

RESEARCH STUDY

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Analysis of Sodium Content in Commercially Salty Snack and its Contribution to Daily Salt Intake: A Market Survey in East Surabaya

Analisis Kandungan Natrium pada Snack Asin Komersial dan Kontribusinya terhadap Asupan Garam Harian: Survei Pasar di Surabaya Timur

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ABSTRACT

Background: Nearly the entire global population consumes excessive sodium. A food in sodium is salty snacks. Excessive sodium consumption can cause health problems such as hypertension, heart disease, stroke, and obesity. Salty snacks are popular and are frequently consumed and favored by the public.

Objectives: To identify various commercial salty snack products and analyze their sodium content as well as their contribution to daily sodium and salt intake.

Methods: The study was conducted through a survey of 32 commercial salty snacks produced in Indonesia and labeled with nutrition information. Products were collected from three supermarkets in East Surabaya—Superindo, Indomaret, and Alfamart, using a convenience sampling method. The survey was only conducted on small or medium packages of each product brand and variant so was limited.

Results: A total of 32 salty snack products were identified and categorized into chips, light snacks, sticks and crackers, and nuts. The highest sodium content was 1394,4 mg per 100 g found in the sticks and crackers, which accounted for 50% of the daily sodium requirement. The average sodium content in other categories ranged around 500 mg, fulfilling 20-30% of the daily sodium.

Conclusions: Commercial salty snack products are widely available in the market and generally contain high sodium levels. Attention to nutritional labeling, particularly sodium content, is essential in managing daily sodium and salt intake. In addition, the implementation of regulations or legislation regarding sodium labeling restrictions on salty snack products in Indonesia is necessary.

INTRODUCTION

Sodium is an essential nutrient that plays a role in maintaining the body's homeostasis, including fluid balance, acid-base balance, osmotic pressure, stabilizing cell membrane potential, active transport across cell membranes, and cell growth¹. However, excessive sodium consumption can lead to health issues such as hypertension, heart disease, stroke, and obesity^{2,3}. Epidemiological data show that nearly the entire global population consumes sodium beyond the recommended intake⁴. This excessive consumption has been identified across all age groups, from children to the elderly. In Indonesia, the average daily salt intake is around 6.6 g, or more precisely, 2674 mg of sodium. This indicates that approximately 52.7% of Indonesians consume more than 5 g of salt or 2000 mg of sodium per day⁵.

High-sodium or salty foods are commonly found in food additives such as sauces, soy sauce, seasoning powders, and salty snacks. Salty snacks generally contain

high amounts of salt and can contribute to excessive sodium intake⁶. In addition, salty snacks can be addictive, which can lead to excessive consumption or energy consumption. Snacks are practical and simple foods in small portions that can be consumed between meals⁷. Various salty snacks are available in the market, such as crackers, chips, crispy sticks, and others. Salty snacks produced by the food industry and ready-to-eat products are commonly referred to as commercial snacks. These snacks are popular and frequently consumed by people of all age groups. This aligns with a study conducted by Warde & Yates (2017), which found that chips are among the top three most consumed snack categories, with approximately 12% consumed on weekdays and 15% on weekends. Additionally, a study in Mexico found that more than 24% of teenagers consume salty snacks daily⁸.

Various efforts have been made to reduce the sodium intake in the population, including government regulations limiting the sodium or salt content in salty

snack products. Several countries have implemented regulations or policies to control the salt or sodium levels in food products. For instance, Chile has introduced mandatory nutritional labeling, requiring a warning on food packaging if a product contains more than 400 mg of sodium per 100 g or 100 ml, stating "high sodium content"⁹. Additionally, the United Kingdom has implemented a color-coded labeling system based on the sodium content per 100 g of food, categorizing it into green (low) for ≤ 0.3 g, yellow (medium) for >0.3 to ≤ 1.5 g, and red (high) for >1.5 g¹⁰.

Although Indonesia has not yet established regulations on sodium or salt limits in food products, the Ministry of Health Regulation No. 30 of 2013 states that the recommended daily salt intake is one teaspoon (5 g) or equivalent to 2000 mg of sodium. However, no previous study has analyzed the sodium content of commercial salty snack labels in Indonesia. Therefore, this study aimed to identify various commercial salty snack products and analyze their sodium content, as well as their contribution to daily sodium and salt intake adequacy.

METHODS

This study was conducted using a survey method on various salty snack products produced in Indonesia. The sampling method applied was convenience sampling, a non-probability technique in which products were selected based on accessibility and availability. The criteria for the salty snack products surveyed were commercial salty snacks that are only sold in supermarkets and have a nutrition label. Salty snack products come from various brands and are classified into several categories, such as chips, light snack, stick and cracker, and nuts. According to BPOM Regulation No. 34 of 2019, these products are included in the category of

ready-to-eat snack foods. This classification is made because each category differs in terms of main ingredients, processing methods, and nutritional content. The survey was limited to small or medium-sized packaging of each product brand and variant, resulting in a limited number of samples. The survey was carried out in three supermarkets in Surabaya, particularly in East Surabaya, namely Superindo, Indomaret, and Alfamart. These supermarkets were chosen because they are easily accessible to the public and widely available. Data collection was conducted by photographing the products and their nutrition labels. The collected data included the product name, product weight, energy content per serving, and sodium content per serving. Data collection occurred between December 2024 and January 2025, under research ethics approval number 1162/HRECC.FODM/XII/2024 which was issued on 10 December 2024. Furthermore, the salty snack products were categorized based on the UK labeling regulations, which use a color-coded system according to the salt content per 100 g. The classification includes green (low) for ≤ 0.3 g, yellow (medium) for >0.3 to ≤ 1.5 g, and red (high) for >1.5 g¹⁰.

RESULTS AND DISCUSSIONS

In this study, a direct survey was conducted on commercial salty snack products. In addition, an analysis of the sodium and energy content in these products, an analysis of the sodium and energy adequacy in relation to daily requirements, as well as an analysis of the sodium content per product per 100 g along with its category were carried out and are presented in the following table. The results of this analysis are expected to provide an overview of the contribution of salty snack consumption to the daily nutritional intake, particularly sodium.

Table 1. Sodium and energy content of 32 commercial salty snack products in East Surabaya

Category Type	Number of Products	Sodium Content (mg)				Energy Content (kcal)			
		Average	SD	Min	Max	Average	SD	Min	Max
The chips category	15	497.84	354,36	168	1485	401.22	184.96	200	728
The light snack category	6	554.6	215,37	385	868	303	35.63	270	350
Stick and cracker category	5	1081.5	935.5	366.8	1743	235	49.49	200	326.6
Category of nuts	6	583.66	296.94	304	1012	412	86.07	288	494
All category	32	679.4	450.54	305.95	1277	337.8	89.03	239.5	474.65

Table 1 shows that there are four identified categories of salty snacks, with 32 different products. The most frequently identified category was chips, with 15 products, while the least identified category was sticks and crackers. The average sodium content of all salty

snack products was 679.9 mg. The highest average sodium content was found in the sticks & crackers category, at 1081.5 mg, with a maximum value of 1743 mg. The average sodium content in other categories was around 500 mg. Additionally, the maximum sodium

content was found in a stick & cracker product, containing 1743 mg per serving, which nearly meets the daily salt requirement. Meanwhile, the highest average

energy content was found in the nuts category at 412 kcal, with the average energy content in other categories ranging between 200 and 400 kcal.

Table 2. Analysis of daily salt and energy adequacy from various salty snack products

Category Type	Number of Products	Daily salt intake (%)				Daily energy intake (%)			
		Average	SD	Min	Max	Average	SD	Min	Max
Chips category	15	24.89	17.71	8.4	74.25	18.66	8.6	9.3	33.86
Light snack category	6	27.73	10.76	19.25	43.4	14.09	1.65	12.55	16.27
Stick and cracker category	5	54.07	46.77	18.34	87.15	10.93	2.3	9.3	15.19
Category of nuts	6	29.18	14.84	15.2	50.6	19.16	4	13.39	22.9

Table 2 shows the daily salt adequacy in salty snack products, with the highest being in the stick and cracker category at 54.07%, while other categories are around 20-30%. The consumption of salty snacks can

exceed the recommended portion, which should account for only 10%–20% of the total daily intake. Meanwhile, the average energy adequacy from salty snacks ranges from 10 to 20%.

Table 3. Sodium content in salty snack products per product and per 100 g and snack product categories based on Sodium content.

Product name	Product weight (g)	Sodium content per product (mg)	Sodium content per 100 g (mg)	Product categories based on sodium content		
				Low (≤ 120 mg)	Medium (>120 – ≤ 600 mg)	High (>600 mg)
Product A	42	168	400		✓	
Product B	65	325	500		✓	
Product C	68	391	575		✓	
Product D	68	289	425		✓	
Product E	60	285	475		✓	
Product F	140	560	400		✓	
Product G	140	840	600		✓	
Product H	40	280	700			✓
Product I	68	476	700			✓
Product J	60	280	466.6		✓	

Product name	Product weight (g)	Sodium content per product (mg)	Sodium content per 100 g (mg)	Product categories based on sodium content		
				Low (≤ 120 mg)	Medium (>120 - ≤ 600 mg)	High (>600 mg)
Product K	68	578	850			✓
Product L	22	205.3	933			✓
Product M	62	620	1000			✓
Product N	55	343.75	625			✓
Product O	135	1485	1100			✓
Product P	62	868	1400			✓
Product Q	70	385	550		✓	
Product R	55	440	800			✓
Product S	60	690	1150			✓
Product T	65	537.5	827			✓
Product U	60	390	650			✓
Product V	60	600	1000			✓
Product W	70	513.3	733.2			✓
Product X	40	420	1050			✓
Product Y	125	1743	1394.4			✓
Product Z	60	366.8	611.3			✓
Product AA	70	364	520		✓	
Product AB	95	304	320		✓	
Product AC	92	1012	1100			✓
Product AD	80	840	1050			✓
Product AE	95	646	680			✓
Product AF	60	336	560		✓	

Table 3 shows that based on the sodium content per 100 g, the product with the lowest sodium content was 320 mg, while the highest was 1394.4 mg. Among the 32 salty snack products, the majority have a sodium content per 100 g ranging from 500 to 1000 mg. Additionally, salty snack products are categorized based on labeling regulations in the UK, which are divided into

three colors: green/low (≤ 120 mg), yellow/medium (>120 - ≤ 600 mg), and red/high (>600 mg)¹⁰. The identification results showed that no snacks fell into the low category, but 12 snacks were classified as yellow/medium and 20 snacks were classified as red/high.

Salty snacks are snacks made from basic ingredients such as starch or vegetables, oil, salt, and spices¹¹. Additionally, salty snacks usually have a fairly high sodium content. Sodium is the primary cation found in extracellular fluid and is considered a micronutrient with several benefits, including maintaining blood volume and pressure by binding water, playing a role in electrolyte balance in the body, and regulating osmotic pressure in cells, or the movement of fluids in and out of cells. However, sodium should not be consumed excessively because it can have negative health impacts, such as hypertension. Hypertension that is not addressed immediately can lead to complications such as stroke, kidney disease, heart disease, and more¹².

The study results show that the average sodium content in the 32 salty snacks was highest at 1081.5 mg, while the average for other snacks was around 500 mg (Table 1). Thus, the sodium content can fulfill 50% of the daily sodium or salt requirement (Table 2). This exceeds the recommended energy and nutrient distribution for a single meal, which should be 25% for breakfast, 30% for lunch, 25% for dinner, and 10% for both morning and afternoon snacks¹³. This indicates that the sodium content in the salty snacks exceeds the recommendation for snacks. Therefore, it can be proven that salty snacks contain high levels of sodium. Despite this, salty snacks are frequently consumed by the public. This aligns with research on the increasing snacking trends among children in the United States, where the average consumption of salty snacks is 3 snacks per day⁶. Furthermore, a study on children aged 6-8 years found that 26.9% of them consumed salty snacks at least once a day¹⁴. This can also occur in adults with a frequency of consuming salty snacks once to several times per week⁶.

The research also shows the sodium content analysis per 100 g of 32 salty snack products, with most snacks containing 500-1000 mg of sodium (Table 3). According to the Food Labeling and Advertising Act (Law 20.606) established in Chile, the sodium limit for solid food is 400 mg per 100 g¹⁵. If a product exceeds or equals this limit, a warning label is required on the packaging. Based on the analysis of 32 salty snack products in Indonesia, the majority of snacks, 31 products, exceeded, the sodium limit per 100 g. Additionally, the UK labeling regulation uses a color-coded system based on the salt content per 100 g: green/low (≤ 0.3 g), yellow/medium (> 0.3 to ≤ 1.5 g), and red/high (> 1.5 g)¹⁰. According to this regulation, 12 salty snacks fall into the yellow/medium category, while 20 salty snacks fall into the red/high category, indicating high sodium content.

Based on the analysis, almost all the salty snack products contain high sodium. This could be because Indonesia has not yet implemented or applied any regulations or laws related to labeling. Additionally, there are no guidelines on the consumption of salty snacks, so individuals consume them according to their preference. The saltier the snacks a person consumes, the higher their sodium intake. High sodium intake can lead to increased plasma volume, blood pressure, and cardiac output, which can result in diseases such as hypertension, heart disease, and stroke¹⁶. High sodium intake is also associated with an increased risk of obesity¹⁷. According to the 2018 Riskesdas data, the prevalence of

hypertension in Indonesia is 34.1%, while the prevalence of stroke is 10.9%¹⁸. However, based on the 2023 Indonesian Health Survey, the prevalence of hypertension decreased by 30.8%. Currently, cardiovascular diseases are the leading cause of morbidity and mortality in Indonesia¹⁹. Given these issues, regulations and laws on product labeling should be implemented in Indonesia as a strategy and preventive effort.

Regulations and laws related to product labeling are implemented to help consumers understand the nutritional content of food²⁰. These regulations should include limits on specific nutrients, such as sodium, which can influence consumers' decisions when choosing products and help reduce sodium intake in their diets²¹. Such regulations benefit not only consumers but also companies or factories, allowing them to introduce new low-sodium products, reduce the portion sizes in packaging, and discontinue the production of high-sodium products²⁰. Furthermore, labeling calorie limits can reduce the purchase of high-calorie foods and encourage companies and restaurants to serve low-calorie foods. This agrees with a study by Bleich SN (2017), which found that calorie labeling can influence consumers' food choices and encourage restaurants to offer low-calorie options²².

High sodium consumption is closely linked to a preference for salty taste and taste thresholds, and it has been proven to be associated with chronic diseases¹². Reducing the amount of salt in food products can decrease appetite and, in turn, reduce the purchasing power for those products. The innovation and production of healthy snacks present a challenge for the food industry, as a salty taste preference is critical to food choices^{12,23}. Spices replace added salt without compromising the flavor of the food product and can also improve the nutritional value²⁴. However, innovation in formulation and testing should continue until the product is accepted by society.

The limitation of this analysis study is that the survey of commercially salty snack products was only conducted in stores in the East Surabaya area such as Superindo, Indomaret, and Alfamart. There are many salty snack products circulating in traditional markets, both labeled and unlabeled, that may contain higher sodium content. The analysis of the products does not reflect the actual intake consumed by the public, so further studies on the salty snacks consumed by the public are necessary. Moreover, public education should be conducted as a preventive step to increase awareness of the limits of sodium or salt consumption. However, this study also has advantages, as an analysis of commercial salty snack products related to daily salt needs has never been conducted in Indonesia, making this the first study.

CONCLUSIONS

Commercial salty snack products are widely available in the market. This study shows that most commercial salty snack products analyzed contain high levels of sodium. Therefore, these salty snacks can contribute to excessive sodium intake, which can lead to health issues such as hypertension, heart disease, stroke, and obesity. However, in Indonesia, there are still no

regulations regarding labeling related to the sodium limits in salty snack products. Therefore, it is crucial to implement regulations and laws regarding labeling especially on salty snack products. The introduction of these labeling regulations is expected to raise awareness among the public and various companies about the importance of sodium limits.

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AUTHOR CONTRIBUTIONS

MAP was directly involved in writing the manuscript draft, data collection, interpreting the results, and editing. FF participated in conceptualization, writing the manuscript draft, and reviewing the manuscript. ZAMD was responsible for viewing and supervising the final manuscript. All authors read and verified the final version of the manuscript.

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