

# Knowledge, Attitudes, Practices, and Perceptions for Salt/Sodium Reduction in the Gastronomic Sector of Costa Rica

Hilda P. Núñez-Rivas<sup>1\*</sup>, Marlene Roselló-Araya<sup>1</sup>, Adriana Blanco-Metzler<sup>1</sup>, Benavides-Aguilar Karla<sup>2</sup>, Karol Madriz-Morales<sup>3</sup>

<sup>1</sup>Unit of Health and Nutrition of the Costa Rican Institute of Research and Education on Nutrition and Health (INCIENSA), Cartago, Costa Rica

<sup>2</sup>Independent Researcher, Cartago, Costa Rica

<sup>3</sup>Directorate of Research and Health Technologies, Ministry of Health, San José, Costa Rica

Email: \*hnunez@inciensa.sa.cr, mrosello@inciensa.sa.cr, ablanco@inciensa.sa.cr, karla@crealimentos.com, karol.madriz@misalud.go.cr

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## Abstract

Excess sodium intake is associated with high blood pressure and cardiovascular diseases. This study examined food services in Costa Rica as a major source of sodium. The research included six cafeterias, six fast food establishments, 13 restaurants, and 15 diners using non-probabilistic convenience sampling. Interviews were conducted with workers to assess knowledge, attitudes, and practices regarding salt reduction. The findings were analyzed to determine effective intervention strategies. Participants showed regular knowledge about salt/sodium. While they recognized the link with high blood pressure, understanding of other health problems was limited. Positive attitudes were observed toward healthy cooking and reducing sodium in pre-prepared food, especially in restaurants. Over 70% expressed a desire to reduce salt in food services, with more than 80% indicating a need for staff training, particularly in cafeterias lacking knowledge of low-salt preparations. High-sodium ingredients were prevalent, with saltshakers and sauces readily available. However, some individuals were reluctant to reduce salt/sodium intake, citing concerns about taste, food variety, and customer complaints. Obstacles to reducing salt/sodium levels included limited accessibility and the cost of low-sodium ingredients. The data collection tools and methodologies used in this study can serve as a foundation for future investigations and strategies to reduce salt consumption in food services. The study recommends government support for transforming the gastronomic sector and implementing regulations and knowledge enhancement. Collaboration with the productive sector is crucial for creating healthy environments. This research presents valuable

evidence regarding the utilization of salt and sodium in the gastronomic sector, thereby assisting in the decision-making process for public health initiatives and the prevention of non-communicable chronic diseases. It highlights the significance of tackling sodium reduction in food services to encourage the adoption of healthy culinary practices and enhance the overall health of the population.

## Keywords

Salt, Sodium, Gastronomic Sector, Food Environment, Knowledge, Attitudes, Practices, Perceptions, Non-Communicable Chronic Diseases

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## 1. Introduction

Common salt, scientifically known as sodium chloride (NaCl), is a chemical compound resulting from the combination of sodium and chlorine. This compound serves as a culinary ingredient, predominantly utilized to enhance the flavor of diverse food preparations. In contrast, sodium is an elemental substance inherently present in salt and various consumables, whether occurring naturally or intentionally added as a food additive. Its indispensability stems from its fundamental role in preserving fluid balance and facilitating the optimal functionality of neural and muscular processes. Nonetheless, it is crucial to acknowledge that excessive sodium consumption can potentially give rise to detrimental implications on overall health and well-being [1] [2].

Sodium consumption in excess is the primary risk factor for high blood pressure (HBP) and non-communicable chronic diseases (NCCD), which are the leading causes of death worldwide. One of the main initiatives aimed at preventing and controlling these diseases is the reduction of excessive salt intake. Dietary recommendations advocate for the restriction of sodium intake to less than 2300 mg per day or 5 grams of salt, and even less than 1500 mg for individuals with conditions such as BPH or a heightened risk of NCCD [2]. This measure is recognized as a cost-effective strategy (Best-buys) [3] [4]. In Costa Rica, the prevalence of HBP in the population aged 18 and above is 37.2% [5], and the sodium intake exceeds the maximum international recommendation [6] [7] [8].

The food environment (FE) is a crucial factor in reducing sodium/salt content, as it either facilitates or hinders the choice of healthy foods [9] [10]. In the gastronomic sector food services (FS) are influenced by cultural, ideological, economic, social, and nutritional factors, among others, which create scenarios that impact food decision-making, dietary intake, and consequently, the nutritional status and health of consumers [10].

This is why international organizations such as the World Health Organization (WHO) address out-of-home eating as an environmental determinant of health [11] [12] [13]. In Costa Rica, the main sources of sodium are “processed

culinary ingredients” (salt and condiments) and “ultra-processed foods and beverages” [6] [7] [8].

The food services (FS) have the potential to promote unhealthy eating behaviors by offering drinks and meals made prepared with these ingredients. A study was conducted to determine the sodium content in meals offered by seven fast food chains that are commonly visited by Costa Rican families. Only one national chain provided nutritional information, while the others displayed information based on menus prepared in the United States of America (USA), Canada, and Europe. A direct correlation between caloric intake and sodium content was found, with significant variability [14].

In terms of street foods (86%), such as “enyucado” (it is a traditional Costa Rican dish that combines the flavors of annatto with mandioca. It is typically filled with cheese or meat, like a croquette) with cheese; meat patty, known as “empanada de carne”; and “pupusa” (an El Salvadorean snack of a corn tortilla stuffed with cheese and fillings), and 50% of fast foods (fried chicken, mixed nachos, and cheeseburgers), a moderate sodium content was reported. However, there was considerable variability in sodium content among the same type of food sold in different establishments [14]. More than half of artisanal foods (57%) were found to have high sodium content, with notable examples including salty bread with cheese, tortillas with cheese, stuffed sweet bread, and hamburgers, according to the United Kingdom Traffic Light Nutrition Profile [15]. This represents a challenge in promoting healthy, low sodium eating practices in the gastronomic sector.

Due to the health crisis caused by the global COVID-19 pandemic, there have been observed changes in food consumption habits among populations [16] [17]. Consequently, the nutritional quality of diets has been impacted. People have altered their food purchasing patterns, opting for express or delivery meals and showing a preference for products with extended shelf life and pre-packaged options due to concerns about “safety,” food safety, and convenience [18] [19] [20] [21] [22]. Some of these food products are accessible but have an unfavorable nutritional profile [23], with excessive amounts of critical nutrients such as sodium, sugars, and fats, which are associated with the development of non-communicable chronic diseases (N-CCD) (high blood pressure, diabetes, and obesity), known risk factors for COVID-19 morbidity and mortality, as they increase the likelihood of infection and its severity [24]-[29].

Considering the scientific evidence, the epidemiological profile of the population in Costa Rica, as well as the environmental factors in food services (FS) that influence dietary behavior, it was deemed necessary to explore the knowledge, attitudes, and practices (KAP) and perceptions of owners, managers, and cooks in FS regarding the use of discretionary salt and high-sodium products in food preparation. The aim is to propose strategies to reduce the excessive use and consumption of salt/sodium in FS, which is expected to have a positive impact on the health of customers [30] [31] [32]. The proposed strategies described in this paper are part of the grant titled “Reduction of Discretionary Salt Consump-

tion in Costa Rica,” led by Dr. Adriana Blanco-Metzler from INCIENSA and funded by the LINKS Program, Resolve to Save Lives [33].

## 2. Methodology

This study is exploratory, cross-sectional, and observational conducted from a quantitative perspective. The fieldwork was conducted between November 2021 and July 2022, and was approved by the Scientific Ethics Committee of INCIENSA (code IC-2021-01).

The study was carried-out in restaurants, fast food establishments, cafeterias, and canteens (known in Costa Rica as “sodas”) of certain cantons of the provinces of Cartago and San José, Costa Rica. In Costa Rica, the concept of “sodas” is defined in Executive Decree No. 36910-MEP-S, which outlines the regulations for the operation and administration of the soda service in public educational centers (2012) [34]. A non-probabilistic convenience sampling method was used, stratified according to the category of food services (FS) with proportional allocation based on the quantity of each category.

In this research the concept of a “restaurant” refers to a FS that offers table service, banquet, buffet, take-out, or delivery. It has kitchen areas, dining rooms, bar service, as well as places where food and beverages are prepared, sold, and served to customers for consumption in various ways, including a la carte dishes and menus [35]. A “Fast food establishment” was defined as a FS where customers typically choose, order, and pay before eating. It provides fast service, practical and affordable meals. The menu is limited, highly standardized, and often includes images of food. Franchises or chains are the most common mode of expansion in this type of FS [36].

The concept of a “cafeteria” refers to an informal FS where meals and beverages are prepared, sold, and served to customers for consumption in a fast and agile manner. It is characterized by having waiter service or self-service, where only plate retrieval and table cleaning services are provided. The offerings often include pastries, sandwiches, salads, snacks, bread, cookies, sweet and savory pastries. Emphasis is placed on coffee and other beverages such as tea, fruit juices, soft drinks, and alcoholic beverages are not included [36].

The “canteen” in Costa Rica consists of a FS that offers popular and informal food (natural juices, smoothies, hot drinks, tacos, empanadas, sandwiches, and daily specials, among others) where they are handled, stored, and prepare the food. These are sold and served conveniently, in a quick service style and in a relaxed atmosphere. Traditionally they have represented the gastronomy of the communities where they operate according to their tastes and preferences, since this is usually their main target market [34].

From the sampling frame (1130 FS) of the Ministry of Health’s Establishment Registry database, 40 FS were conveniently selected, and distributed proportionally to the number of FS, according to category in each province. The selection of FS considered those with a daily clientele of 15 or more, preferably with

branches in the central canton of the participating provinces, possessing a current health operating permit from the Ministry of Health, having a permanent structure (*i.e.*, excluding food trucks or other mobile locations), and exclusively providing food service (establishments offering other services such as bars, lodging, dancing, supermarkets were excluded). The final study sample consisted of six cafeterias, six fast-food establishments, 13 restaurants, and 15 canteens.

Inclusion criteria for the subjects, owners and/or administrators, and cooks of the FS, was they were able to read and had access the computer, cellphone, and internet.

This study consisted of four phases. Phase 1 involved the administration of two semi-structured questionnaires to owners and/or administrators and cooks of restaurants, fast-food establishments, canteens, and cafeterias. These questionnaires consisted of closed-ended questions with a five-point Likert scale response options (ranging from strongly disagree to strongly agree) and multiple-choice and open-ended questions.

A validation of the consistency of the questionnaire was conducted using correlation analysis, and the following statistical tests were employed to correlate categorical and continuous variables. The polychoric test was used to correlate categorical variables with more than two categories [37]. The poliserial test was employed to correlate a continuous variable with one having more than two categories (multiple options) [38]. The Spearman correlation coefficient was used to correlate two continuous variables [39]. A significance level of  $p < 0.05$  was established. This analysis allowed for the evaluation of the reliability and coherence of the questionnaires used.

With the first questionnaire, we explored the knowledge, attitudes, and practices (KAP) and perceptions of the participants regarding strategies to reduce the excessive use and consumption of salt/sodium that are being implemented in their FS, as well as potential future strategies, considering the perceived benefits and barriers.

The second questionnaire consisted of closed and open-ended questions, as well as an observation guide of the environmental factors in the FS that could either facilitate or hinder the reduction of excessive salt/sodium use and consumption. Average KAP and perception scores were calculated for the participants in each of the four FS categories studied.

Based on the results from Phase 1, we proceeded to Phase 2, which involved identifying problems related to KAP, perceptions, and strategies for reducing the excessive use and consumption of salt/sodium. These problems were subsequently prioritized based on their frequency of occurrence.

Concurrently with this prioritization, Phase 3 was carried out, which focused on reviewing scientific literature and international guidelines on salt/sodium reduction strategies in the gastronomic sector. The research team identified intervention strategies that were consistent with the areas outlined in the SHAKE guide [40].

Finally, for Phase 4, a national group of experts was formed, consisting of

eight government officials, academics, and independent individuals with expertise in nutrition, public health, and food services. The purpose of this phase was to validate and prioritize the strategies. According to the criteria of importance (need, impact, and equity) [41] [42] and affordability (feasibility, acceptability, cost, and efficiency) [43] were taken into consideration. The technical contents of the strategies that should be addressed, modified, or omitted were validated.

### 3. Results

#### 3.1. Characteristics of the Food Environment in the Participating Food Services

A total of 40 food services participated, including fifteen canteen, thirteen restaurants, six cafeterias, and six fast food establishments; 78% operate independently and the remaining are part of a chain. On average, they have a capacity of  $45 \pm 31$  people. During weekdays, the majority (27.5%) have a visitation of fewer than 30 people/day; however, on weekends, 30% serve more than 90 customers/diners per day. These averages may be underestimated as part of this study was conducted during the COVID-19 pandemic.

A à la carte service is offered in 65% of the food services, with cafeterias having 100% implementation, followed by counter service (37.5%), with canteen being the ones that mostly use this system (60%). Out of the 40 food establishments, 28 (70%) have express food service, and among these, 22 are affiliated with online ordering platforms such as Uber Eats or Didi, representing 55% of the total sample. The menu booklet of FS is mostly in print form (67.6%), and it is placed on the tables of the establishment (60%), although a significant proportion also uses digital means such as QR codes (35%).

Regarding the availability of products, such as saltshakers, sauces, condiments, pickles, among others, for the customers/diners, most of them are not available on the customers' tables; others are accessible on auxiliary tables or provided by the waiters or servers. In 77.5% of the FS, saltshakers are available, with canteen standing out as their availability reaches up to 93.3%.

#### 3.2. General Characteristics of the Study Population and Indices of Knowledge, Attitudes, Practices, and Perceptions Were Analyzed

A total of 57 owners and/or managers and cooks from 40 food services located in Cartago and San José participated in the study, with 27 (47.4%) being owners and/or managers, 17 being cooks, and 13 fulfilling the roles of owner/manager/cook. More than half of the participants were women (54.4%). The age ranged from 20 to 69, with an average of  $42 \pm 11$  years, with the canteen staff being the oldest. In terms of education, 45.6% had a university degree or even postgraduate qualifications (data not shown). It is worth noting that 19.3% ( $n = 11$ ) of the participants reported having HBP, and 24.6% reported obesity.

The average indices of KAP, and perceptions of the participants according to the four categories of food services studied are presented in **Table 1**.

**Table 1.** Index of knowledge, attitudes, practices, and perceptions of the participants, according to food services. Costa Rica, 2022.

Variable Average $\pm$ DE	Food service				Total
	Cafeteria (n = 10)	Fast-food establishment (n = 7)	Restaurant (n = 21)	Canteen (n = 19)	
Index of knowledge	0.8071 $\pm$ 0.1390	0.7449 $\pm$ 0.1589	0.8163 $\pm$ 0.1096	0.7820 $\pm$ 0.0966	0.7945 $\pm$ 0.1169
Index of attitudes	0.8820 $\pm$ 0.0881	0.7743 $\pm$ 0.1365	0.8314 $\pm$ 0.0898	0.8284 $\pm$ 0.1552	0.8323 $\pm$ 0.1214
Index of practices	0.6880 $\pm$ 0.0607	0.6200 $\pm$ 0.1133	0.6005 $\pm$ 0.0973	0.6095 $\pm$ 0.0780	0.6212 $\pm$ 0.0911
Index of perceptions	0.7467 $\pm$ 0.1559	0.6548 $\pm$ 0.1486	0.7349 $\pm$ 0.0823	0.6851 $\pm$ 0.1392	0.7105 $\pm$ 0.1264
Global rate of use of salt and high-sodium products	0.7810 $\pm$ 0.08314	0.6985 $\pm$ 0.08709	0.7458 $\pm$ 0.05956	0.7262 $\pm$ 0.0901	0.7396 $\pm$ 0.07996

### 3.3. Knowledge Related to the Reduction of Excessive Salt/Sodium Use and Consumption in Food Services

Overall, the participants' knowledge is adequate (**Table 1**). The lowest index is 0.75, represented by the staff of fast-food establishments. Almost all participants are aware that excessive salt/sodium consumption is associated with HBP (97%); a little over half (56%) associate excessive salt/sodium consumption with heart problems and fluid retention, and around 85% are unaware that excessive salt/sodium consumption is associated with stroke, osteoporosis, and asthma.

Less than a quarter stated that they are unaware that five grams or less of salt is the recommended daily amount for an adult. It is noteworthy that 94.7% of the canteen staff did not know this. Similarly, 19.3% are unaware of the recommended daily salt intake, with 50% of cafeteria staff being unaware.

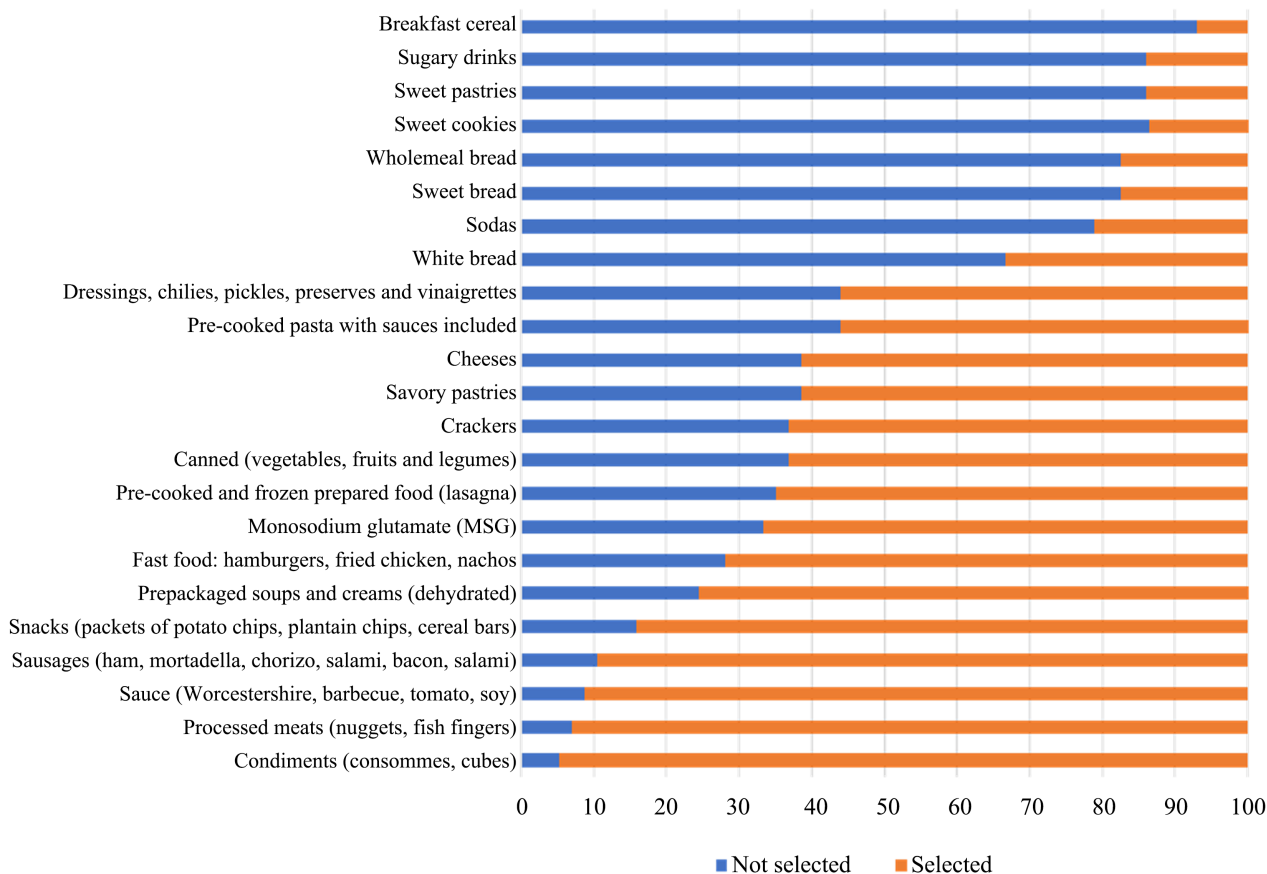
It was found that 40% are unaware that there is a difference between salt and sodium, with canteen staff (11/19) being unclear about this concept. When asked about what sodium is, it was found that 100% are unaware that sodium is a chemical element, a mineral, an electrolyte, and a component of table salt. Just under half (47%) are unaware that salt is the main source of sodium in the Costa Rican diet.

When assessing knowledge about which foods or ingredients have a high salt/sodium content, the majority (95%) correctly selected condiments with added sodium, processed and pre-formed meats, sauces, and sausages. However, over 66% did not identify those foods such as savory and sweet pastries, breakfast cereals, sweet biscuits, white and whole wheat bread, as well as carbonated and sugary drinks, are products with a high salt/sodium content (**Figure 1**).

### 3.4. Attitudes Regarding the Reduction of Excessive Salt/Sodium Use and Consumption in Food Services

Overall, favorable results are observed (index  $0.8323 \pm 0.1214$ , **Table 1**) from all food services, with restaurants showing the highest index.





**Figure 1.** Knowledge of the study population regarding foods or ingredients high in salt/sodium content. Costa Rica, 2022.

Among the positive attitudes, 100% of participants reported healthy cooking, and 82.5% try to reduce the use of pre-prepared food, such as pre-cooked and/or frozen items (bread, pastries, among others), with restaurants leading the way (90%), followed by fast food establishments and canteen, and lastly, cafeterias (80.0%). Over 70% reported trying to reduce the amount of salt and the use of products or ingredients with high sodium content in the food and beverages offered in their food services. More than 80% expressed interest in having the staff of their food service receive training about healthier culinary techniques, with cafeterias showing the highest level of interest (90%), followed by restaurants and canteen, and fast-food establishments showing less interest (42.9%).

On the other hand, among the negative attitudes, was found that 45.6% of participants are not interested in reviewing nutritional information to select low-sodium products, and this proportion increases to 57.1% in restaurants. Nearly 30% reported that the quantity of salt or high-sodium products added to their food preparations is not measured in their food services. Regarding the attitude towards purchasing low-sodium foods, 70.2% of food service staff expressed an interest in starting to do so in the short term. **Table 2** shows the proportions of participants who fully agree or agree with each of the examined attitudes.



**Table 2.** Attitudes of participants favoring the reduction of salt use and high-sodium products in food services. Costa Rica, 2022.

Participants' attitudes	Proportion who strongly agree or agree (%)
Willingness to receive training to reduce the use of salt and high-sodium products in food preparation	80.6
Interested in reducing the amount of discretionary salt	77.2
Willing to implement strategies to reduce the use of salt and high-sodium products	77.2
Willing to purchase and use low-sodium products	70.2
Interested in measuring the amount of salt added to preparations	70.1
Interested in reducing the use of ingredients or products with high sodium content	68.4
Interested in reviewing nutritional information to select low-sodium products	54.4

### 3.5. Practices Related to the Reduction of Excessive Salt/Sodium Use and Consumption in Food Services

Three-quarters of the study population reported that cooks do not receive training on methods of preparing low-salt and low-sodium foods and beverages. Almost all participants do not use salt substitutes for cooking, while over 70% reported using ingredients with high sodium content, such as sauces (Worcestershire-Lizano®, barbecue, tomato, Chinese, soy, and others), processed meats, cheeses, white bread, condiments and bouillon cubes, dressings, and chili sauces. Additionally, over half place saltshakers, sauces, and dressings on the tables for customers or diners.

More than 60% do not review nutritional information to select ingredients or products with low salt/sodium content, with restaurants showing the least interest (76.2%). Approximately 60% do not purchase ingredients with low salt/sodium content; however, they use herbs, spices, and citrus juices. Just around one-third use canned vegetables and fruits because they prefer fresh ones. They also use other types of salt besides discretionary table salt, such as sea salt. Almost one-quarter of the participants add salt to ready-to-serve preparations, and only 20% measure the amount used in food preparation. **Table 3** shows the main practices of the 40 examined food services.

### 3.6. Perceptions Related to the Reduction of Excessive Salt/Sodium Use and Consumption in Food Services

Regarding the perceptions to reduce the use of salt and high-sodium products, 82.5% of the staff in the 40 food services perceive that the amount of salt they use in preparations is adequate, while 15.8% perceive that the amount they use is very little. In other words, in 98.3% of the food services, it is perceived that they are using an “adequate” or “low” amount of salt.

**Table 3.** Practices related to the use of salt and high-sodium products in food services. Costa Rica, 2022.

Practices	Proportion who strongly agree or agree (%)
Adds salt to food during its preparation	82.2
Adds salt to ready-to-serve preparations	22.8
Adds ingredients with high sodium content to ready-to-serve preparations	19.3
<b>Uses ingredients with high sodium content</b>	
Sauces and dressings	93.0
Processed meats	93.0
Cheeses	89.5
Condiments and bouillon cubes	77.2
Dressings and chili sauces	71.9
Places saltshakers, sauces, dressings, etc., on tables for customers to use	52.6
Prepares low-sodium food and beverages	68.4
Uses salt substitutes	7.0
Reviews nutritional information to select low-sodium products	35.0
Measures the amount of salt added to preparations	80.7
Measures the amount of ingredients with high sodium content added to preparations	79.0
Provides training to cooks to reduce the amount of salt/sodium	22.8
<b>Uses other types of salt besides regular table salt</b>	
Sea salt	31.6
Pink salt	24.6
Himalayansalt	14.0

More than half (52.6%) of the staff in the 40 food services perceive it as difficult to understand the sodium content of nutritional labeling, with the staff in fast food establishments being who perceive it the most (71.4%). Additionally, the participants perceive that discretionary salt is healthier than other types of salt (59.7%), and 63.1% of the services that adding salt to food makes them tastier.

On the other hand, 54% perceive that reducing the amount of salt in the menu preparations could improve the image of the food services and would not affect sales due to the pressure from the gastronomic sector to offer healthy food and beverages to customers. **Table 4** shows the proportion of participants' responses that fully agree or agree with each of the examined perceptions.

**Table 4.** Perceptions related to the use of salt and high-sodium products in food services. Costa Rica, 2022.

Perceptions	Proportion who strongly agree or agree (%)
Could acquire the knowledge to reduce the quantity of salt/sodium in preparations through culinary training.	85.8
The health of customers would improve if the use of salt is reduced.	84.2
The amount of salt used in the food service preparations is adequate.	82.5
Salt is added to food to enhance its flavor.	63.1
Reducing the amount of salt in the menu could improve the image of the food service.	56.1
Reducing salt in preparations would not negatively impact sales.	54.4
There is pressure from the gastronomic sector to offer healthy food and beverages to customers.	52.6
The nutritional information on food labels is easy to understand.	47.4
Customers would choose options from the menu that are identified as low in salt/sodium.	43.8
Table salt is less healthy than other types of salt.	40.3

### 3.6.1. Perceptions regarding the Benefits Related to the Reduction of Excessive Salt/Sodium Use and Consumption in Food Services

Among the benefits that are less perceived are those related to taste and variety, followed by the health benefit. For example, one-fifth of all participants do not perceive the improvement in the overall health of customers, as well as those with specific needs, as a benefit if the use of salt and high-sodium products is reduced. Among them, more than 50% of fast-food establishments do not consider it as a benefit.

### 3.6.2. Perceptions regarding Barriers Related to the Reduction of Excessive Salt/Sodium Use and Consumption in Food Services

More than a third of owners/administrators and cooks perceive that no benefits would be obtained if the use of salt and high-sodium products were reduced in the preparations they offer to their customers in food services. Among the barriers that are most perceived as such, those related to taste and variety are the most prominent, followed by health effects. For example, one-fifth of all participants do not believe that reducing the use of salt and high-sodium products would improve the health of customers in general and those with specific needs, especially in fast food establishments.

More than half of the participants consider that there are barriers to food ser-

vices to reduce the use of salt and high-sodium products. One of the major barriers is the fear of receiving complaints from customers because they do not like reduced salt/sodium food offerings (e.g., saltshakers, chili sauces, condiments).

On the other hand, 61.4% of the participants indicate that they have limited knowledge and skills to prepare low-salt/sodium food and beverages; 59.6% state that there is limited availability of low-sodium ingredients or products in the market, and 52.6% believe that these ingredients are expensive, which would increase the price of the preparations for customers. In addition to these barriers, 28.5% consider that more time and effort would be required to prepare low salt/sodium food.

### **3.7. Actions Related to the Reduction of Excessive Salt/Sodium Use and Consumption in Food Services**

Among the actions that over 68% of the participants indicate as possible to implement in the near future are: 1) training addressed to cooks (and owners when they are the cooks) on methods of preparing low-salt and low-sodium foods and beverages, 2) use of salt substitutes and low-sodium products, 3) inclusion of information on the salt and sodium content of preparations in the menu booklet, and 4) use of stickers on the menu booklet to highlight low-sodium preparations.

## **4. Discussion**

To the best of our knowledge, this scientific article represents a pioneering endeavor in comprehensively examining the KAP as well as the perceptions of owners, managers, and cooks of FS regarding the utilization of discretionary salt and products with high sodium in food preparation. Our study sheds light on an important aspect of the gastronomic sector that has thus far been relatively unexplored.

In general, our findings reveal that within food environment from the FS, food preparations and products with lower sodium content were less readily available compared to those with higher sodium content. This prevailing pattern was observed during a food supply study conducted in Guam (an unincorporated territory of the USA situated in the western Pacific Ocean). These results mean the need for concerted efforts to address the prevalence of high-sodium offerings within the gastronomic sector.

By contributing new insights through this research, we hope to encourage further investigation and promote initiatives that foster a gastronomic offer with healthier food choices within the FS establishments. It is our belief that these endeavors can have a positive impact on public health and can contribute to the overall well-being of individuals in Guam, Costa Rica, and beyond [44]. Similarly, findings from a study conducted in Philadelphia involving Chinese takeout restaurant owners and chefs [45] align closely with our own research, demonstrating that a significant proportion of the owners/managers and cooks in the FS sector possess a regular level of knowledge ( $0.7396 \pm 0.07996$ ) regarding the

adverse effects of excessive salt/sodium consumption on HBP. They understand high-sodium foods and ingredients include condiments with added sodium, processed meats, preformed meats, sauces, and sausages.

This regular level of knowledge may be attributed to the health promotion and NCCD prevention strategies implemented by the Costa Rican health sector over the past decade [46]. Furthermore, it is worth noting that some individuals in this group have personal experiences with sodium-related health conditions, with approximately one-fifth reporting HBP and one-quarter reporting obesity.

These findings underscore the effectiveness of ongoing efforts to raise awareness and educate individuals within the gastronomic sector about the risks associated with sodium consumption. They also highlight the potential for continued progress in promoting healthier practices and preventing NCCD in Costa Rica.

On the contrary, our study reveals that a smaller proportion of participants demonstrate awareness of other health implications associated with excessive salt/sodium consumption, such as cardiovascular issues and fluid retention. They do not recognize that products like salty and sweet pastries, breakfast cereals, sweet cookies, white and whole wheat bread, as well as soft drinks and sugary beverages, can contain high levels of salt/sodium. Moreover, they lack knowledge about the distinction between salt and sodium, particularly among staff in canteens, and are unaware that salt serves as the primary source of sodium in the Costa Rican diet. These findings align with previous research [45], which indicates that many owners and chefs exhibit limited awareness of additional health effects and major sources of sodium in the American diet.

It is noteworthy that many participants possess limited knowledge regarding other health consequences stemming from excessive salt/sodium intake, such as cerebrovascular diseases, osteoporosis, and asthma. They are unfamiliar with the definition of sodium and its inclusion in discretionary salt. Furthermore, they are unaware of the recommended daily intake of salt for adults. Notably, this lack of awareness is more prevalent among participants working in canteens, potentially due to lower levels of education (data not shown) [47] [48] in comparison to those working in restaurants, cafeterias, and fast-food establishments.

These findings underscore the importance of addressing knowledge gaps and enhancing awareness among participants in the food service industry. It is crucial to provide education and information regarding the various health effects of excessive salt/sodium consumption, as well as the sources and recommended daily limits of sodium intake. By increasing knowledge in these areas, we can facilitate the adoption of healthier practices and contribute to the overall well-being of individuals.

Attitudes were examined to assess the receptiveness of food service owners/managers and cooks towards adopting healthier cooking practices by reducing the use of salt and high-sodium products. Consistent with the findings of the study conducted by Ma GX *et al.* (2014) [45], our research also reveals encouraging results in terms of attitudes. Many owners/chefs expressed a positive outlook regarding the reduction of sodium in their meals if customer preferences

were still met. Moreover, they expressed a desire for training in areas such as food preparation, sourcing, and marketing.

These findings highlight the willingness of food service staff to embrace healthier cooking practices and adapt to meet the needs and preferences of their customers. The positive attitudes observed suggest that there is potential for successful implementation of strategies aimed at reducing sodium content in meals. Furthermore, the expressed interest in further training indicates a proactive approach toward enhancing skills and knowledge to meet the evolving demands of the industry and the population, too.

The global attitude index ( $0.8323 \pm 0.1214$ ) is the highest among all indices examined in this study and indicates that restaurant staff show the greatest willingness to implement changes. In contrast, those working in fast food establishments show lower levels of interest in receiving training to improve their knowledge and address deficiencies identified within these establishments. They also demonstrate reluctance to transform risky recipes and practices into healthier alternatives, which would imply reducing the use of salt and high-sodium ingredients or products and at the same time increasing the incorporation of herbs, spices, and natural seasonings in the food preparations offered by establishments of fast food.

The negative attitude towards training is significant because the global knowledge index of the participants in our study falls below 80% ( $0.7945 \pm 0.1169$ ). This lack of knowledge likely contributes to poor practices in reducing the risk associated with salt/sodium in the food supply within FS. Furthermore, the overall rate of practices ( $0.6212 \pm 0.0911$ ) among our study participants is the lowest among all indices examined, with restaurant and “canteen” workers being the main contributors to practices that promote consumption of salt/sodium in excess within FS.

These findings highlight the necessity for targeted interventions and educational programs aimed at enhancing the KAP within food services. By proactively addressing these gaps, we can foster a positive shift towards healthier culinary practices, including the implementation of culinary techniques to lower sodium levels in menu offerings. Moreover, establishing an environment within food services that facilitates informed food choices, such as embracing the use of herbs and spices for flavoring or eliminating saltshakers from tables, can effectively bolster a healthier gastronomic atmosphere. Ultimately, these endeavors strive to contribute significantly to the reduction of salt and sodium consumption among the general population.

Most participants in this study, as well as in previous studies with cooks or chefs [45], have indicated that they have not received formal culinary training focused specifically on the preparation of foods and beverages with reduced salt and sodium content. Therefore, it is not surprising that their current practices are not aligned with recommended guidelines. For example, they do not use salt substitutes during cooking but continue to incorporate high-sodium ingredients into their dishes, which they then serve to their customers. Furthermore, they do

not prioritize reviewing nutritional information to select products with lower salt/sodium content, with restaurant staff showing the least interest in changing this approach.

One possible explanation for the resistance to change observed is their perception that the nutritional information provided on food labels, particularly in fast-food establishments, is difficult to understand. This perception may contribute to their reluctance to make necessary adjustments to their practices.

These findings emphasize the immediate need for specific culinary training programs to provide cooks and chefs with the knowledge and skills necessary to prepare foods with lower salt and sodium content. Additionally, the belief that sea and Himalayan salt, among other varieties, is healthier than regular or discretionary salt must be reversed, as well as the understanding and accessibility of nutritional information on food labels improved, especially in fast food establishments, to facilitate informed decision making, and promote healthier practices. The observed practices align with those reported in the study conducted in Philadelphia [45]. Similarly, participants in our study tend to add salt to prepared meals and do not measure the amount of salt used in the preparation of meals served in FS. Most perceived the amount of salt used as “sufficient” or “minimal.” However, a significant number of FS participants expressed a desire to purchase foods low in sodium and/or ingredients and salts.

Our findings highlight the need to coordinate efforts with the food industry, particularly manufacturers, to increase the availability of low-sodium ingredients, reduce their costs, and improve their marketing. This would enable the acquisition of these ingredients at a competitive price [45]. If the goal is to reduce sodium intake at a population level, it is essential to actively involve the food industry. Making significant dietary changes can be challenging for individuals on their own, and the cooperation of the food industry is crucial in facilitating and promoting healthier choices [49].

There is scientific evidence indicating that reductions of 10% to 20% in the quantity of salt/sodium added to foods may go undetected by human taste receptors [50]. As a result, implementing measures to reduce excessive salt/sodium consumption among populations becomes crucial. A successful example of such a public health policy can be observed in the United Kingdom [51], where awareness campaigns targeting the general population regarding high sodium intake have been implemented. Importantly, these initiatives have not had any adverse effects on technology, food safety, or consumer satisfaction [52] [53]. Collaborative actions between researchers, FS, and the food industry are necessary to address the practices related to salt consumption and to create an environment that supports healthier choices. By working together, we can make a meaningful impact on sodium reduction efforts and improve public health outcomes.

Policies are needed to promote the availability, affordability, and labeling of low-sodium salts, as this can contribute to reducing blood pressure and preventing cardiovascular diseases [54]. It is also crucial to consider the barriers and facilitators identified in relation to the acceptance of reduced sodium salts by the popu-



lation [55]. Additionally, implementing continuing education strategies that encompass training and technical assistance for healthcare professionals and those in the gastronomic sector is advisable. This presents a significant challenge due to the taste preferences of customers/diners, who have become accustomed to excessive amounts of salt/sodium in the foods offered by the FS.

However, studies by Dotsch *et al.* (2009), IOM (2010), and Mattes (1997) [56] [57] [58] cited by Ma GX *et al.* (2014) [45] suggest that taste preferences can gradually adjust to incremental changes in sodium content. This implies that with time and consistent efforts, individuals can adapt to lower sodium levels and still find the food enjoyable.

Another challenge is that a significant number of participants feel that they lack knowledge and skills to prepare foods and beverages with low salt/sodium content. Additionally, they perceive a limited availability of ingredients or products that are low in sodium in the market, and when available, consider them to be expensive. These findings align with those reported by Ahn SH *et al.* (2021) [59], highlighting the need for personalized and gradual educational and support processes to effectively implement salt/sodium reduction programs in food services.

Furthermore, the general perception index of the participants was slightly above 70% ( $0.7105 \pm 0.1264$ ). They do not perceive any benefit in reducing the use of salt and products with high sodium content in the food preparations offered by FS to their clients/diners. This is primarily due to the fear that reducing salt/sodium will lead to a decrease in flavor and variety, consequently impacting their profits. In fact, most participants believe that adding salt enhances the taste of foods. Moreover, a significant barrier they face is the fear of receiving complaints from customers/diners regarding the taste of low salt/sodium foods.

Addressing the knowledge gaps, improving the availability and affordability of low-sodium ingredients, and addressing the perceived negative impact on flavor and variety is crucial in overcoming the barriers to salt/sodium reduction in food services. Implementing personalized and gradual educational programs, as well as addressing concerns about customer satisfaction, can contribute to the successful implementation of salt/sodium reduction initiatives.

They also do not perceive the improvement in the health of clients/diners as a benefit, particularly those working in fast-food establishments. The majority believes that preparing food with less salt/sodium would require more time and effort, potentially leading to increased prices for all menu items offered in FS. This finding is concerning, especially when considering that most fast-food establishments (originating from the United States) in developing countries, such as Costa Rica, adhere to standardized recipes established by the main headquarters of the fast-food organization or entity. This standardized approach makes implementing modifications challenging.

A study conducted in the USA revealed that between 1997 and 2010, the average sodium content in foods from eight major fast-food establishments increased from 624 mg/serving ( $n = 450$ ) to 770 mg/serving ( $n = 695$ ), representing

a 23% increase [60]. Another study showed a 3% increase in the sodium content of fast-food products ( $n = 78$ ) between 2005 and 2011 [61], while a third study found no change in the average sodium content of fast-food items ( $n = 2795$ ) between 2012 and 2016 [62].

These findings highlight the challenges associated with reducing sodium in fast-food establishments, where standardized recipes and concerns about time, effort, and potential price increases pose significant barriers. It underscores the importance of addressing these obstacles to achieve meaningful sodium reduction in the fast-food sector.

However, more than half of the participants in our study perceive that reducing salt/sodium in the dishes they offer on their menu could have a positive impact on the image of their FS. They believe that this modification would not affect the financial aspect of their businesses, and some have already taken action to promote this healthy change. These actions include training cooks, using salt substitutes and low-sodium products, providing salt/sodium information on menu items, and using labels (stickers) on the menu to highlight healthy low-sodium preparations. Qualitative menu labeling, such as traffic light labels, healthy food symbols, and ingredient lists, has been shown to positively influence customers' food choices [63].

Similarly, a study conducted with restaurant owners and cooks in South Korea [59] revealed health promotion options that were well-received by the participants. These options include the delivery of recognition plaques to healthy restaurants, advertising restaurants participating in the government's salt/sodium reduction strategy and providing technical training for staff. Nearly half of the restaurant owners and chefs in the study expected that sodium reduction would enhance the image of their food service. It is also known that concerns about customer satisfaction and maintaining income are significant barriers to offering low-sodium menus in various food services [64], and the reformulation and development of new dishes can be challenging and time-consuming, requiring financial investment. Therefore, restaurant owners may be reluctant to offer healthier food options unless they can see a potential increase in profits [65].

These findings demonstrate the importance of acknowledging the positive attitudes and actions of some participants in promoting salt/sodium reduction in food services. Implementing recognition programs, government support, and providing technical training can further encourage the adoption of healthier practices. Addressing the barriers associated with customer satisfaction and financial concerns is crucial in facilitating the offering of low-sodium menus in food services.

The findings emphasize the need to consider multiple aspects when developing strategies for FS to reduce salt/sodium in their menu offerings. An intervention study conducted in Korea demonstrated that customers were satisfied with reduced-sodium menus when they were aware that restaurants were actively participating in a sodium reduction program [65]. Furthermore, it was observed that restaurant owners and chefs who consumed less dietary sodium were more

inclined to participate in low-sodium restaurant initiatives [66]. These studies underscore the ongoing importance of educating both consumers and restaurant workers about the benefits of a healthy diet.

These findings highlight the significant role that awareness and education play in promoting healthier food choices. By informing customers about the efforts made by restaurants to reduce sodium content, their satisfaction with low-sodium menus can be enhanced. Moreover, encouraging restaurant owners and chefs to adopt lower-sodium diets themselves can increase their willingness to actively participate in initiatives focused on reducing sodium in their establishments.

Ongoing education and awareness campaigns are essential to foster a culture of healthy eating among consumers and food service workers. By equipping individuals with knowledge about the benefits of reduced salt/sodium intake, we can encourage healthier choices and contribute to the overall well-being of the population.

Based on the findings of this study, it is strongly recommended that governments provide support for the transformation of the gastronomic sector. This can be achieved by implementing a minimum of six strategies aimed at reducing the utilization of discretionary salt and high-sodium products within the FS. These strategies should align with the SHAKE strategy, ensuring coherence and effectiveness in salt and sodium content reduction efforts [40].

In the field of “Surveillance” of SHAKE acronym, there is a pressing need to enhance the monitoring and surveillance of sodium content in prepackaged food products, as well as the ingredients used, and preparations offered by FS. This will contribute to ensuring greater awareness and control over the sodium levels in the food industry.

Furthermore, in “Harness”, it is essential to promote research, innovation, and development processes focused on creating food and beverage preparations with lower salt/sodium content within the gastronomic sector. By doing so, we can encourage healthier alternatives and contribute to the overall reduction of sodium consumption.

Regarding the “Adoption of norms”, it is of utmost importance to implement a comprehensive nutritional labeling system on the menu, making it mandatory for pre-packaged foods. This will enable consumers to make informed choices about the nutritional value of the food they are consuming. Additionally, voluntary measures should be taken to eliminate saltshakers, salt bags, sauces, dressings, chilies, and preserves from customer tables and auxiliary tables in food services. This will help reduce the excessive use of salt by customers and encourage healthier eating habits.

Lastly, it is crucial to establish front warning labeling on pre-packaged foods to facilitate informed and healthy decisions for owners and chefs in FS. By implementing these measures, we can effectively address the issue of excessive sodium consumption and promote healthier choices within the gastronomic sphere. In the realm of “Knowledge”, it is essential to launch a social marketing campaign that emphasizes the value of a low-salt or low-sodium diet, aiming to re-

duce the use and consumption of discretionary salt and food ingredients or products with high sodium content in the FS. Additionally, it is important to develop skills and competencies in culinary techniques that focus on reducing the use of discretionary salt, such as incorporating natural flavorings and utilizing food products with lower sodium content. The objective is to encourage the acquisition of these techniques and modify recipes gradually, allowing for the inclusion of flavorful herbs, spices, and citrus juices while maintaining a balanced sodium level.

On the other hand, in the field of Environment, it is necessary to transform environments that promote excessive salt/sodium consumption into healthy ones, in such a way that healthy eating is promoted in the gastronomic sector, perhaps by designating special distinctions.

Finally, the implementation of the recommended actions in the areas of Surveillance, Harness, Adoption of norms, and Knowledge is required and that promotional activities for the reduction of salt/sodium focus on the Corporate Social Responsibility (CSR) of the FS, taking into account not only sales but also the good health of its clients/diners [67].

## 5. Conclusion

This study offers valuable scientific evidence on salt and sodium usage in the gastronomic sector, aiding decision-making in public health initiatives and non-communicable chronic diseases (NCCD) prevention. The research team recommends government support for transforming the gastronomic sector and implementing strategies to reduce salt usage. Actions should focus on surveillance, norms, knowledge, and corporate social responsibility. Collaboration and shared responsibility with the productive sector are essential for fostering healthy environments. By incorporating Corporate Social Responsibility (CSR), governments can effectively engage with diverse stakeholders, thoroughly understanding their motivations, and actively involving them in the collaborative process of creating and sustaining healthy environments. This approach underscores the significance of collective participation and shared responsibility in building a society that is both sustainable and mindful of promoting good health.

## 6. Strengths and Limitations

To the best of our knowledge, this study represents the first comprehensive research conducted in Costa Rica that examines the knowledge, attitudes, and practices (KAP) of FS owners, managers, and cooks regarding the use of discretionary salt and high-sodium ingredients or products in food preparation. Moreover, it provides valuable insights into the initiatives that FS have implemented or are willing to pursue to reduce the salt/sodium content in their dishes.

However, it is important to acknowledge the limitations of this research. Firstly, the data collection instruments were only applied within a limited region of Costa Rica, which may restrict the generalizability of the findings to owners, managers,

and cooks in canteens, restaurants, cafeterias, and fast-food establishments across the country.

Secondly, there is a possibility of participant response bias, as their willingness and actions to reduce sodium levels might be influenced by social expectations. Furthermore, the practices self-reported by participants may not entirely reflect their day-to-day activities within the establishments, as our observations were limited to a single day in each participating FS.

Lastly, it is worth noting that some of the fieldwork was conducted during the COVID-19 pandemic, which could have potentially influenced participants' responses in unforeseen ways.

In conclusion, this study offers significant insights into the knowledge, attitudes, and practices (KAP) of food service owners, managers, and cooks regarding salt/sodium reduction. However, it is essential to consider these findings considering certain limitations inherent to the study. By recognizing these constraints, a more comprehensive understanding of the research outcomes can be achieved.

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## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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