
Noodles such as *udon* and *ramen*	1.1 ± 0.7	1.3 ± 0.6	0.15
Senbei, *okaki*, potato chips and so on	0.6 ± 0.7	0.6 ± 0.6	0.89
Additional seasoning, frequency of eating out and home-meal replacement (four items: 0–12 points)	3.2 ± 2.0	3.9 ± 1.7	0.07
Frequency of seasoning with soy sauce, sauces and so on	1.1 ± 0.8	1.3 ± 0.9	0.53

Table 3 (Continued)

Obesity	*Without* (n = *116*)	*With* (n = *24*)	
Do you consume *udon*, *ramen* or other soups?	1.0 ± 0.8	1.0 ± 0.8	0.85
Eating out or having convenience-store-bought *bento* (lunch plate) for lunch	0.5 ± 0.8	0.8 ± 0.9	0.09
Eating out or having ready-made side dishes for dinner	0.6 ± 0.6	0.8 ± 0.6	0.05
Taste of your homemade dishes, amount of food (two items: 0–6 points)	1.7 ± 1.4	2.6 ± 1.6	0.01
Taste of your homemade dishes: comparison with those you eat out	0.6 ± 1.0	1.1 ± 1.1	0.04
Amount of food	1.1 ± 0.7	1.5 ± 1.0	0.01
Total	10.6 ± 4.2	13.6 ± 3.5	0.00
Hypertension	*Without* (n = *89*)	*With* (n = *51*)	
Frequency of high-salt diet intake (7 items: 0–17 points)	5.8 ± 2.5	6.2 ± 2.2	0.26
Miso soup, soup and so on	1.6 ± 0.8	1.8 ± 0.8	0.23
Pickles, pickled plums and so on	0.9 ± 0.9	1.1 ± 0.9	0.23
Fish-paste products such as *chikuwa* and *kamaboko*	0.4 ± 0.6	0.6 ± 0.7	0.28
Opened dry horse mackerel, *mirin*-seasoned dried fish, salted salmon and so on	0.4 ± 0.6	0.5 ± 0.6	0.52
Ham or sausage	0.6 ± 0.7	0.7 ± 0.8	0.58
Noodles such as *udon* and *ramen*	1.1 ± 0.7	1.1 ± 0.6	0.69
Senbei, *okaki*, potato chips and so on	0.6 ± 0.7	0.5 ± 0.7	0.45
Additional seasoning, frequency of eating out and home-meal replacement (four items: 0–12 points)	3.3 ± 1.9	3.4 ± 2.1	0.75
Frequency of seasoning with soy sauce, sauces and so on	1.1 ± 0.8	1.2 ± 0.9	0.94
Do you consume *udon*, *ramen* or other soups?	0.9 ± 0.8	1.0 ± 0.9	0.48
Eating out or having convenience-store-bought *bento* (lunch plate) for lunch	0.6 ± 0.8	0.5 ± 0.8	0.59
Eating out or having ready-made side dishes for dinner	0.6 ± 0.6	0.6 ± 0.7	0.53
Taste of your homemade dishes, amount of food (two items: 0–6 points)	1.9 ± 1.5	1.7 ± 1.4	0.49
Taste of your homemade dishes: comparison with those you eat out	0.7 ± 1.1	0.6 ± 1.0	0.51
Amount of food	1.2 ± 0.8	1.1 ± 0.8	0.71
Total	10.9 ± 4.2	11.4 ± 4.2	0.48

urinary salt excretion levels between the 'low' and 'medium' groups or between the 'medium' and 'high-to-very high' groups. The correlation coefficient between total salt check-sheet scores and 24-h urinary salt excretion levels was low (0.27). However, the 24-h urinary salt excretion levels reflect the salt intake on a specific day, whereas the salt check sheet assesses the average daily salt intake. Thus, the two assessment methods are unlikely to correlate strongly in any case. Our results are compatible with this argument. Indeed, one previous study reported that the correlation coefficient between the results of the BDHQ,[10,11] which assesses participants' daily eating behavior over the previous month, and those of 24-h urinary salt excretion measurement was 0.34—comparable with the coefficient in our study.[12]

The questions on the salt check sheet address a high-salt diet and eating behavior, making it less time consuming and easier to complete than the BDHQ specified above.[10,11] When focusing on salt restriction in the population, it is more important to limit individual salt intake than to compare the accuracies of salt-intake estimates. The salt check sheet is efficient in terms of time; it confers low psychological and physical burdens on subjects and instructors, and it can be repeated frequently. Thus, it can be used to inform the public about salt intake, and thus motivate individuals to monitor their own diets in this regard.

One limitation of the present research was the small number of men: only 16.4%. We need to reevaluate the measured parameters among men in the local community. Second, this study used the data from 24-h urinary salt excretion measurements on one specific day. Thus, to assess longer-term fluctuations in salt intake,[20] we would need to evaluate the same parameters over longer periods. Third, because the salt check sheet was based on nutritional data from people in a small local area,[8,12] the relationship between the check sheet and 24-h urine salt excretion should be analyzed in different subjects from other areas. The influence of 24-h urine salt excretion may differ between questions on this salt check sheet; some questions may be changed for this reason. In our opinion, concomitant use of the salt check sheet and urinary salt excretion may provide better and more practical information regarding salt reduction.

In conclusion, the total salt check-sheet scores significantly correlated with 24-h urinary salt excretion levels and can therefore be used to assess salt intake in local residents.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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