Innovative Equipment to Monitor and Control Salt Usage When Cooking: Acceptance of This New Technology to Healthy Eating Promotion

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Abstract. A large number of studies support the concept that high salt intake is the main risk factor in increasing blood pressure and cardiovascular diseases in the population. The main objective of this study is to analyze consumers' preliminary satisfaction questionnaires regarding the use of an innovative prototype equipment to monitor and control salt during cooking – the Salt Control H (SCH) during their participation in one clinical trial. Most of the participants (37.5%) reported that stayed very satisfied with the use of the equipment (overall satisfaction) and 78.1% of participants would like to recommend the SCH to a friend. This acceptance study shows satisfactory results, even though it is a prototype version, to encourage the use of this innovative equipment in order to improve family's tools to healthier cooking.

Keywords: Salt · Technology · Cardiovascular disease prevention

1 Introduction

Non-communicable diseases (NCDs) are the main factor for global morbidity and mortality and have been identified as one of the top ten threats to health in 2019 responsible for over 70% of global deaths (World Health Organization 2019). Approximately 17 million people die annually from cardiovascular disease and about 9.4 millions of these deaths are due to complications of hypertension (Lim et al. 2012; World Health Organization 2011). In Portugal, in 2017, cardiovascular diseases were the main cause of death, 29.4% of people died because of this disease (INE 2019).

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High sodium intake is associated with an increased risk of NCDs, including hypertension and cardiovascular disease. The most common form of sodium consumption is sodium chloride, commonly known as table salt (Institute of Medicine 2005).

A large number of studies support the concept that high salt intake is the main risk factor in increasing blood pressure in the population (Aburto et al. 2013; He and MacGregor 2010). Worldwide, about 70 million disability-adjusted life-years (DALYs) and 3 million deaths in 2017 were attributed to high salt intake, making it one of the top 3 dietary risk factors (GBD 2017 Diet Collaborators 2019). Worldwide, a 10% reduction in salt consumption over 10 years is projected to avoid approximately 5.8 million DALYs per year related to cardiovascular disease (Webb et al. 2017).

Although salt intake varies widely across countries, daily salt intake among adults in most countries is approximately 10g/day (Brown et al. 2009; Powles et al. 2013), which is the double of the World Health Organization (WHO) recommended limit for adults (5 g/day) (World Health Organization 2012a). In Portugal, according to most recent data, daily salt consumption is 7.3 g/day, with intake above the maximum tolerated level reported by 65.5% of the women and 85.9% of the men. The major contribution of sodium in the diet was salt addition (29.2%) (IAN-AF 2017).

The reduction of population salt consumption was identified as one of the five major priority interventions to prevent NCDs and the goal is to reduce world salt consumption to less than 5g per person per day by 2025 (Beaglehole et al. 2011). Indeed, in 2014, 75 countries with national salt reduction strategies were identified. In all regions, consumer education was the most commonly used strategy. Educational interventions provide consumers with information, education, or skills to reduce salt intake changing people's salt-related behavior by strengthening salt knowledge and its effects and adverse abilities to help reduce salt intake (Trieu et al. 2015).

There are different studies reporting educational interventions, with different methodologies such as nutritionists or doctors who educate people about the dangers of consuming salt; lectures about not adding salt to food; web applications focusing on salt reduction through education; provision of a salt-restriction spoon; lifestyle advice through a computer-based lifestyle modification support tool and; cooking classes (Chen et al. 2013; He et al. 2019; Johnson et al. 2017; Trieu et al. 2017).

However, there is no quick and user- friendly instrument to monitor and control salt added to food during the preparation of food at home. This study describes the innovative prototype equipment to monitor and control salt during cooking – the Salt Control H (SCH) (patent number 20191000033265 registered in INPI) and analyze consumers' preliminary satisfaction questionnaires regarding its utilization.

2 Methods

The SCH equipment was used in workers from a public university to reduce dietary salt intake in a randomized clinical trial. A detailed description of the methods used to assess the impact of the SCH equipment has been published previously (Gonçalves et al. 2020).

2.1 Salt Control H - Equipment

The SCH equipment (patent N° 20191000033265) (Gonçalves et al. 2019) consists of a dosing device that provides doses of salt according to the number and age (children or adult) of the person who will consume the meal. The prototype is available only for testing, and not for commercial distribution. The prototype was developed using common product development guidelines, and additive manufacturing was used as a mean to achieve the production of a limited run of 25 prototype sets, to be later used by the test subjects It will be tested by researchers in controlled dietary studies. This prototype system relates to a dosing device that comprises a dosing mechanism that dispenses 0.8 g of salt (for adult) or 0.2 g of salt (for children up to 12 years old) for meals, and 0.2g of salt for every 250 mL of soup for adults or 0.1 g of salt for every 250 mL of soup for children up to 12 years old.

Instructions about the use of Salt Control H equipment to prepare and cook meals were presented to participants through a short video. After watching the video, participants were asked to verbally confirm their understanding of the use of the equipment. If participants had doubts, the researcher reinforces the instructions using practical examples. Monitoring of the correct use of equipment was carried out by a researcher through telephone, email and at visit 2 in order to clarify doubts about its use and to verify compliance with its use.

2.2 Study Population

Our sample of subjects is a subsample of 32 participants from the iMC Salt project, a randomized clinical trial (NCT03974477, ClinicalTrials.gov), which is still ongoing. Participants are university workers who meet the eligibility criteria and are enrolled in occupational health appointments. Our subsample is the participants in the intervention arm who used the SCH equipment and have already completed the intervention period (8 weeks).

2.3 Sociodemographic Data

The sociodemographic data of the participants, age, sex, marital status and education level were evaluated by questionnaire adapted from WHO STEPS instrument (World Health Organization 2012b).

2.4 Satisfaction Data

The satisfaction data was assessed trough questionnaire developed by the researchers. After four weeks using SCH to cook at home, participants were invited to evaluate the

equipment completing the questionnaire composed by the following statements and a five-point Likert scale (from "nothing satisfied" to "totally satisfied"):

- Satisfaction with the use of SCH to control salt during cooking;
- Satisfaction with the taste of meals cooked with SCH;
- Satisfaction with the state of conservation of the SCH materials;
- Satisfaction with the facility of the use of SCH;
- Satisfaction with the promotion of healthy eating habits with SCH;
- Satisfaction with the safety conditions using the SCH;
- Satisfaction with the hygiene conditions using the SCH;
- Global satisfaction with SCH;
- Global satisfaction reported from family and friends with the taste of the meals cooked with the use of the SCH.

Besides these questions, the researchers also ask to participants "Would you recommend SCH to a friend?" (yes/no), and the frequency and whom use the SCH during the time of intervention.

2.5 Ethical Considerations

The project was approved by the Ethics Committee of the Centro Hospitalar Universitário São João.

3 Results

A total of 32 participants were evaluated, with a mean age of 49 years old, 56.3% women, most participants completed higher education (90.6%) and 71.9% were married.

The SCH equipment was used twice a day by 12.5% participants, once a day by 18.8% participants, 4 to 5 times a week by 31.3% participants, 2 to 3 times a week by 31.3% participants and 6.3% of the participants used less than 2 times a week. During the intervention period, 50% of the participants were the ones who always used the SCH equipment, the other options was the wife/husband or the maid, for example.

Most of the participants were very satisfied (46.9%) with the use of the SCH equipment to control salt during cooking and 34.4% of the participants were very satisfied with the taste of the meals cooked with SCH (Table 1).

Most of the participants (37.5%) reported that stayed very satisfied with the use of the equipment (overall satisfaction) and 78.1% of participants would like to recommend the SCH to a friend (Table1).

Table 1. Satisfaction level with salt control H equipment.

Satisfaction issues	Scale	n (%)
Satisfaction with the use of Salt Control H to control salt during cooking	Not at all satisfied	3 (9.4%)
	Not very satisfied	3 (9.4%)
	Satisfied	8 (25.0%)
	Very satisfied	15 (46.9%)
	Totally satisfied	3 (9.4%)
	I don't know/I don't answer	0 (0.0%)
Satisfaction with the taste of meals cooked with Salt Control H	Not at all satisfied	0 (0.0%)
	Not very satisfied	6 (18.8%)
	Satisfied	11 (34.4%)
	Very satisfied	11 (34.4%)
	Totally satisfied	3 (9.4%)
	I don't know/I don't answer	1 (3.1%)
Satisfaction with the state of conservation of the Salt Control H materials	Not at all satisfied	2 (6.3#)
	Not very satisfied	3 (9.4%)
	Satisfied	14 (43.8%)
	Very satisfied	3 (9.4%)
	Totally satisfied	10 (31.3%)
	I don't know/I don't answer	0 (0.0%)
Satisfaction with the ease of use of Salt Control H	Not at all satisfied	5 (15.6%)
	Not very satisfied	2 (6.3%)
	Satisfied	6 (18.8%)
	Very satisfied	11 (34.4%)
	Totally satisfied	8 (25.0%)
	I don't know/I don't answer	0 (0.0%)
Satisfaction with the promotion of healthy eating habits with Salt Control H	Not at all satisfied	1 (3.1%)
	Not very satisfied	0 (0.0%)
	Satisfied	2 (6.3%)
	Very satisfied	18 (56.3%)
	Totally satisfied	11 (34.4%)

(*continued*)

Table 1. (*continued*)

Satisfaction issues	Scale	n (%)
	I don't know/I don't answer	0 (0.0%)
Satisfaction with Salt Control H safety conditions	Not at all satisfied	0 (0.0%)
	Not very satisfied	2 (6.3%)
	Satisfied	7 (21.9%
	Very satisfied	9 (28.1%)
	Totally satisfied	13 (40.6%)
	I don't know/I don't answer	1 (3.1%)
Satisfaction with the hygiene conditions of Salt Control H	Not at all satisfied	0 (0.0%)
	Not very satisfied	2 (6.3%)
	Satisfied	3 (9.4%)
	Very satisfied	13 (40.6%)
	Totally satisfied	13 (40.6%)
	I don't know/I don't answer	1 (3.1%)
Global satisfaction with Salt Control H	Not at all satisfied	3 (9.4%)
	Not very satisfied	5 (15.6%)
	Satisfied	6 (18.8%)
	Very satisfied	11 (34.4%)
	Totally satisfied	7 (21.9%)
	I don't know/I don't answer	0 (0.0%)
Global satisfaction reported from family and friends with the taste of the meals cooked with the use of the equipment Salt Control H	Not at all satisfied	0 (0.0%)
	Not very satisfied	9 (28.1%)
	Satisfied	8 (25.0%)
	Very satisfied	12 (37.5%)
	Totally satisfied	2 (6.3%)
	Not applicable	1 (3.1%)

4 Discussion and Conclusion

SCH is an innovative equipment that does not exist on the market and can be part of the solution to reduce salt consumption by the population, one of the five main priority interventions to prevent NCDs. All around the world, the recommendation for the population is to reduce the consumption of salt, however it's difficult to understand what the ideal amount should be added when cooking food. SCH makes this for us, helping to consume the recommended amount of salt.

These results are collected during the first stages of one randomizated controlled trial (RCT) and allow the researchers to identify and perform some minor improvements

to the equipment, for example improve the dynamics of the dosing buttons to make the dispensing of salt more fluid. The results of this study should be interpreted carefully since the sample is small and very literate.

The RCT is still ongoing, so we haven't yet conclusions about the effectiveness in reducing salt consumption with SCH, however, previous studies of community intervention using spoons to restrict salt intake have shown encouraging effects (Chen et al. 2013).

This acceptance study shows satisfactory results, even though it is a prototype version, to encourage the use of this innovative equipment in order to improve family's tools to healthier cooking.

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