Proposed Nomenclature for Salt Intake and for Reductions in Dietary Salt

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There is considerable confusion about what ranges of dietary salt[a] could be considered low, normal, or high and also what ranges of reduction in dietary salt are small or large. The World Hypertension League with other organizations involved in dietary salt reduction have proposed a standardized nomenclature based on normal ancestral levels of salt intake and also on ranges of reduction in salt intake in clinical and population interventions. Low daily salt (sodium) intake where harm due to deficiency would be expected to occur is recommended to remain undefined because of inadequate research but likely <0.25 g (100 mg), normal (physiological) intake <2.5 g (1000 mg), recommended intake <5.0 g (2000 mg), high ≥5.0 g (2000 mg), very high >10 to 15 g (4000–6000 mg), and extremely high >15 g (6000 mg). Reductions in daily salt (sodium) intake are recommended to be called small if <2.5 g (1000 mg), moderate if 2.5 to 5.0 g (1000–2000 mg) and large if >5.0 g (2000 mg). Use of this nomenclature is likely to result in less confusion about salt intake and interventions to reduce dietary sodium. *J Clin Hypertens (Greenwich).* 2015;17:247–251. © 2014 Wiley Periodicals, Inc.

Extensive research in animal, clinical, and public health domains support harmful effects of high dietary salt (sodium)*.[1–11] Reducing dietary salt is estimated to be one of the most effective (and cost-saving) interventions to improve health and has been recommended by major health and scientific organizations around the world.[2–9,12–26] Nevertheless, there remains confusion about what ranges of dietary salt could be considered normal (physiological), low, or high, with different authors citing the same levels of dietary salt as high and low.[27,28] Further, there is also confusion about what ranges of reduction in dietary salt are small or large.

We recommend standard nomenclature for describing salt intakes and extent of reductions to aid in communications and a common understanding of this important public health issue. The range of dietary salt intakes that fulfill usual physiological requirements are likely to be within the range of dietary salt that humans evolved on prior to the widespread availability of commercial sources of salt that are now commonly added to food.[28–31] Analysis of salt intake in hunter-gatherer societies, dietary intake estimates based on the salt content of Paleolithic diets, and very careful metabolic studies can provide assurances of a range of salt intakes that satisfy physiological requirements.[29–31] Hence, the basis of our definitions is on the normal ancestral level of sodium intake.

NORMAL ANCESTRAL LEVELS OF SODIUM INTAKE

Analysis of the composition of the Paleolithic diet estimates that intakes of dietary salt were approximately 1.7 g (sodium 690 mg) per day.[32] Careful metabolic studies have shown that sodium balance can be maintained with long-term salt intakes of 0.25 g to 0.9 g (sodium 100–375 mg) per day.[31] Several studies have estimated salt intake in hunter-gatherer societies with a range of results (Table I), with nearly all population mean levels less than 2.5 g of salt (sodium 1000 mg) per day. Some of the higher levels of salt intake that have been reported in hunter-gatherer societies may reflect a nutritional transition within these societies and the addition of salt to foods or higher natural sources of salt (eg, marine sources).[33,34] For example, we have not included intakes from coastal dwellers in New Guinea, Quash'Qai tribes people, and similar peoples in Northern Kashmir with high dietary salt from natural sources. Hypertension is prevalent in those areas and hence salt intakes may represent pathophysiological rather than physiological levels.[33,35–37] A mean urinary 24-hour sodium excretion of less than 1000 mg (equivalent to 2.5 g salt in the diet) per day in specific human groups is associated with low rates of hypertension (<5%) and little to no increase in blood pressure with age (the main adverse health effect of higher levels of dietary

For the purposes of this manuscript we use "salt" as a common term for "sodium," which is largely consumed as "sodium chloride" but is also consumed in other forms such as sodium monoglutamate.

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TABLE I. Daily Dietary Salt Intake in Hunter-Gatherer Societies Where Hypertension Has a Low Prevalence

Society	Estimate of Daily Intake[a]		
	Salt, g	Sodium, mg	Sodium, mmol
Pukapukans (Cook Island)[55–57]	3.5	1400	61
Yanomamo Indians (Brazil)[38,58]	0.1	46	2
Xingu (Brazil)[38]	0.33	133	5.8
Chimbu (Papua New Guinea)[33,38]	1.54	616	27
Bushmen Botswana[33,55,59]	2	800	35
Kenya[38]	2.95	1180	51
Kwaio (Solomon Islands)[34,55]	1.2	480	21
Aita and Baegu[34]	0.58–1.7	230–690	10–30
Alaskan Eskimos[31]	3.91	1564	68

[a]Urinary excretion of sodium is used as a proxy for sodium ingestion, which is most commonly ingested as sodium chloride or "salt."

salt).[33,36,38,39] Hence, in part for ease of classification, we recommend defining normal (physiological) ranges of salt intake as <2.5 g salt (sodium <1000 mg) per day even though the true requirement range for salt remains unclear (Table II). The upper limit of our definition may be higher than minimal physiological requirements but less than some hunter-gatherer societies consumed.[28]

Notably, dietary salt requirements can be higher in settings of high temperatures and vigorous physical activity in unacclimatized individuals.[8] The process of acclimatization takes several days. Nevertheless, highly active people in tropical hunter-gatherer societies do not have features of salt depletion at salt consumption levels less than 2.5 g (sodium 1000 mg) per day and for the Yanomamo Indians it is even less than 0.25 g (sodium 100 mg) per day. Illnesses (eg, diarrhea) may result in increased dietary salt requirements. Our recommended nomenclature for physiological or normal intake does not account for disease or unusual circumstances where salt requirements may be higher.

TABLE II. Recommended Dietary Salt Daily Intake Nomenclature

Terminology	Dietary Intake Per Day		
	Salt, g	Sodium, mg	Sodium, mmol
Low intake	Not defined, but likely <0.25	Not defined, but likely <100	Not defined, but likely <4.3
Normal ancestral level of sodium intake	<2.5	<1000	<43
Recommended	<5.0	<2000	<87
High	≥5.0–10	≥2000–4000	≥87–174
Very high	>10–15	>4000–6000	>174–261
Extremely high	>15	>6000	>261

LOW LEVELS OF DIETARY SALT

Studies have not been conducted in humans to remove naturally occurring salt from foods to assess the lower physiological requirements of dietary salt. Nevertheless, sodium is an essential nutrient and animal studies demonstrate that removing salt from foods can cause sodium depletion, reduced breeding success, and increased mortality.[40] Humans have a remarkable ability to conserve sodium by reabsorbing sodium from renal tubules.[41] Low daily salt (sodium) intake where harm caused by deficiency would be expected to occur is recommended to remain undefined because there is inadequate evidence to establish such a range. However, available evidence in hunter-gatherer societies indicates that the level of salt intake where harm would occur is likely below <0.25 g (100 mg) per day (Table II).

RECOMMENDED LEVELS OF DIETARY SALT

The World Hypertension League and the International Society of Hypertension support the World Health Organization's (WHO's) recommendations for salt intake to be less than 5 g (sodium 2000 mg) per day in adults and, hence, support a definition of recommended salt intake be less than 5 g of salt (sodium 2000 mg) per day[3,25] (Table II). Other national salt intake recommendations are between less than 5 g and less than 8 g of salt (sodium 2000–3200 mg) per day.[6]

HIGH DIETARY SALT

Whilst there is currently no agreed definition of high dietary salt, we recommend that all levels of intake above 5 g (sodium 2000 mg) per day be classified as high. Further, we recommend that levels of consumption above 10 g (sodium 4000 mg) per day be classified as very high and above 15 g (sodium 6000 mg) per day as extreme (Table II). These latter definitions represent multiples of the upper limit of the recommended intake definition (ie, two and three times above the recommended intake definition).

REDUCTIONS IN DIETARY SALT

Reductions in dietary salt have also had various conflicting descriptions. Nevertheless, clinical trials can indicate what levels of reduction in salt intake can be achieved. A meta-analysis of 30 randomized trials lasting 1 month or more that examined effects on blood pressure with a reduction of at least 2.3 g of salt (sodium 920 mg) per day found an average reduction in dietary salt of 4.3 g (sodium 1725 mg) per day.[42] A meta-analysis of 167 clinical trials of salt reduction that examined effects on blood pressure had an average reduction in salt of 7.1 g (sodium 2875 mg) per day in people with hypertension and 8.6 g of salt (sodium 3450 mg) per day in those with normal blood pressure. The latter meta-analysis had many short-term studies of limited clinical or public health relevance and, hence, was not considered in setting these recommendations.[43] The distributions of the reductions in salt

intake were not indicated in the results of recent meta-analyses.[42–44] Nine of the 30 trials in the meta-analysis of clinical trials lasting at least 1 month had reductions in dietary salt of more than 5 g (sodium 2000 mg) or more, while only one trial was less than 2.5 g (sodium 1000 mg) per day (studies less than 2.3 g salt mg per day were excluded). A meta-analysis of the long-term effects of salt reduction had an average reduction in dietary salt of 2 g salt (sodium 805 mg) per day and had small changes in blood pressure.[45] The United Nations has recommended a 30% reduction in dietary salt to be achieved by 2025, which, considering an average national intake of 10 g salt (sodium 4000 mg) per day, equates to an average reduction of 3 g (sodium 1200 mg) per day. Population reductions in dietary salt of 5.75 g (sodium 2300 mg) per day have been achieved in Finland over 30 years while smaller reductions have been achieved in Japan and the United Kingdom.[46] In a community intervention in Portugal, a reduction in dietary salt of about 9.25 g (sodium 3700 mg) per day was achieved over 2 years.[47]

We propose that the reduction in dietary salt of 2.5 to 5 g (sodium 1000–2000 mg) per day be considered moderate reduction in dietary salt, while that less than 2.5 g (sodium 1000 mg) per day be considered small and that greater than 5 g (sodium 2000 mg) per day be considered large (Table III). A limitation to this definition is that it is based on absolute reductions in intake and the magnitude of the reductions attained should be put into the context of the specific population and the time frame of any reduction. Some societies may require a large reduction and others a more moderate one, and the measures and strategies established will certainly influence the speed of the expected reduction and the time at which the goal or expected final mean sodium intake is attained.

DISCUSSION

Current nomenclature describing salt intake is not standardized with terms "high" and "low" being used to describe similar salt intake. The foundation for the nomenclature for intake recommended in this commentary is based on estimates of a range of dietary salt intakes from Paleolithic diets and hunter-gatherer societies where hypertension prevalence is low. We note that dietary salt intakes to less than 0.38 g (sodium 152 mg) per day were also achieved with Kempner's rice fruit diet, which was used to effectively treat severe hypertension prior to widespread availability of antihypertensive drugs.[48] The nomenclature is specifically not based on current consumption levels. A recent review of salt intakes around the world has found that the average national intake of salt is close to 10 g (sodium 4000 mg) per day, with none of the estimated average intakes in our proposed normal range, few countries at a recommended range, and nearly all national averages at high and many at very high levels.[49] There is currently no upper threshold for salt intake where higher intake has been shown to have less impact on blood pressure. Further, there is no lower threshold where less intake has been shown to have less impact on blood pressure (with the limitation that intervention studies have only been conducted to about 3 g (sodium 1200 mg) per day, and that societies consuming less than 2.5 g of salt (sodium 1000 mg) per day have low prevalence of hypertension with little to no aging-related increase in blood pressure.

TABLE III. Recommended Nomenclature for Reduction in Daily Dietary Salt Intake

	Reduction in Daily Dietary Intake Per Day		
Terminology	Salt, g	Sodium, mg	Sodium, mmol
Small	<2.5	<1000	<43
Moderate	2.5–5.0	1000–2000	43–87
Large	>5.0	>2000	>87

Similarly, current nomenclature describing reductions in dietary salt is not standardized, with terms *high* and *low* being used to describe similar reductions in salt intake. The recommended nomenclature is largely arbitrary but based on a range of what has been achieved in clinical trials and community interventions. Within the range of intakes tested, the reductions in blood pressure with reductions in dietary salt are dose dependent and appear linear, with no established thresholds where this relationship does not hold true.[44,46,50] Even small reductions in blood pressure can have very substantive public health benefits, while large reductions in blood pressure have larger benefits.[51–53]

We have not suggested a nomenclature for foods (normal or high in salt). Clearly, though, foods that have a normal level of salt are those that are naturally occurring without added salt and, that when consumed in a usual diet, result in salt intakes that average less than 2.5 g (1000 mg sodium) per day. Foods that have added salt or are naturally high in salt where consumption in a usual dietary pattern results in average salt intakes of less than 5 g could be considered as being "recommended" and also would include the "normal" category. Foods with added salt or those naturally high in salt where consumption in a usual dietary pattern results in average daily intakes of salt greater than 5 g (sodium 2000 mg) per day can be considered high in dietary salt. Although such definitions would be complex, they could be based on the sodium/calorie ratio of foods and consider the caloric needs of the individual and thereby also account for the WHO's recommendations for children based on their lower caloric needs.[3]

A limitation of our recommendations for nomenclature is that they are based on estimates of intake from 24-hour excretion of sodium. Excretion of sodium over 24 hours on multiple days is currently considered the gold standard method for assessing salt intake.[54] It is likely when little salt is eaten that proportionally more sodium is excreted via nonrenal elimination routes

(eg, sweat, gastrointestinal).[28] Nevertheless, because 24-hour urine excretion is the gold standard for assessing salt intake and recommended for surveillance of salt intake, we have retained this definition of intake range.

The adoption of the recommended nomenclature will aid in better understanding dietary salt intakes relative to usual dietary needs for health and also for the feasibility and utility of different degrees of reducing dietary salt. This nomenclature is supported by the World Hypertension League, World Action on Salt & Health, and the Australian Division of World Action on Salt & Health.

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