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SODIUM CONTENT PROFILE OF PACKAGED PROCESSED FOODS AND ITS COMPLIANCE WITH WHO GLOBAL SODIUM BENCHMARKS

Profil Kandungan Natrium Pangan Olahan Kemasan dan Kesesuaiannya dengan WHO Global Sodium Benchmarks

Risda Yulianti [1*], Okdi Natan [1], Vina Dwinata [1]
[1]Department of Nutrition, Politeknik Kesehatan Kementerian Kesehatan Bengkulu, Bengkulu, Indonesia
Email: risda@poltekkesbengkulu.ac.id

ABSTRACT

Packaged processed foods have become an integral part of modern lifestyles, yet they often contain high sodium levels that pose significant risks for hypertension and cardiovascular diseases. This study aims to evaluate the sodium content of packaged processed foods in Bengkulu City based on the 2nd Edition of the WHO Global Sodium Benchmarks. A descriptive cross-sectional study was conducted in May 2024, analyzing 500 products across 22 food subcategories sourced from modern retail outlets. Data on sodium content were collected from nutrition facts labels and converted to mg/100 g or mg/100 ml to ensure comparability with international standards. The results revealed that the highest median sodium levels were found in concentrated bouillon (3,914 mg/100 g), soy sauce (2,000 mg/100 ml), and instant noodles (1,294 mg/100 g). A vast majority of products, particularly canned fish (0% compliance), savory nut and seed snacks (0% compliance), and instant noodles (2.63% compliance), failed to meet the WHO benchmarks. Conversely, subcategories such as soy sauce (100%) and chocolate (81.81%) demonstrated high compliance rates. In conclusion, most packaged foods in the local market significantly exceed international sodium standards. These findings underscore the urgent need for integrative national benchmarks and progressive food reformulation policies to mitigate the burden of non-communicable diseases in Indonesia.

Keyword : *processed food; sodium; WHO Global Sodium Benchmarks*

ABSTRAK

Pangan olahan kemasan telah menjadi bagian dari gaya hidup modern, namun sering kali mengandung natrium tinggi yang berisiko terhadap hipertensi dan penyakit kardiovaskular. Penelitian ini bertujuan untuk mengevaluasi kandungan natrium pada produk pangan olahan kemasan di Kota Bengkulu berdasarkan *WHO Global Sodium Benchmarks* Edisi ke-2. Penelitian deskriptif dengan desain *cross-sectional* ini dilakukan pada Mei 2024 terhadap 500 produk dari 22 subkategori pangan yang diambil dari gerai ritel modern. Data kandungan natrium diperoleh dari label informasi nilai gizi dan dikonversi ke satuan mg/100 g atau mg/100 ml. Hasil penelitian menunjukkan nilai median natrium tertinggi terdapat pada kaldu konsentrat (3914 mg/100 g), kecap (2000 mg/100 ml), dan mi instan (1294 mg/100 g). Sebagian besar produk belum memenuhi *WHO Global Sodium Benchmark*, terutama pada subkategori ikan kaleng (0%), snack kacang-kacangan (0%), dan mi instan (2.63%). Sebaliknya, tingkat kepatuhan tinggi tercatat pada kecap (100%) dan cokelat (81.81%). Kesimpulannya, mayoritas pangan olahan di pasar domestik masih melampaui standar natrium internasional, sehingga diperlukan penetapan tolok ukur nasional yang integratif serta kebijakan reformulasi pangan

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yang progresif untuk menekan beban penyakit tidak menular di Indonesia.

Kata Kunci : natrium; pangan olahan; WHO Global Sodium Benchmarks

INTRODUCTION

Packaged processed foods have become an inseparable part of the modern lifestyle, offering convenience and a longer shelf life. Advances in packaging technology have significantly enhanced the practicality of processed food products. Modern packaging of processed foods plays an important role in extending shelf life, providing protection, and facilitating storage, distribution, and brand imaging, thereby effectively meeting the demands of modern consumers (Mmari, 2019).

The use of sodium in packaged processed foods refers to the practice of adding sodium, usually in the form of salt (sodium chloride) or other sodium-containing additives, to packaged food products (Mkhwebane, Bekker and Mokgalaka-Fleischmann, 2023). Packaged processed foods utilize sodium primarily for preservation, flavor enhancement, and texture. Sodium plays an important role in ensuring food safety and quality by functioning as a preservative and antimicrobial agent, thereby extending shelf life and improving palatability (Loren *et al.*, 2023).

Most of the sodium we consume generally comes from processed foods. Excessive sodium intake has serious health implications, prompting global initiatives to reduce sodium levels in processed foods (Loren *et al.*, 2023). The health risks associated with high sodium intake have driven research and regulation aimed at reducing sodium levels in processed foods. The challenge lies in balancing the functional role of sodium in food processing with its health impact (Kurtz, Pravenec and Dicarlo, 2022).

A poor diet, including the habit of high sodium consumption, can have negative health consequences, particularly an increase in blood pressure. The prevalence of hypertension (blood pressure ≥140/90 mmHg) in many countries exceeds 40% (Manjrekar *et al.*, 2024). Hypertension is a major risk factor for cardiovascular disease, contributing to 62% of stroke cases and 49% of coronary heart disease (CHD) cases, and is a leading cause of global mortality. The 2023

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Indonesian Health Survey (SKI) reported that the prevalence of hypertension in the population aged ≥15 years based on blood pressure measurement was 29.2%, and the prevalence of heart disease was 0.85%. Limiting salt intake to approximately 5 grams (or < 2 g of sodium) per day, in accordance with the recommendation of the World Health Organization (WHO), is estimated to prevent approximately four million cases of disease per year globally (Ojo *et al.*, 2023).

Since 2021, the WHO has established the *Global Sodium Benchmarks* for sodium in packaged processed foods. This standard regulates the maximum sodium content (in mg per 100 g) for each food category. The *WHO Global Sodium Benchmarks* 2021 edition regulated 18 categories of processed foods that were further divided into 70 subcategories. In 2024, the WHO published the latest standard, the *WHO Global Sodium Benchmarks* 2nd Edition (WHO, 2024), which is a refinement of the previous edition. In this latest edition, the number of subcategories has been expanded to 76. *WHO Global Sodium Benchmarks* regulates sodium limits per food subcategory based on the global median value because this is considered rational (achievable). The use of the median value as the basis for setting benchmarks implies that half of the products in a given subcategory at the global level are already at or below the threshold, while the other half still exceed it. In addition, the advantage of the median value is that it is less affected by *outlier*s than the *mean* (WHO, 2024). *WHO Global Sodium Benchmarks* can be used as a recommendation and guidance for countries worldwide in establishing feasible and effective sodium reformulation programs. The goal is to reduce the burden of non-communicable diseases (NCDs) related to diet and nutrition in order to achieve the daily salt intake target.

In Indonesia, the regulation regarding the labeling of processed foods is set out in BPOM Regulation No. 26 of 2021 on Nutritional Value Information on Processed Food Labels. This regulation specifically provides guidance on the inclusion of Nutritional Value Information (ING), including labels that identify products as healthier choices. In addition, BPOM Regulation No. 1 of 2022 on the Supervision of Claims on Labels and Advertisements of Processed Foods further regulates Nutrition Claims and Health Claims. Nevertheless, the healthier choice label as well as nutrition and

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health claims are voluntary for producers wishing to apply them to their products. In other words, there is currently no national *benchmark* regarding sodium limits in packaged processed foods.

Previous studies have reported high sodium levels in packaged processed foods in various countries. Almeida et al. found that 62.7% of supermarket products in Portugal exceeded the global maximum sodium limit (Almeida, Lopes and Patrícia, 2024). Similarly, the study by Bayram and Ozturkcan revealed that 31.8% of packaged processed foods were above the WHO *benchmark* target (Bayram and Ozturkcan, 2021). In Indonesia, the study by Istiqomah et al. reported that 66.56% of products did not meet the WHO *benchmark*. However, previous studies, including those conducted in Indonesia by Istiqomah et al., used the 1st Edition of the WHO *Global Sodium Benchmarks* (Istiqomah, Astawan and Palupi, 2021). Considering that global sodium recommendations continue to evolve, this study therefore aims to analyze the sodium content profile and the compliance rate of packaged processed foods with the WHO Global Sodium Benchmarks 2nd Edition. This will provide an up-to-date understanding of the sodium content in packaged processed foods in Indonesia, particularly in Bengkulu City.

METHOD

Design, setting, and time

This study was a descriptive *cross-sectional* study using sodium content data from the packaging labels of processed food products. The research location was a modern retail outlet/minimarket in Bengkulu City, selected based on the consideration that the products sold across its outlets are relatively similar and that it has wide accessibility throughout Indonesia. Data collection was conducted in May 2024. Packaged processed foods in this study refer to foods or beverages that are processed and packaged using certain methods or techniques, with or without additional ingredients.

Sample size and sampling procedure

The sample of this study consisted of packaged processed food products that may contribute to sodium intake. The sample criteria were as follows:

a) Inclusion criteria
   1) Presence of a food label (composition and nutritional content)

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2) The food label was clearly legible
3) The nutritional value information stated the sodium content
4) The product had a BPOM RI distribution permit
5) The net weight of the product (*netto*) was stated

b) Exclusion criteria
1) Foods for infants and toddlers, such as infant formula and follow-on formula.
2) Fresh foods (fruits, vegetables, fish, eggs, and fresh meat)
3) 100% fruit juice
4) Foods/beverages intended for specific purposes (for example, protein powders, nutritional supplements)
5) Intermediate/semi-finished products (cooking oil, wheat flour)
6) Products that must be pre-ordered (not directly available in the minimarket)
7) Products that do not require a nutrition label (bread products and cut fruit produced and packaged in-store)
8) Products with only a P-IRT distribution permit.

Based on the criteria above, 1,003 products met the sample criteria. A *stratified random sampling* procedure was then applied based on food category, in which 50 percent of the samples were randomly selected from each category. The 500 products obtained were then grouped by subcategory, yielding 22 subcategories of processed food products in this study. The sample size determination followed Yamane's formula for a finite population; at N = 1,003 with a 95% confidence level and a *margin of error* of 5%, the recommended minimum sample size was 286 products (Yamane, 1973). This study selected a sampling fraction of 50% (n = 500), which exceeded that minimum threshold, with the consideration that a larger sample size could improve the precision of the median sodium estimate and ensure stratum representation in smaller subcategories (Israel, 1992).

Type and method of data collection

Data collection was carried out by retrieving information on processed food products from the publicly accessible information system of a modern minimarket chain. Detailed information on the packaging labels was then obtained through online searches on the official product websites and through direct purchase of products for items whose information was not available online. The data recorded from the packaging labels

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were (1) brand type/variant, (2) physical form of the packaged processed food (liquid/solid), (3) net weight (grams), (4) number of servings, and (5) sodium content information.

Data analysis

The sodium content on the packaging label, which is usually expressed in mg per serving, was converted into mg/100 g or mg/100 ml in accordance with the units used in the *WHO Global Sodium Benchmarks*. The data were then entered into Microsoft Office Excel, where each product was assigned a sample code, grouped by food subcategory, and compared with the maximum sodium limit per food category according to the WHO standard.

Data analysis was conducted descriptively. For each food subcategory, the median, minimum, and maximum sodium content values were calculated. The median sodium value of each food subcategory was compared with the WHO *Global Sodium Benchmark* so that the percentage of compliant products could be determined. This percentage of compliance with the standard was not calculated for processed fruits, beverages, yogurt, candies, and ice cream because the WHO *Global Sodium Benchmark* does not yet regulate maximum sodium content for these products. In addition, the percentage gap of sodium content compared with the WHO *Global Sodium Benchmark* was also analyzed using the formula: median sodium content of each subcategory / maximum sodium limit of the subcategory according to WHO × 100.

Ethical approval

Ethical approval for this study was granted by the Ethics Committee of Politeknik Kesehatan Kementerian Kesehatan Bengkulu (Approval No. KEPK.BKL/026/02/2024).

RESULTS AND DISCUSSION

Sample Characteristics and Sodium Content of Packaged Processed Foods

This study identified 500 samples of packaged processed food products that were classified into 22 subcategories according to the *WHO Global Sodium Benchmarks*. Table 1 shows that the subcategories with the largest number of samples consisted of beverages (17%), yogurt (11.2%), potato

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chips and extruded snacks (11.2%), and biscuits (10.6%).

The sodium content of the processed foods is presented as minimum, maximum, and median values. Table 1 shows that, among all packaged processed foods, the five subcategories with the highest median sodium values were concentrated bouillon (3,914 mg/100 g), soy sauce (2,000 mg/100 ml), instant noodles (1,294 mg/100 g), cheese (1,250 mg/100 g), and instant seasonings (1,050 mg/100 g). The high median values in the food additive categories—such as concentrated bouillon, soy sauce, and instant seasonings—reflect the functional role of sodium as a *flavor enhancer* as well as an antimicrobial agent that extends product shelf life. Although the volume of seasoning used in a single serving tends to be limited, the extremely high sodium density still contributes significantly to the accumulation of daily intake if used beyond the recommended amount.

Table 1. Sodium Content of Packaged Processed Foods (mg/100 g or mg/100 ml)

Food Subcategory	n	%	Sodium content		
			Min	Max	Median
Beverages	85	17	0	500	25
Yogurt	56	11.2	15	286	44
Potato chips and extruded snacks	56	11.2	71	1,389	533
Biscuits	53	10.6	57	1,500	271
Candies	41	8.2	0	186	33
Instant noodles	38	7.6	463	2,463	1,294
Ice cream	32	6.4	0	80	25
Instant seasonings	21	4.2	0	18,667	1,050
Bread	20	4	64	429	155
Processed meat	19	3.8	255	1,250	740
Cereals	13	2.6	94	425	191
Chocolate	11	2.2	0	400	44
Cheese	10	2	483	1,680	1,250
Processed fruits	10	2	0	2,200	300
Concentrated bouillon	6	1.2	909	24,242	3,914
Nut and seed snacks	6	1.2	300	1,308	500
Condiments	5	1	76	2,250	882
Seaweed snacks	5	1	222	889	222
Butter/margarine and oils	4	0.8	833	1,000	904
Canned fish	4	0.8	560	950	732
Soy sauce	3	0.6	150	2,733	2000

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Food Subcategory	n	%	Sodium content		
			Min	Max	Median
Peanut butter	2	0.4	42	328	125
Total	500	100			

The phenomenon of instant noodles as one of the products with the highest sodium levels is consistent with the findings reported by previous research (Istiqomah, Astawan and Palupi, 2021). Prihatini et al. reported that instant noodles were the leading contributor to sodium intake in the 6–18 year age group, accounting for 13.2%, above sauces and seasonings (Prihatini, Julianti and Hermina, 2016). In addition, based on the *Individual Food Consumption Survey* (IFCS) in DKI Jakarta, Setyowati et al. found that the average daily consumption of instant noodles reached 36.25 g/day across all age groups (Setyowati, Andarwulan and Giriwono, 2018).

Sodium Content of Packaged Processed Foods Compared with *WHO Global Sodium Benchmarks*

The analysis of sodium content in packaged processed foods was conducted by comparing the values with the *WHO Global Sodium Benchmarks* to evaluate the level of *compliance* for each subcategory. Table 2 shows that almost all samples in the canned fish, nut and seed snacks, and instant noodles subcategories did not meet the WHO *Global Sodium Benchmark*. A low *compliance* level was also found in the cheese, processed meat, condiment, and biscuit subcategories, with compliance percentages still below 25%. Conversely, fairly good *compliance* was recorded for the subcategories of soy sauce (100%), chocolate (81%), instant seasonings (76%), bread (70%), and cereals (69%). Several subcategories of packaged processed foods, such as beverages, yogurt, ice cream, and processed fruits, are not yet regulated under the provisions of the *WHO Global Sodium Benchmarks*.

Analysis of the *compliance rate* shows a substantial gap between the nutritional profile of domestic products and international standards. This finding is in line with the study by Istiqomah et al., which found that the majority of processed foods (66.56%) in Indonesia did not meet the WHO 1st Edition criteria, with the lowest *compliance* level found significantly in the

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subcategories of instant noodles (7.39%), canned fish (2.42%), and condiments (6.32%) (Istiqomah, Astawan and Palupi, 2021).

Table 2. Number of Packaged Processed Foods in Percent (n%) Meeting the WHO Global Sodium Benchmarks

Subcategory	Number of samples (n)	WHO sodium standard (mg/100 g)	Median	n meeting the WHO Global Sodium Benchmark	n (%) meeting the WHO Global Sodium Benchmark
Beverages	85	-	25	n.a.	n.a.
Yogurt	56	-	44	n.a.	n.a.
Potato chips and extruded snacks	56	≤470	533	23	41.07
Biscuits	53	≤200	271	13	24.52
Candies	41	-	33	n.a.	n.a.
Instant noodles	38	≤800	1,294	1	2.63
Ice cream	32	-	25	n.a.	n.a.
Instant seasonings	21	≤6,000	1,050	16	76.19
Bread	20	≤370	155	14	70
Processed meat	19	≤540	740	3	15.78
Cereals	13	≤280	191	9	69.23
Chocolate	11	≤150	44	9	81.81
Cheese	10	≤600	1,250	1	10
Processed fruits	10	-	300	n.a.	n.a.
Concentrated bouillon	6	≤1,200	3,914	2	33.33
Nut and seed snacks	6	≤280	500	0	0
Condiments	5	≤650	882	1	20
Seaweed snacks	5	≤575	222	3	60
Butter/margarine and oils	4	≤400	904	2	50
Canned fish	4	≤280	732	0	0
Soy sauce	3	≤4,840	2000	3	100
Peanut butter	2	≤200	125	1	50

n.a. (*not analyzed*): the *compliance* percentage was not calculated because no maximum limit is yet regulated in the WHO Global Sodium Benchmarks for these subcategories

A similar phenomenon has also been reported in Portugal (Almeida, Lopes and Patrícia, 2024) and in China (Ding *et al.*, 2023) indicating that this issue represents a global public health challenge. This contrasts significantly with findings in Turkey, where 70% of products met the established sodium target (Bayram and Ozturkcan, 2021). The results of this study indicate that there is a substantial challenge in food reformulation efforts in Indonesia. The establishment of a national *benchmark* for processed foods is highly important for regulating the sodium content of products on the market. This is expected to reduce the risk of non-communicable diseases in the community,

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particularly cardiovascular disease (Janice Padilla-Moseley, Adriana Blanco-Metzler, Mary R. L'Abbé, 2022).

Sodium Content Gap of Packaged Processed Foods Compared with *WHO Global Sodium Benchmarks*

The *gap analysis* in Figure 1 shows that 10 of 17 subcategories had median values exceeding the WHO standard. Significant gaps were found in concentrated bouillon (226%), canned fish (161%), butter/margarine (126%), cheese (108%), and nut snacks (79%). These results are in line with the previous reported findings (Martini *et al.*, 2022), which showed that sodium content in the processed fish and processed nut groups (nut-based snacks) exceeded the recommended limit by almost twofold. This gap can be associated with the wide variation in sodium *benchmark* values for processed fish products applied across countries. The WHO *Benchmark* of 280 mg/100 g for processed fish products is much lower than the *Healthier Choice Logo* (HCL) limit in Singapore of 550 mg/100 g and the European nutrient profile of 680 mg/100 g (Santos *et al.*, 2019). In establishing a national *benchmark*, more comprehensive consideration is required in setting the maximum limit, given that fishery products may contain naturally occurring sodium.

The analysis of the seven other food subcategories—covering instant seasonings, bread products, cereals, chocolate, seaweed snacks, soy sauce, and peanut butter—shows a positive trend in which the median sodium values are below the maximum threshold set by the WHO. This finding indicates the technical feasibility for producers to manufacture processed foods with sodium content that complies with the WHO *Global Sodium Benchmark*. The existence of these products provides a strong empirical basis for the government to establish stricter national *benchmark*s for sodium. The implementation of such standards could potentially be carried out without drastically disrupting market stability, given that most of these subcategories have already shown natural compliance with the global target.

According to Rosewarne *et al.* (2020), sodium content limits are considered feasible and appropriate when approximately 33% of products on the market already meet the

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criterion, with a deviation range of 10% above or below (23–43%). Conversely, the WHO (2018) states that if less than 10% of existing products are able to meet the criterion, then the sodium threshold may be raised or relaxed so that it becomes more achievable and realistic for the industry. This emphasizes the importance of establishing a sodium threshold that is tailored to the nutrient profile of products available in the domestic market. Therefore, the formulation of a national *benchmark* is more recommended than rigidly adopting the international target approach (Istiqomah, Astawan and Palupi, 2021).

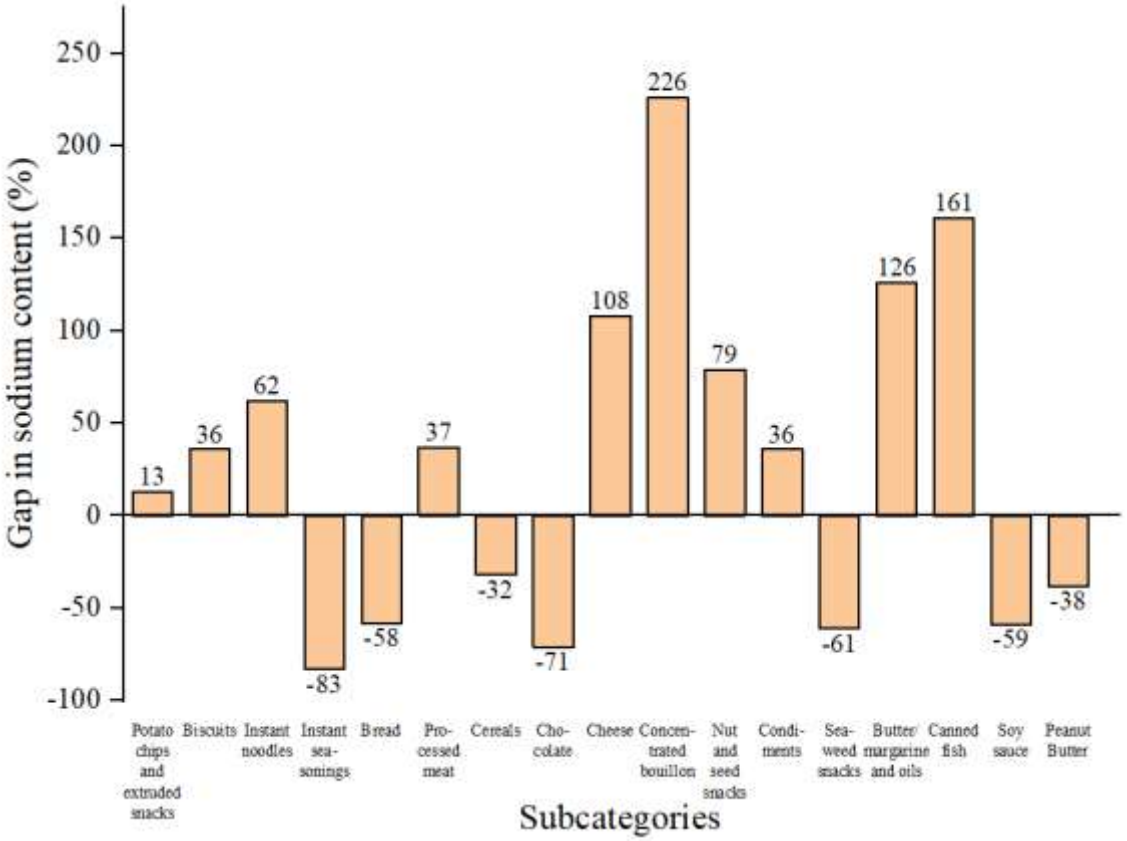

Figure 1. Percentage Gap in Sodium Content of Packaged Processed Foods Compared with *WHO Global Sodium Benchmarks*

At present, there are no national regulations that specifically govern the maximum sodium content in processed foods on a *mandatory* basis. Without binding reformulation policies, producers tend to maintain high sodium levels in order to preserve consumer taste preferences and to keep production costs low (Ojo *et al.*, 2023).

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In addition, the lack of consumer knowledge and awareness in reading nutrition facts labels weakens market pressure on producers to manufacture healthier foods (Manjrekar *et al.*, 2024). A more integrative national policy is needed, such as setting progressive sodium reduction targets for the food industry to reduce the burden of non-communicable diseases in Indonesia. In addition, strategic efforts from modern retailers are needed to support consumer sodium-intake limitation through the application of *Front-of-Pack Nutrition Labelling* (for example, color-coded labeling) to help consumers quickly identify the sodium content profile, while at the same time addressing the low literacy in reading nutrition labels that has long been an obstacle to choosing healthier foods.

The results of this study have several practical implications. For regulators, the National Agency of Drug and Food Control (BPOM) together with the Ministry of Health needs to review and establish a national *benchmark* for sodium content, developed on the basis of domestic food composition data, so that the industry can prepare technologically *feasible* steps that can be implemented through a gradual approach, formulation optimization, and the use of salt substitutes (Inguglia *et al.*, 2017; Loren *et al.*, 2023). For stakeholders in education and public health, a consistent nutrition-label literacy campaign and the training of nutrition personnel at the primary care level are needed to improve consumers' literacy in reading and utilizing sodium information on packaging labels. This study has limitations that should be noted. Sodium content data were obtained from the nutrition facts labels on the packaging; therefore, the actual sodium content may differ from the values listed on the product label.

CONCLUSION

The sodium content in most packaged processed food products does not currently comply with the standards set forth by *WHO Global Sodium Benchmarks*. Very significant non-compliance was found in the subcategories of canned fish, nut and seed snacks, and instant noodles. This condition indicates a substantial challenge in food reformulation efforts in Indonesia. Therefore, the establishment of a more integrative and progressive national *benchmark* is a crucial step to encourage the food industry to reduce sodium levels, in order to reduce the burden of non-communicable diseases such as

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hypertension and cardiovascular disease in the community. Further research is needed to evaluate the contribution of processed food consumption to the total sodium intake of the population.

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