Effect of "Taste Plus Sodium Reduction TMT" for Salt Reduction in Seasonings by Maintaining Sensory Quality of Food

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Abstract
World Health Organization recommends limiting daily common salt to 5 g for a healthy person to reduce sodium intake, as excess sodium can lead to elevated blood pressure, stroke, and cardiovascular diseases. However, many individuals consume double that amount through various food sources. Considering that approximately 40% of common salt contains sodium and other foods have varying quantities of sodium, the initiative is to propose an alternative ingredient called **Taste Plus**, developed from natural sources, that maintains the taste perception of common salt while reducing sodium intake.
Taste Plus is a complex mixture of food additives with a polysaccharide carrier base that easily fuses with foodstuffs. Extensive laboratory testing and verification have demonstrated its effectiveness in reducing sodium content. The study's overall finding is that adding 0.2% Taste Plus TMT tool, which helps deduct 5 g of salt from every 100 g of seasoning, can reduce sodium in a recipe by up to 20% while retaining the same salty perception as before.
Practical Applications
Taste Plus TMT tool is an innovative ingredient in a recipe in place of common salt that enhances the intensity of taste perception without compromising its expected taste profile and does not adversely affect getting healthier products.

1. Introduction

The global food market has been highly dynamic and has undergone significant advancements in recent years. People typically enjoy side dishes or appetizers throughout the main course. Hence, the snack industry in India has experienced tremendous and humongous growth, with volume growth averaging an increase of about 25% annually (8). The increase in processed food sales is attributed to urbanization, population growth, and alterations in lifestyle.

Salt is the most typical ingredient used to impart flavour to food. In addition to their role in giving flavour, salt and sodium additives serve the purpose of preservation by boosting saltiness, lowering bitterness, boosting sweetness, speeding up fermentation reactions, and preserving texture. While sodium is necessary for normal human function, consuming too much raises blood pressure, a significant contributor to cardiovascular diseases.

1.1. Sodium Consumption Trends in Snacks and other foodstuffs

Children and young adults often opt for processed foods due to their widespread availability and affordability. These foods offer essential nutrients while providing a salty, rigid, thick, and crunchy texture, making them highly addictive. However, the high sodium content in processed foods, resulting from preservatives, flavouring agents, stabilizers, raising agents, seasonings, and colour enhancers, poses significant health risks. Excessive sodium consumption increases the risk of high blood pressure, a major contributor to heart disease and stroke.

Samples of processed foods collected from Kochi's suburban supermarkets were analyzed to determine their sodium levels. Table 1 summarizes the sodium concentration in different food categories, showcasing a significant range.

Table 1: Concentration levels of sodium ions in different processed food samples

Sample No.	Food Group	Sodium content in 100 gm	Sample No.	Food Group	Sodium content in 100 gm
1	Fried potato chips	622 mg(0.622gm)	4	Noodles	1247.1(1.2471 gm)
2		678 mg(0.678 gm)	5		1674 mg(1.674 gm)
3		852 mg(0.852 gm)	6	Instant Soup	2242 mg(2.242 gm)

Simply informing consumers that they consume too much sodium and expecting them to alter their eating habits is not a worthy approach for an effective way to reduce sodium intake. As people change their eating habits and low-sodium foods are unavailable, an immense opportunity for sodium-reduced diets lies ahead. Therefore, rather than just providing dietary advice, this kind of product (Taste Plus) is required to lower the sodium content of processed foods.

1.2. Law and policy options for regulating sodium intake in foodstuffs

Governments and public health organizations worldwide are concerned about the prevalence of cardiovascular diseases and other chronic diseases. They advise drastically lowering salt levels in food to decrease salt consumption from 9 g - 12 g/day to 5 - 6 g/day. In the United States, Dietary Guidelines for Americans recommend 2300 mg of sodium per day (2.3 g of sodium or 5.75 g of salt) for healthy adults under fifty years old and 1500 mg of sodium per day (1.5 g of sodium or 3.75 g of salt) for those at risk of heart disease [(7)]. The Food Safety and Standards Authority of India (FSSAI) recommends that a product containing not more than 0.12 g sodium per 100 g (or 0.3 g salt) is low sodium, a product containing 0.04 gm sodium per 100 g (or 0.1 g salt) is very low sodium, and a product containing 0.005 g sodium per 100 g (or 0.0125 g) is sodium-free[(3)].

To meet current nutritional recommendations, the food industry is reformulating processed foods to reduce salt addition and produce healthier products. Symega Food Ingredients developed the Taste Plus TMT tool, a sodium reduction tool that helps reduce the use of common salt in seasoning and create healthier processed foods. This sodium replacer product gave an insight into the effect of natural flavour enhancers on enhancing sodium perception levels.

1.3. Chemical Strategies to reduce sodium in a variety of foods

While the prime objective is to reduce the sodium content in a food recipe, there is also an underlying aim to enhance the saltiness perception as well. With these two activities, the ultimate objective can be met. The following concepts are behind the formulation of sodium replacers.

Replacement: Replacing sodium with other types of salt. E.g., Potassium substitution for sodium is another method, but it leads to an off taste, i.e., a metallic and bitter taste.

Spatial Distribution: Stimulation of taste receptors through flavour enhancer.

Cross Model Interaction: Certain tastes and aromas together may enhance the perception.

1.4. Process of saltiness perception through different consecutive stages:

There are distinct temporal phases or consecutive stages for the taste effects of sodium in the food matrix when using a sodium replacer. The first phase deals with releasing sodium from the food matrix to the surroundings when food enters the oral cavity due to diffusive and convective transports. Diffusion is the process by which sodium ions move from areas of high concentration within the food to areas of lower concentration in the oral cavity. On the other hand, convective transport involves the movement of sodium ions through saliva as it flows around and permeates the food particles. The second phase is mixing fragmented food particulates and saliva to form the bolus.

Meanwhile, sodium diffuses from the bolus to the taste receptor sites on the tongue. The flow rate and salivary composition have an impact on sodium delivery. The third phase is the resistance of sodium migration into the taste receptor cells due to the fat coating on the tongue surface. Subsequently, flavour enhancers may change the response of the taste receptor cells to salty stimuli.

Fig:1 Consecutive stages for the process of taste effects of salt in the food matrix

1.5. The role of the Taste Plus TMT Tool for salt perception

Flavour ingredients in the Taste Plus TMT Tool stimulate the umami receptors. The synergy between umami and saltiness can make foods taste saltier than they are, even if the sodium content is not exceptionally high. Therefore, the Taste Plus TMT Tool can contribute to the overall flavour profile of food and make it more appealing to consume.

2. Objectives

- To study the effect of the Taste Plus TMT Tool that enhances the salt perception and reduces the sodium content in foodstuffs
- To estimate the most appropriate replacement of sodium content in a specified product through the application of Taste Plus TMT Tool by using the sensory spider web test

3. Materials and Methods

3.1. Composition of Taste Plus:

The current study uses the cross-model interaction technique to prepare Taste Plus TMT Tool. Carrier agents, Lipids, flavour enhancers, Nutrient ingredients, and some food additives will be required materials for preparing Taste Plus TMT Tool.

3.2. The method used for the development of Taste Plus:

Cross Model Interaction-approach and Powder Dispersion method are used in developing Taste Plus TMT Tool. Dispersion of natural flavour enhancers in a carrier with various food additives and nutrient ingredients can effectively regulate sodium reduction in foods.

3.3. Physicochemical Properties of Taste Plus

The prepared product was characterized systematically, and its sodium reduction percentage was assessed through the following section. Table 2 overviews the Physicochemical Properties of Taste Plus TMT Tool.

Table:2: Physicochemical Properties of Taste Plus

Parameters	Results
Moisture Content (%):	< 8 %.
P^H (1%)	Less acidic
Ash (%)	<0.5%
Particle Size	0 - 500 microns

3.4. Procedure for the application of Taste Plus

The food matrix has been modified with Taste Plus to lower the sodium level. However, complete sodium substitution is not feasible. Taste Plus modulates the response of the taste receptor cells' signals and intensifies other flavours.

3.4.1. Preparation of the sample:

Potential uses of Taste Plus to lower the sodium content of particular foods are shown in the sections below.

3.4.1.1. Seasoning:

The extruded snack is fried in vegetable oil to reduce moisture and coated with seasoning in an appropriate percentage, such as 15%, 20 %, and 25% sodium reduction with 0.2% Taste Plus TMT Tool. Subsequently, it is kept for more than 24 hours to mature.

3.4.1.2. Instant Noodles:

Mix the Noodles from the pack with the appropriate 15%, 20 %, and 25% sodium-reduced taste maker containing 0.2% Taste Plus and add suitable amount of water. Bring to a boil while stirring continuously.

3.4.1.3. Soup

Appropriate amounts of 15%, 20%, and 25% sodium-reduced soup powder with 0.2% Taste Plus and add the necessary amount of water. Stir the mixture so that it does not form lumps. Bring to a boil while stirring continuously. Lower the heat for 5 minutes. Cook until the mixture turns thick and has no raw smell. Remove it from the flame and keep it aside.

3.4.2. Sample codes for sensory analysis

All samples are blind-labelled with random three-digit codes. Table 3 provides an overview of the coded samples.

Table 3 : An overview of the coded samples.

Sequence of samples	Masala snack seasoning				Chicken noodles seasoning				Vegetable soup seasoning			
	Control sample	15%	20%	25%	Control sample	15%	20%	25%	Control sample	15%	20%	25%
Notation symbols	ABC	BAC	BCA	CAB	XYZ	YXZ	YZX	ZXY	PQR	QPR	QRP	RPQ

3.4.3. Sensory Panel:

The Indian Standard Sensory analysis — General guidance for the selection, training, and monitoring of assessors – IS 15317 (Part 1): 2003, ISO 8586-1: 1993, and manufacturing company's guidelines for ethical and professional practices for the sensory analysis of foods serve as the foundation for the selection, training, and monitoring of sensory panels that evaluate the organoleptic profile of foods.

4. Analysis and Interpretation

4.1. Analysis of samples by using the sensory evaluation of food

Sensory analysis was carried out to determine the intensity of sodium perception. A special sensory panel of 13 evaluation experts from the company evaluated samples using the Ranking Test and Quantitative Descriptive Analysis (QDA) approach. The assessors (five females and eight males) were aged 30–60. The panellists selected the matching concentration of the control and trial samples and rated the organoleptic qualities and overall acceptability.

The control sample was prepared with 100% sodium, and the trial sample was prepared with different percentages of sodium reduction with Taste Plus. In the trial sample, sodium was replaced partially, and a little Taste Plus was added. Sensory analysis was performed between the control sample with 100% sodium and the trial sample with different percentages of sodium content. This test aimed to rank the entire sample in increasing or decreasing order around attributes like sweetness, saltiness, etc. The context for conducting this sensory assessment is product matching. The test is performed to determine whether there is a sensory difference between the control products and the three trial samples with 15%, 20%, and 25% sodium reduction. In the ranking test, in-house panellists evaluated the coded sample for acceptance in order from the least acceptable to the most acceptable. They gave each sample a different rank [the most acceptable texture (3), acceptable (2), and least acceptable (1)]. The sensory profiles of the samples that were evaluated and compared using a spider web plot. The centre point is equivalent to the least acceptable and highest acceptable samples at the end of the axis. Representations of comparison between control samples and three trial samples of seasoning in Masala, Chicken Noodles, and Vegetable Soup with 15 %, 20%, and 25% sodium reduction using a spider–web chart are given in Figures 2(a), 2(b), and 2(c), respectively.

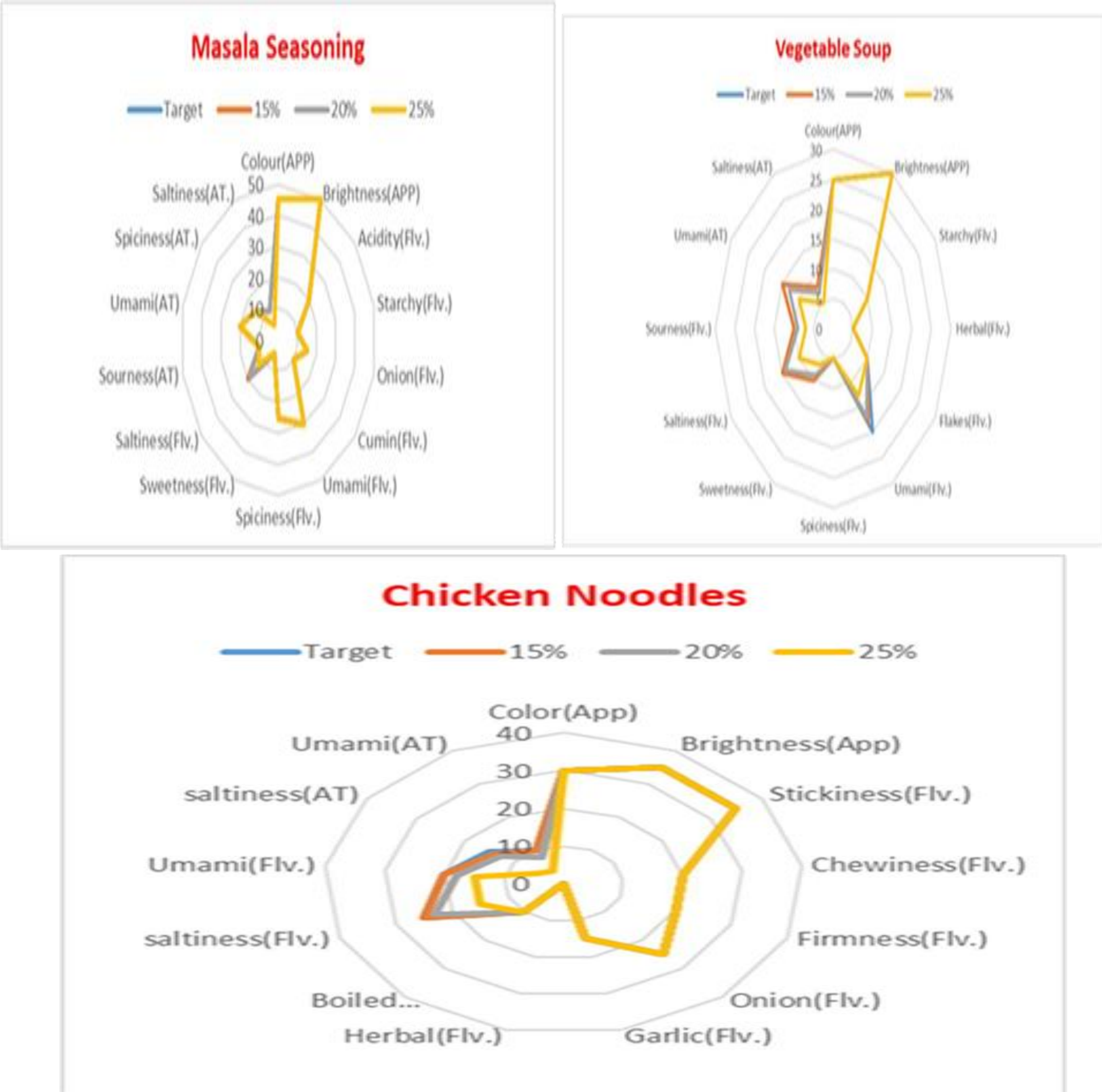

Fig. 2(a), 2(b) and 2(c): Representation of comparison between Control Sample of Seasoning in Masala, Chicken Noodles and Vegetable Soup against 3 Trial Samples having 15 %, 20%, 25% sodium reduction and Table 4 provides sensory analysis results of the coded samples.

Table 4: Sensory Analysis Results of coded Samples

Coded Samples	**Interpretation**
BAC, YXZ, QPR	**In line with control samples such as ABC, XYZ and PQR and hence accepted**
BCA	**Match with control sample such as ABC and hence accepted**
CAB, YZX, ZXY, QRP, RPQ	**showing variation in the salt perception with respect to the Control sample such as ABC, XYZ, PQR, and hence rejected**

Figures 2(a), 2(b), and 2(c) observed that up to 15% sodium reduction of the trial sample with Taste Plus had an excellent flavour. The mouthfeel was good in the case of the trial sample due to its originality.

Overall, up to 20% sodium reduction in the masala seasoning trial sample with 0.2% Taste Plus was found in the same profile based on the control sample. Results show up to 20% masala seasoning in the trial sample is preferable, while 25% indicates a significant difference in sodium perception. Significant differences in taste perception can be seen in the profiles of the chicken noodles and vegetable soup control and trial samples at 20%.

5. Results and Discussions:

The present study focused on preparing Taste Plus incorporated into different seasonings such as Masala, Noodles and Soup to varying percentages of sodium reduction. Physicochemical and sensory assessments were used to confirm the intensity values of the attributes of Taste Plus. According to the findings of the current investigation, the developed product has reduced sodium in trial samples compared to the control sample. Taste Plus maximizes the stimulation of salt receptors by ensuring the rapid release of salt from the surface of the food. Therefore, Taste Plus can reduce overall salt levels in foods while maintaining their palatability. Taste Plus reduces salt by enhancing taste via cross-modal interactions without affecting the sensory appeal of foodstuffs.

6. Safety aspects of Taste Plus Sodium Reduction TMT

The safety of Taste Plus is determined by carefully assessing a wide range of pertinent data on its chemical composition and toxicity in experimental animals. The acute toxicity estimation is used to evaluate the safety of Taste Plus. Each ingredient is added to the formulation in accordance with the respective component's lethal dose. All food ingredients contained in Taste Plus are generally recognized as safe. The contaminants, such as bacteria infestations, pesticide residues, solvent residues, and heavy metals, are well controlled in the developed product. During its laboratory phase, this product underwent various inspections and verifications, proving that chemical and biological toxic substances are within the limit. According to the available scientific evidence, using Taste Plus for seasoning poses no risk to food safety. The conducted assessments support that using Taste Plus at the recommended levels is safe. Combining various ingredients in a Taste Plus could significantly impact flavour continuity due to its synergistic effect when added at suggested concentrations to maintain the desired flavour without going beyond the sensorial and technological limits.

7. Conclusion:

Taste Plus can help food manufacturers achieve challenging sodium reduction goals by supporting product reformulation and leading insights. The natural flavour enhancers and other food additives in Taste Plus drive the sodium reduction tool. However, product reformulation should be one of many methods of salt reduction. A very effective strategy is required to educate consumers about consuming less salt. Nevertheless, Taste Plus shows that product re-engineering by the food industry can lower the amount of salt used in seasonings. Taste Plus offers the chance to enhance taste perception during the tasting process while reducing the salt content of foods by approximately 5 g per 100 g. The study's overall finding is that by increasing the perception of saltiness, adding 0.2% Taste Plus, which helps to reduce 5 g of salt from every 100 g of seasoning, will decrease sodium in the recipe by up to 20%.
Taste Plus can provide the following insights:

- Meet consumer demand for sodium reduction depends on the products
- Snack Seasoning: up to 20%; Cooked-up application: up to 15%.

- Salt reduction to around 5 g in the seasonings.
- Our wide range of flavour modulators enhances the intensity of sodium perception levels without affecting the nutritional value.
- Experiencing a long-lasting taste sensation.
- Crafting a world of rich taste in the food matrix enhances a robust taste profile beyond the classic dish. So consumers will get delicious products that do not drop in taste quality.
- The levels of chemical and biological toxic substances are within acceptable limits based on the results of numerous product inspection.

Abbreviations:
Taste Plus: Taste Plus Sodium Reduction TMT Tool.

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