

## Review Article

# Strategies and Opportunities Ahead to Reduce Salt Intake

Shahram Rafieifar MD<sup>1</sup>, Hamed Pouraram PhD\*<sup>2</sup>, Abolghassem Djazayeri PhD<sup>2</sup>, Fereydoun Siassi PhD<sup>2</sup>, Zahra Abdollahi PhD<sup>3</sup>, Ahmad Reza Dorosty PhD<sup>2</sup>, Mitra Abtahi MSc<sup>4</sup>, Hossein Kazemini MD<sup>5</sup>, Farshad Farzadfar PhD<sup>6</sup>

## Abstract

In Iran, as in most countries, cardiovascular diseases are the leading cause of death (highest mortality rate), but rank third in terms of disease burden. On the other hand, the relationship between high salt intake, hypertension, and cardiovascular disease has been proven. Food consumption pattern in Iran shows that consumption of salt, pickled foods and salty snacks is common. Regarding the World Health Organization (WHO) target for salt intake (about 5 g per day), the evidence indicates that Iranian people consume 2–3 times more than the recommended amount of salt. Fortunately, serious attention has been paid to this matter since 2009 and along with arrangements for it, support of all relevant sectors (public and private) has been included in the agenda. At present, reduction of salt intake is among the major priorities of planners, policy makers, and experts of the Iranian health services system. On the other hand, many studies in EMRO have shown high levels of daily salt intake in these countries. In this review, the solutions used in the Islamic Republic of Iran at various levels were considered, including determination of salt intake measurement methods, revision in the amount of salt in processed food products, food labeling, promoting awareness of various social groups, gathering support from all relevant sectors, designing a regular public awareness campaign for reducing salt intake, and lessons learned in this regard, that can be helpful to countries in the region.

**Keywords:** Iran, Salt reduction, Strategies

**Cite this article as:** Rafieifar Sh, Pouraram H, Djazayeri A, Siassi F, Abdollahi Z, Dorosty AR, Abtahi M, Kazemini H, Farzadfar F. Strategies and Opportunities Ahead to Reduce Salt Intake. *Arch Iran Med.* 2016; 19(10): 729 – 734.

## Background

According to the World Health Organization (WHO) report, cardiovascular diseases cause approximately 17 million deaths per year worldwide.<sup>1</sup> In total, 45% of deaths from cardiovascular diseases and 51% of fatal strokes have been linked to high blood pressure.<sup>2</sup> However, 80% of heart diseases, stroke, type II diabetes, and 40% of cancers can be prevented through implementation of effective and inexpensive interventions.<sup>3</sup> Recently, various studies have proven that high salt intake causes high blood pressure and thus, increases the risk of stroke, heart attacks, and kidney dysfunction.<sup>4–8</sup> Therefore, the World Health Organization (WHO) recommended in the most recent guideline, that countries should reduce the amount of salt consumption by as much as 30% by the year 2025 and if possible bring it to 5 g per day.<sup>9</sup>

To sum up the experiences of countries, we used many keywords such as; salt, salt consumption reduction, salt reduction strategies, successful strategies in salt reduction and others to gather all available useful articles which were published inside and outside of Iran.

**Authors' affiliations:** <sup>1</sup>Health Promotion and Education Department, Ministry of Health & Medical Education (MOH), Tehran, Iran. <sup>2</sup>Community Nutrition Department, School of Nutritional Sciences and Dietetics, Tehran University of Medical Sciences (TUMS), Tehran, Iran. <sup>3</sup>Nutrition Department, Ministry of Health & Medical Education (MOH), Tehran, Iran. <sup>4</sup>Nutrition Research Department, National Nutrition and Food Technology Research Institute (NNFTRI), Faculty of Nutrition Sciences and Food Technology, Shahid Beheshti University of Medical Sciences, Tehran, Iran. <sup>5</sup>Health Network Management Center, Ministry of Health & Medical Education (MOH), Tehran, Iran. <sup>6</sup>Non-Communicable Disease Research Center, Endocrinology & Metabolism Research Institute, Tehran University of Medical Sciences (TUMS), Tehran, Iran. **•Corresponding author and reprints:** Hamed Pouraram PhD, Community Nutrition Department, School of Nutritional Sciences and Dietetics, Tehran University of Medical Sciences (TUMS), Tehran, Iran. E-mail: hpouraram@yahoo.com.

Accepted for publication: 20 September 2016

Iran is the second most populous country in the Middle East. Unfortunately, statistics show that in the Islamic Republic of Iran, like most countries, cardiovascular diseases cause the highest mortality rate but rank the third in terms of burden of disease.<sup>10</sup> Blood pressure is a major risk factor for cardiovascular diseases, including myocardial infarction, stroke and congestive heart failure.<sup>11</sup> The main reason for increased prevalence of hypertension in the country could be the daily growth in the elderly population, and increase in risk factors, such as unhealthy food habits (increased intake of salt, saturated fat, etc.), reduced physical activity, weight gain, and stress.<sup>12</sup> One of the most important factors in unhealthy food habits is the intake of salt. According to FAO and WHO technical report, daily salt intake should be limited to 5 g (equivalent to about two grams of sodium). The report also showed that sodium (Na) intake in the diet from any source, including added during the preparation of meals or at the table, canned foods, and salted foods, affect blood pressure and thus must be limited so as to reduce the risk of cardiovascular diseases.<sup>13</sup> It should be noted that some countries like the United States and Britain have recommended salt intake of less than 6 g daily.<sup>14,15</sup>

In most countries, such as Iran, salt intake is in the range of 8–12 g per day and reduction in daily salt intake has been proposed as one of the most economical strategies to promote public health.<sup>16–18</sup> The results of a meta-analysis showed that reducing salt intake to about 2–2.3 g per day was linked with a 20%–30% reduction in the incidence of cardiovascular diseases.<sup>4,6,19</sup>

## Review and Summary of Existing Studies in Iran

In the Iranian culture and food habits, consumption of salty food, pickles, salty nuts, salty snacks (chips, snacks, etc.), confectionary products and desserts, soft drinks, cheese, yogurt and yogurt drinks and a variety of sauces are common and form part of food habits in some areas.<sup>20</sup> Table 1 presents the studies that have measured

the amount of salt intake in Iran.

As seen in Table 1, no united and national study has been conducted so far to determine the exact amount of salt intake<sup>20</sup> and the majority of the existing studies are limited to some provinces and conducted in different age and gender groups.<sup>21-29</sup> Based on the per capita amount of salt production in the country, experts believe that the average amount of salt consumed in the country is around 10-15g per day. Salt consumption is part of people's lives, as its risks are hidden, and we repeatedly witnessed excessive consumption.<sup>30</sup> This hidden risk, its slow harm, and general neglect have imposed a heavy burden on the community.

### Actions conducted in Iran

A report by the Institute for Health Metrics and Evaluation in the field of information in Iran, reported hypertension as the second largest risk factor among ten major risk factors that increased DALYs in 2010. This report also showed that high blood pressure is the most important component of cardiovascular diseases.<sup>31</sup>

Comprehensive and consistent thought to reduce salt consumption in the Islamic Republic of Iran began by the Ministry of Health and Medical Education about seven years ago (around 2009). Following that, by inviting all relevant departments of the Ministry (Nutrition Department, Food and Drug Administration, Health Promotion and Education Department, etc.) to the project and regular meetings, the important role of reducing salt intake was defined in promoting public health and the short and long-term tasks of the relevant agencies and departments were mentioned and an executive plan was designed with their cooperation. Among the key issues discussed in these meetings was understanding the various aspects of this problem for better planning, as well as more effective and purposeful projects. For

this purpose, the strategic planning analysis model of SWOT was used and summarized in Table 2.

One of the important points discussed with special attention in the sessions was to identify weaknesses in information and performance of the country.

The following strategies and methods have been considered in Iran:

### A review of the practices of successful countries

The UK experience was very helpful in this field, because similar to the United Kingdom, an important part of salt intake in Iran comes from bread and thus, reducing the amount of salt in bread was among the key objectives in reducing salt intake, which actually yields good results.<sup>32</sup> Bread is one of the main foods in Iran and since a significant proportion of salt intake in diet comes from bread and cheese,<sup>29</sup> measures were designed to reduce the amount of salt used in bakeries. Some of these activities included coordinating meetings with stakeholders of the bread industry, modification of bread formulation, and encouraging low-salt production of bread. Of course, to achieve the desired result, actions should be swift. Currently, action is being taken to revise salt content of food products with objective of reducing salt contents of processed food. Countries in the region such as Kuwait, the UAE, Qatar, and Bahrain have also begun activities to reduce salt in bread<sup>12</sup> and countries such as Tunisia, Syria, Palestine and Turkey have also done studies on its cost effectiveness.<sup>33</sup>

In general, according to the studies, it can be concluded that in most developing countries, almost 75% –80% of salt intake is due to salt added to food during cooking and at the table (e.g., China, which is similar to Iran).<sup>34</sup> For this reason, a key strategy in Iran should be to reduce the amount of salt added to food during cooking and concentration of salt in bread.

**Table 1.** Studies that have measured the amount of salt intake in Iran.

Place of study	Authors (publication year)	Participants (sample size)	Salt or sodium intake Measurement method	Mean salt or sodium intake (unit)
Isfahan	Rafiei <i>et al.</i> ,(2008)	Adult 20-60 yr (912)	Sodium in 24 h urine collections	11.1 (g/d) in men and (9.6 g/d) in women
Isfahan (healthy heart Program 1999–2007)	Khosravi <i>et al.</i> ,(2012)	Adult 19-55 yr (1059) (374) (806)	Sodium in 24 h urine collections, 24 hour dietary record and Food Frequency Questionnaire (49 items)	11.37 (g/d) in men and 9.936 (g/d) in women
Isfahan (Urban &Rural)	Kelishadi <i>et al.</i> ,(2013)	Children 3-10 yr (220)	Spot urine test and Three days dietary recall	2017 mg (sodium/d)
Iran	Fahimi <i>et al.</i> , 2012	Review article	Sodium in 24 h urine collections	9.4 salt(g/d)
Yazd	Motlagh <i>et al.</i> ,(2011)	Adult 18-45 yr (247)	Urine sodium according to Kawasaki formula	10.09 g (sodium/ d)
Rasht	Azizi <i>et al.</i> ,(2001)	2-79 yr (340)	Food Frequency Questionnaire	7.2 g
Sari	Azizi <i>et al.</i> ,(2001)	2-79 yr (343)	Food Frequency Questionnaire	7.7 (g/d)
Ilam	Rahmani <i>et al.</i> ,(2001)	2-79 yr (644)	Food Frequency Questionnaire	10.3 (g/d)
South of Tehran	Nazeri <i>et al.</i> ,(2010)	Household (383)	Sodium in24 h urine collections and Weighing method	9.1 (g/d)
Tehran	Houshiarrad <i>et al.</i> ,(2014)	Adult 20-65yr (155)	Sodium in 24 h urine collections, Weighing method, 24 hours dietary intake	9.00 (g/d) in men and 6.87 (g/d) in women

**Table 2.** SWOT Analysis.

Strengths	-Availability of professional specialists to train and raise the awareness, health and nutrition literacy of the community -Attention of Experts and planners to this problem
Weaknesses	-Lack of systematic planning in this regard -Lack of awareness of the harmful effects of a high intake of salt -Accurate estimation regarding the amount of salt intake in Iran -Food labels without salt information
Opportunities	-Special attention of public about health -Higher health literacy in recent years -Self-care -Existence of high council for health and food security presided by the president of the republic
Threats	-Difficult and costly measurement of salt intake with standard procedures (24 hours urine collection) -Salty food consumption habit -The taste of salt in most traditional dishes -High consumption of fast foods and soft drinks -Inadequate intake of fruit and vegetables as a source of potassium -Producing and offering high salt products

### Revision of salt content in food production

In most developed countries, more than 75% of salt is added to food during its production, processing, and storage, while only 15% of the total intake of salt is added during cooking or at the table, and 5% occurs naturally in food.<sup>35,36</sup> In countries where much of the salt comes from processed and prepared foods, reducing the amount of salt in these products is the first interventional priority and the food industry in these countries can play a crucial role. A recent study in south of Iran showed that 40% reduction of salt in bread, which was acceptable to people, significantly reduced urinary sodium and systolic blood pressure.<sup>37</sup> According to available reports, 38 countries have so far included reduction of salt in food products in their strategies, among which nine have even passed a law for this purpose.<sup>38</sup> Also in England, 80% of salt enters the daily food program through processed food and thus, close cooperation of the industry and production managers is crucial for the country.<sup>39,40</sup> England's experience has shown that salt reduction programs, despite their simple appearance, are one of the most complicated interventional programs and, thus, close cooperation of all relevant stakeholders is essential, especially the industrial sector. According to the national KAP study in Iran, about 50% of the daily salt intake comes from salt used in cooking food and that added to food at the table. In Iran, regular meetings were held with participation of all relevant units with the aim of presenting feasible strategies to reduce salt consumption. The result of these meetings was modification of formulation of foods containing salt. It was also decided that foods containing salt in the country should be divided into two groups: foods in which salt acts as a preservative and food in which salt acts as a flavoring. In the first case, it was decided that the amount of salt in their formulation should be reduced to the extent that does not adversely affect the product quality. Experts believe that 10%–20% reduction in the amount of salt in food products is undetectable by taste and does not affect product quality as well and is therefore applicable.<sup>41</sup> Regarding the second group, it was decided that reduction in salt amount should be continued, as long as it does not affect the products' acceptance and the salt in the formulation should be replaced with other flavorings with less harmful effects (if salt elimination and replacement by other

flavors is possible). Meanwhile, reduction in the amount of salt should be performed through short and long-term approach and the amount of salt consumed in household food products should be reviewed and re-targeted every three years.<sup>42</sup> So far, national standards of several food items such as cheese, ketchup, canned fish, and bulky cereals have been revised with the aim of reducing their salt contents.

### Encouraging the food industry to devote part of their products to low-salt diet food

The experience of successful countries shows that an essential and effective method for reducing salt intake is to declare the salt content, so that consumers can make the right decision when buying food products based on the amount of salt. In different countries, different methods are used for labeling food products, the most effective of which is the use of the traffic light.<sup>43</sup> "Traffic light" usage in the country begun last year and has been operational. In fact, one of the things that can be a good incentive for the food industry to reduce salt intake in food products is using the tips. The traffic light has been designed with three colors of orange, red, green for five important food constituents affecting/ endangering the consumers' health, one of which is salt. Using the Traffic Light helps people to evaluate the foodstuff at a glance. For example, the "red color" means that the product is high in salt. So, since people are advised to choose the less salty product, they will be more inclined to buy products with a low salt content, and food companies offering low-salt foods have been more successful in marketing/selling their products. It should be noted that paying attention to the product label persuades manufacturers to dedicate a part of their productions to low-salt foods according to the market demand.

One of the practical regulation strategies for industry holders is the setting of rules, so that producers receive reward or healthy product certificate when this rule is adhered to or receive heavy fines if they disobey the rules. In this way, it can be expected that the salt content of food products will be reduced in a competitive market. Meanwhile, the Ministry of Health in its annual evaluation encourages the companies whose products are designed with compliance to the recommendations and rules.

Rise in awareness of the society by designing and implementing public awareness campaigns

The latest KAP study in Tehran showed that 90% of participants knew that salt is one of the risk factors of non-communicable diseases, and almost half of the participants believed that the amount of salt intake should be reduced to have a healthy lifestyle. In addition, 57% started reducing their salt intake and only 6% of them had reduced salt intake during cooking.<sup>29</sup> According to the literature review of studies, Britain, Finland, and Japan are the most successful countries in the reduction of salt intake.<sup>38,44</sup> The reasons for the success of these countries are implementation of systematic awareness campaigns, attracting support of policy makers, and cooperating with the food industry.<sup>45</sup> However, the UK, unlike the two other countries (Japan and Finland) that have benefited from government support to implement educational campaigns, has designed and started the salt reduction strategies through the private sector and by organizing awareness campaigns proved a very successful pattern. It should be noted that, among the developed countries, England has one of the lowest rates of salt intake (8.1 g per day in 2011, based on a random sample of adults in the UK).<sup>46</sup> As we said before, the salt reduction strategy in this country started by focusing on improving the awareness of the people, regarding salt intake reduction methods by regular educational campaigns, and connecting with industry and parliament in this country.<sup>29</sup> Careful planning and regular follow-up of this program were driven by the non-governmental organization, which caused reduction of salt intake from 9.5 to 8.1 g per day in 7 years.<sup>14</sup> However, in the beginning, unlike the World Health Organization recommended level of salt consumption, National Institutes of Health in England determined the amount as 6 g per day in 2015. Currently, the ultimate goal for salt intake amount has been limited to 3 g per day by 2025.<sup>18</sup> The United States, Canada, and Australia are now a follower of the UK pattern to reduce their salt intake.<sup>47</sup> Turkey, which is one of Iran's neighbors, has begun measures to raise awareness of the society since 2013, which is far from reaching results and formation of a full awareness campaign.<sup>48</sup>

The latest research regarding effective strategies in reducing salt intake showed that most people fail to correctly estimate the concentration and amount of salt consumed.<sup>49</sup> There are also useful experiences in this field. For example, in Beijing, China, plastic spoons with a capacity of 2 g were distributed among 5 million households to help reduce the amount of salt intake and introduce the appropriate amount of salt for daily use, and thus about 15 million people were covered.<sup>34</sup> In practice, to introduce the appropriate amount of salt, everyone should know is the amount of salt contained in one teaspoon or a pinch. These will be effective by holding constant campaigns for all ages, especially students, and development of food product labels as mentioned.

Reducing salt intake requires a comprehensive and long-term planning with participation of all government agencies, the private sector, and industry. The experience of the aforementioned countries has shown that holding regular and accurate informational campaign has an essential role in improving people's awareness and is one of the most important strategies in successful countries.<sup>50</sup>

#### Advocacy strategies

There is an article with the same title which has been published before.<sup>30</sup> In this paper, a summary of the methods for obtaining

support from different sectors, authorities, etc. of the Islamic Republic of Iran has been mentioned generally, so there is no need to repeat it. The experience of successful countries has shown that absence of proper and targeted planning will cause food trade and industry of government to oppose the reduction of the amount of salt in their food products.<sup>51</sup> In order to identify methods to attract support of different sectors of the country, a comprehensive and appropriate model of inclusive support was defined to reduce salt intake in the community. At the first level, it is necessary to identify who plays a key role (mass media, doctors, health personnel, popular people including artists, athletes; school health educators, teachers, kindergarten educators, and health professionals). Attracting the support of policymakers and sensitizing them must be done by explaining the expensiveness of diseases caused by salt overuse. For food producers, the most effective method of attracting their support is through debate and discussion; however, by raising awareness, modifying views and changing public's demand, food manufacturers are forced to produce low-salt food.

#### Recommendation

Reducing the amount of daily salt intake is one of the cheapest and most effective strategies to reduce cardiovascular diseases in the world.<sup>33,52,53</sup> Improving community's awareness by organizing national campaigns as well as, ongoing monitoring and evaluation can play a key role in guiding national programs; it is also recommended to use encouraging policies at the beginning and according to the current situation.<sup>12,32,44,53</sup> Actions that have been carried out in Iran so far have placed our country among the few in the region which have a strategic plan to reduce salt intake.<sup>54</sup>

Finally, a summary of measures that countries should consider regarding the reduction of salt intake is presented below:

- Using SWOT analysis method to identify the current situation is extremely efficient and helpful.
- It is necessary to establish a committee made up of specialists of relevant sectors with necessary and sufficient executive power.
- Development of national and practical policies in the country regarding cultural considerations with a focus on the major sources of salt in the diet is essential.
- Policies to reduce salt consumption should be developed in close association with other related policies in the country.
- Attracting participation of the private sector (salt producers and manufacturers of food products containing salt) is very important and crucial.
- Sustainability of the developed policy is subject to permanent and annual credit and funding of reduction in salt consumption in the country.
- Defined strategies should be based on available resources and facilities.
- Strategies should cover all sectors and groups of society.
- Defined strategies should have no conflict with other developed strategies in other sectors.
- Public campaigns to reduce salt intake should be held and evaluated every year.
- Continuous evaluation and monitoring of the program is necessary.
- In revision and development of food standards, special attention should be paid to reduction of the amount of salt and sodium of food products.
- Developing standards for salt substitutes as a flavoring in the



- production of products for manufacturers is necessary.
- Social marketing is necessary to affect the behavior of consumers in reducing salt intake.
- In countries where salt is enriched with micronutrients, like iodine, reviewing the amount of iodine in salt is necessary when advertising to reduce daily salt intake.

#### Author contributions

HP and ADJ designed the review; searches were carried out by ShR, HP, MA, ADJ, ARD, ZA, and HK; SR and HP wrote the first draft of the paper; HP, ADJ, FF, FS, ZA revised the paper. Final approval was given to the final manuscript by all authors.

#### Funding and sponsorship

This study was supported by the Health Promotion and Education Department, Ministry of Health & Medical Education, Tehran, Iran.

#### Declaration of interest

We have no conflicts of interest to disclose

#### Acknowledgments

The authors would like to thank Dr. Robabeh Sheikholeslam for general support and encouragement and Maryam Chamari for technical help.

#### References

- World Health Organization. *Causes of Death 2008: Data Sources and Methods*. Geneva: World Health Organization; 2011.
- Lim SS, Vos T, Flaxman AD, Danaei G, Shibuya K, Adair-Rohani H, et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet*. 2013; 380(9859): 2224–2260.
- World Health Organization. 2008–2013 Action plan for the global strategy for the prevention and control of noncommunicable diseases: prevent and control cardiovascular diseases, cancers, chronic respiratory diseases and diabetes; 2009.
- He FJ, Li J, MacGregor GA. Effect of longer term modest salt reduction on blood pressure: Cochrane systematic review and meta-analysis of randomised trials. *BMJ*. 2013; 346: f1325.
- Aburto NJ, Ziolkovska A, Hooper L, Elliott P, Cappuccio FP, Meerpohl JJ. Effect of lower sodium intake on health: systematic review and meta-analyses. *BMJ*. 2013; 346: f1326.
- He FJ, MacGregor GA. Salt reduction lowers cardiovascular risk: meta-analysis of outcome trials. *Lancet*. 2011; 378(9789): 380–382.
- Mozaffarian D, Fahimi S, Singh GM, Micha R, Khatibzadeh S, Engell RE, et al. Global sodium consumption and death from cardiovascular causes. *N Engl J Med*. 2014; 371(7): 624–634.
- Haghighatdoost F SN, Khosravi A, Noori F, Boshtam M, Mohammadifard N, et al. Is the association between salt intake and blood pressure mediated by body mass index and central adiposity? *Arch Iran Med*. 2013; 16(3): 167.
- World Health Organization. *WHO Issues New Guidance on Dietary Salt and Potassium*. Geneva: WHO; 2013.
- Naghavi M, Abolhassani F, Pourmalek F, Lakeh M, Jafari N, Vaseghi S, et al. The burden of disease and injury in Iran 2003. *Popul Health Metr*. 2009; 7(1): 9.
- Asgari A, Mirzazadeh M, Heidarian H. Non communicable diseases risk factors surveillance data book for 2007 Tehran: MOH; 2008.
- World Health Organization, WHO. A global brief on hypertension: silent killer, global public health crisis. Women 2015.
- World Health Organization. Reducing salt intake in populations: report of a WHO forum and technical meeting, 5--7 October 2006, Paris, France. Geneva, Switzerland: World Health Organization; 2007.
- Sadler K, Nicholson S, Steer T, Gill V, Bates B, Tipping T, et al. National Diet and Nutrition Survey: assessment of dietary sodium in adults (aged 19 to 64 years) in England, 2011. Department of Health 2012.
- Jackson A. Scientific advisory committee on nutrition, Salt and health. The stationery office, London, UK; 2003.
- Asaria P, Chisholm D, Mathers C, Ezzati M, Beaglehole R. Chronic disease prevention: health effects and financial costs of strategies to reduce salt intake and control tobacco use. *Lancet*. 2007; 370(9604): 2044–2053.
- Bibbins-Domingo K, Chertow GM, Coxson PG, Moran A, Lightwood JM, Pletcher MJ, et al. Projected effect of dietary salt reductions on future cardiovascular disease. *N Engl J Med*. 2010; 362(7): 590–599.
- (NICE) NiHACE. Guidance on the prevention of cardiovascular disease at the population level. Available from: URL: <http://www.guidance.nice.org.uk> (Accessed 2013).
- Taylor RS, Ashton KE, Moxham T, et al. Reduced dietary salt for the prevention of cardiovascular disease: a meta-analysis of randomized controlled trials (Cochrane review). *Am J Hypertension*. 2011; 24(8): 843–853.
- Food Consumption survey in Islamic republic of Iran 2000–2001. Tehran: National Nutrition and Food Technology Research institute (NNFTRI); 2005.
- Rafiei M, Boshtam M, Sarraf-Zadegan N. The relation between salt intake and blood pressure among Iranians. *Kuwait Med J* 2008; 40(3): 191–195.
- Khosravi A, Kelishadi R, Sarrafzadegan N, Boshtam M, Nouri F, Zarfeshani S, et al. Impact of a community-based lifestyle intervention program on blood pressure and salt intake of normotensive adult population in a developing country. *J Res Med Sci*. 2012; 17(3): 235–241.
- Kelishadi R, Gheisari A, Zare N, Farajian S, Shariatinejad K. Salt intake and the association with blood pressure in young Iranian children: first report from the Middle East and North Africa. *Int J Prev Med*. 2013; 4(4): 475–483.
- Fahimi S, Pharoah P. Reducing salt intake in Iran: priorities and challenges. *Arch Iran Med*. 2012; 15(2): 110–112.
- Motlagh Z, Mazloomi S, Mozaffari Khosravi H, Morowatisharifabad M, Askarshahi M. Salt Intake Among Women Refer to Medical Health Centers, Yazd, Iran. *J Shahid Sadoughi Univ Med Sci*. 2011; 19(4): 550–560.
- Azizi F, Rahmani M, Allahverdian S, Hedayati M. Effects of salted food consumption on urinary iodine and thyroid function tests in two provinces in the Islamic Republic of Iran. *East Mediterr Health J*. 2001; 7(1-2): 115–120.
- Rahmani M, Koohkan A, Allahverdian S, Hedayati M, Azizi F. Comparison of dietary iodine intake and Urinary excretion in urban and rural Households of Ilam in 2000. *IJEM*. 2000; 2(1): 31–37.
- Nazeri P, Mirmiran P, Mehrabi Y, Hedayati M, Delshad H, Azizi F. Evaluation of iodine nutritional status in Tehran, Iran: iodine deficiency within iodine sufficiency. *Thyroid*. 2010; 20(12): 1399–1406.
- World Health Organization. Determination of Sodium intake by dietary intake surveys and validation of the methods with 24 hour urine collections in Tehran. Tehran: National Nutrition and Food Technology Research Institute; 2014.
- Mohammadifard N, Fahimi S, Khosravi A, Pouraram H, Sajedinejad S, Pharoah P, et al. Advocacy strategies and action plans for reducing salt intake in Iran. *Arch Iran Med*. 2012; 15(5): 320–324.
- Global Burden of Disease, GBD Profile: IRAN [database online]. Iran; 2010. Available from: URL: <http://www.healthmetricsandevaluation.org>.
- Brinsden HC, He FJ, Jenner KH, Macgregor GA. Surveys of the salt content in UK bread: progress made and further reductions possible. *BMJ Open*. 2013; 3(6): e002936.
- Mason H, Shoaibi A, Ghandour R, O'Flaherty M, Capewell S, Khatib R, et al. A cost effectiveness analysis of salt reduction policies to reduce coronary heart disease in four Eastern Mediterranean countries. *PLoS One*. 2014; 9(1): e84445.
- Xi B, Hao Y, Liu F. Salt reduction strategies in China. *Lancet*. 2014; 383(9923): 1128.
- WHO. Mapping salt reduction initiatives in the WHO European Region. Copenhagen, Denmark; 2013.
- Powles J, Fahimi S, Micha R, Khatibzadeh S, Shi P, Ezzati M, et al. Global, regional and national sodium intakes in 1990 and 2010: a systematic analysis of 24 h urinary sodium excretion and dietary surveys worldwide. *BMJ Open*. 2013; 3(12): e003733.
- Jafari M, Mohammadi M, Ghazizadeh H, Nakhaee N. Feasibility and Outcome of Reducing Salt in Bread: A Community Trial in Southern

- Iran. *Glob J Health Sci*. 2016; 8(12): 163.
38. Hashem KM, Pombo-Rodrigues S, Capewell S. Reducing Sodium in the Global Food Supply to Reduce Population Burden of Cardiovascular Disease. *Curr Cardiovasc Risk Rep*. 2015; 9(3): 1 – 6.
  39. Webster J, Trieu K, Dunford E, Hawkes C. Target salt 2025: a global overview of national programs to encourage the food industry to reduce salt in foods. *Nutrients*. 2014; 6(8): 3274 – 3287.
  40. Europarchive. Effects of reducing salt in processed food on the population's salt intake - the salt model. Available from: URL: <http://food.gov.uk/healthiereating/salt/saltmodel>. ()
  41. Girgis S, Neal B, Prescott J, Prendergast J, Dumbrell S, Turner C, et al. A one-quarter reduction in the salt content of bread can be made without detection. *Eur J Clin Nutr*. 2003; 57(4): 616 – 620.
  42. He FJ, Brinsden HC, Macgregor GA. Salt reduction in the United Kingdom: a successful experiment in public health. *J Hum Hypertens*. 2014; 28(6): 345 – 352.
  43. Food Standard Agency. Traffic light labelling, Signposting. Available from: URL: <http://www.food.gov.uk/foodlabelling/signposting/>.
  44. Ji C, Sykes L, Paul C, Dary O, Legetic B, Campbell NR, et al. Systematic review of studies comparing 24-hour and spot urine collections for estimating population salt intake. *Rev Panam Salud Publica*. 2012; 32(4): 307 – 315.
  45. Consensus Action on Salt and Health. 2012.
  46. Millett C, Lavery AA, Stylianou N, Bibbins-Domingo K, Pape UJ. Impacts of a national strategy to reduce population salt intake in England: serial cross sectional study. *PLoS One*. 2012;7(1): e29836.
  47. He FJ, MacGregor GA. Reducing Population Salt Intake-time for Global Action. *J Clin Hypertens (Greenwich)*. 2015; 17(1): 10 – 13.
  48. WHO. Progress in reducing salt consumption in Turkey. Available from: URL: <http://www.euro.who.int/en/health-topics/disease-prevention/nutrition/news/2013>. (Accessed in 2013).
  49. Newson RS, Elmadfa I, Biro G, Cheng Y, Prakash V, Rust P, et al. Barriers for progress in salt reduction in the general population. An international study. *Appetite*. 2013; 71: 22 – 31.
  50. Cappuccio F, Capewell S. Facts, issues and controversies in salt reduction for the prevention of cardiovascular disease. *Funct Food Rev*. 2015; 7(1): 41 – 61.
  51. MacGregor GA, Sever PS. Salt—overwhelming evidence but still no action: can a consensus be reached with the food industry? *BMJ*. 1996; 312(7041): 1287 – 1289.
  52. Wilcox ML, Mason H, Fouad FM, Rastam S, al Ali R, Page TF, et al. Cost-effectiveness analysis of salt reduction policies to reduce coronary heart disease in Syria, 2010–2020. *Int J Public Health*. 2015; 60(1): 23 – 30.
  53. Wang G, Labarthe D. The cost-effectiveness of interventions designed to reduce sodium intake. *J Hypertens*. 2011; 29(9): 1693 – 1699.
  54. Trieu K, Neal B, Hawkes C, Dunford E, Campbell N, Rodriguez-Fernandez R, et al. Salt reduction initiatives around the world—A systematic review of progress towards the global target. *PLoS one*. 2015; 10(7): e0130247.