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Evaluation of Nutritional Labeling and Commercialization of Salted Pork Offal and Salted Fish in Supermarkets in the South Zone of Rio de Janeiro Municipality

Avaliação da Rotulagem Nutricional e das Condições de Comercialização de Miúdos Suínos Salgados e Peixes Salgados em Supermercados da Zona Sul do Município do Rio de Janeiro

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Abstract

Salted foods such as pork offal and fish are widely consumed in traditional Brazilian dishes, such as feijoada, and during festive occasions like Easter and Christmas. However, improper handling and preparation of these products may lead to excessive sodium intake, increasing the risk of chronic diseases. This study aimed to evaluate the compliance of nutritional labeling and packaging practices of salted pork offal and salted fish, based on declared sodium content, presence of food additives, shelf life, packaging type, desalting instructions, and storage conditions. Labels from 29 salted pork offal and 11 salted fish products, belonging to 19 different brands and sold in five supermarket chains in the South Zone of Rio de Janeiro, were analyzed. Data collection was conducted through photographic records at points of sale and analyzed according to ANVISA's regulatory standards IN n° 75/2020, n° 92/2002, and n° 01/2019. Nonconformities were identified in pork offal and salted fish, respectively: absence of the sodium warning symbol (24% and 64%), omission of sodium content in the nutritional table (24% and 45%), variations in shelf life (41.19% and 35.36%), lack of desalting instructions (83% and 100%), and poorer labeling and storage conditions (41.37% and 81.81%) when repackaged by supermarkets. The presence of curing agents (72%) and lack of information on additives (28%) were also observed in pork offal. The findings reinforce the need for enhanced inspection and training of retail establishments to ensure compliance with current legislation.

Keywords: Salted Pork Offal. Salted Fish. Dry-Salted Fish. Sodium. Labeling.

Resumo

Os alimentos salgados: miúdos suínos e peixes são amplamente consumidos em preparações típicas, como a feijoada e em datas comemorativas como a Páscoa e o Natal. O pré-preparo inadequado deles pode favorecer o consumo excessivo de sódio, aumentando o risco de desenvolvimento de doenças crônicas. Este estudo teve como objetivo avaliar a conformidade das informações nutricionais e práticas de rotulagem de miúdos suínos salgados e peixes salgados, com base na análise do teor de sódio declarado, presença de aditivos alimentares,

validade, tipo de embalagem, orientações de dessalgue e condições de armazenamento. Foram analisados os rótulos de 29 miúdos suínos salgados e 11 peixes salgados, pertencentes a 19 marcas, comercializados em 5 redes de supermercados na Zona Sul do município do Rio de Janeiro. A coleta dos dados ocorreu através de registros iconográficos nos pontos de venda, analisados conforme as Instruções Normativas da ANVISA n° 75/2020, n° 92/2002 e n° 01/2019. Foram identificadas inconformidades nos miúdos suínos salgados e peixes salgados, respectivamente: ausência da lupa indicativa (24% e 64%), omissão do teor de sódio na tabela nutricional (24% e 45%), variações nas validades (41,19% e 35,36%), ausência de orientações de dessalgue (83% e 100%), condições de rotulagem e armazenamento mais precários (41,37% e 81,81%) quando fracionados pelos supermercados. Também foi observada a presença de agentes de cura (72%) e ausência de informações sobre aditivos (28%) nos suínos salgados. Os achados reforçam a necessidade de fiscalização e capacitação dos estabelecimentos, assegurando o cumprimento da legislação.

Palavras-chave: Miúdos Suínos Salgados. Peixes Salgados. Peixes Salgados Secos. Sódio. Rotulagem.

1 Introduction

Feijoada, recognized as Intangible Cultural Heritage of the State of Rio de Janeiro, is traditionally prepared with black beans, jerked beef, sausages and salted pork offals, such as trotters, ears, tails and skin (Bitelli; Jurema, 2019). These salted pork offals are widely marketed and undergo an industrial salting process, which aims to reduce the activity of meat water to delay microbial proliferation, as recommended by Normative Instruction N° 92 of the Ministry of Agriculture, Livestock and Supply - MAPA (Brasil, 2020a).

Brazilian pork represents 3.2% of the world market, with a production of 3.9 million tons in 2019, positioning Brazil among the five largest producers worldwide, behind China, the European Union and the United States (Bastos *et al*., 2023). In Brazil, porks are the third type of meat most consumed, being behind only beef and chicken meat (Santos *et al*., 2024). Its characteristic flavor, relatively affordable price and cultural relevance, especially in the preparation of dishes such as feijoada and feijoada dumpling, give pork an important role in national cuisine (Bitelli; Jurema, 2019; Santos *et al*., 2024).

The consumption of salted meats is traditional in Brazilian gastronomy, which includes not only the salted pork offals, but also the dried salted fish that are widely used in the preparation of dishes consumed in daily Rio, such as roast cod, due to the influence of Portuguese colonization (Rocha, 2015).

Brazil is a major importer of salted fish (Lima; Sant'Ana, 2011; Moura; Souza; Almeida Filho, 2021). In 2020, Norway exported approximately 17,663 tons of salted fish to the country, with cod (*Gadus morhua*) accounting for 30% of this total (Moura; Souza; Almeida Filho, 2021).

The rich nutritional composition of the fish favors its deterioration by microorganisms and enzymes, requiring the use of conservation techniques to prolong their useful life. Salting, by reducing fish water activity, is an effective method to prevent its deterioration, and its quality is regulated by Normative Instruction N° 1 of MAPA (Brasil, 2019a).

Although salting is an effective method of conservation, it can be a health risk when the desalting of these salty products is not performed correctly during pre-preparation of food, leading to a high consumption of sodium, a risk factor for systemic arterial hypertension (SAH). When not properly treated, SAH can aggravate and accelerate loss of renal function in patients with chronic kidney disease (CKD) (Rezende *et al*., 2021).

CKD is a syndrome marked by the slow, silent and progressive loss of renal functions, and may evolve into chronic renal failure (CRF) triggering severe cardiovascular and neurological manifestations (Santos; Ferreira; Santos, 2021; Vasconcelos *et al*., 2021). In patients submitted to hemodialysis, the diet sodium intake should be carefully controlled, and a daily intake of between 5 g to 6 g per day is recommended to avoid complications such as interdialytic weight gain (IDWG), hypertension, congestive heart failure and even death (Françozi; Vasata; Cervo, 2017).

The interaction between SAH and CKD involves mechanisms of hydro electrolytic balance and renin-angiotensin-aldosterone system that contribute to the progression of renal disease (Rezende *et al*., 2021). In this sense, excessive sodium intake in the diet is directly related to the development and worsening of arterial hypertension, a factor that accelerates the loss of renal function in CKD patients.

Given this context, the present study aimed to evaluate the compliance of the sodium content reported on the labels of porks and salted fish and dried salted fish in the light of Normative Instruction N° 75/2020, establishing the requirements for the declaration of nutritional labeling in packaged foods (Brasil, 2020b).

The following were also studied: the values recommended and declared by the manufacturers of portions of salted pork offals, salted fish and dried salted fish; presence of food additives in these products; storage conditions at points of sale; validity of products; and the presence of guidelines on the desalting process of salted pork offals, salted fish and dried salted fish.

2 Material and Methods

Labels of 29 salted pork offals and 11 salted fish and dried salted fish belonging to 19 different brands, distributed across 5 branches of 5 different supermarket chains located in the South Zone of the city of Rio de Janeiro, were analyzed.

The collection of the labels information was carried out through photographic records of the salted pork offals, salted fish and dried salted fish arranged in the sales points of the different supermarket chains. After the images capture, the data were organized in spreadsheets, grouped into two distinct tables: one for salted pork offals and the other for salted fish and dried salted fish (Tables 1 and 2, respectively). In each table the following were recorded: product, brand, supermarket where

the product was marketed, shelf life, presence of animal inspection seal, presence of food additives, magnifying glass identification, portion declared on the label and type of packaging used.

Table 1 - Data on the salted pork offals found in 5 different supermarkets in the South Zone of the Municipality of Rio de Janeiro

Product	Supermarket	Brand	Shelf life (days)	Portion of the label	Suitability of magnifying glass identification	Presence of Additives	Type of seal	Type of package*
Belly	B	1	30	100g	Suitable	Yes	SIF	Tray
Belly	D	2	90	30g	Suitable	Yes	SIE/RJ	Vacuum
Meat	A	3	90	30g	Suitable	Yes	SIF	Vacuum
Rib	B	1	30	100g	Suitable	Yes	SIF	Tray
Rib	C	4	90	30g	Suitable	Yes	SIE/RJ	Vacuum
Rib	E	1	15	100g	Inadequate	No ingredients list	Without seal	Tray
Throat	B	5	15	30g	Suitable	Yes	SIF	Tray
Throat	D	6	75	100g	Unreadable	Yes	SIE/RJ	Vacuum
Throat	E	7	10	30g	Inadequate	Yes	SIE/RJ	Tray
Knee	B	8	30	50g	Suitable	Yes	SIF	Tray
Feijoada kit	A	3	45	100g	Suitable	Yes	SIF	Vacuum
Feijoada kit	B	2	90	100g	Suitable	Yes	SIE/RJ	Vacuum
Feijoada kit	C	9	120	100g	Suitable	Yes	SIF	Vacuum
Feijoada kit	E	2	90	100g	Inadequate	Yes	SIE/RJ	Vacuum
Ear with mask	A	2	90	30g	Suitable	Yes	SIE/RJ	Vacuum
Ear	A	3	90	30g	Suitable	No	SIF	Vacuum
Ear	B	10	30	100g	Suitable	Yes	SIF	Tray
Ear with mask	E	11	15	64g	Inadequate	No	SIF	Tray
Ear with mask	E	2	90	30g	Inadequate	Yes	SIE/RJ	Vacuum
Foot (trotter)	A	3	90	30g	Suitable	No	SIF	Vacuum
Foot (trotter)	B	10	30	100g	Suitable	Yes	SIF	Tray
Foot (trotter)	D	2	90	30g	Suitable	Yes	SIE/RJ	Vacuum
Foot (trotter)	D	6	75	100g	Suitable	Yes	SIE/RJ	Vacuum
Foot (trotter)	E	11	15	70g	Inadequate	No	SIF	Tray
Leg	C	4	90	30g	Suitable	Yes	SIE/RJ	Vacuum
Tail	B	2	30	100g	Suitable	Yes	SIE/RJ	Tray
Tail	D	6	75	30g	Unreadable	No	SIE/RJ	Vacuum
Tail	D	2	90	30g	Unreadable	Yes	SIE/RJ	Vacuum

* Note: Tray (fractionated in supermarket); vacuum (fractionated in industry).
Source: research data.

Table 2 - Data on salted fish and dried salted fish found in 5 different supermarkets in the South Zone of the Municipality of Rio de Janeiro.

Product*	Supermarket	Brand	Shelf life (days)	Portion of the label	Suitability of magnifying glass identification	Presence of Additives	Type of seal	Type of package**
Salted cod dried in pieces	A	Unreadable	15	Without	Inadequate	No	Unreadable	Tray
Salted cod dried	B	1	15	100g - Tray 60g - Counter (Retail)	Suitable	No	SIF	Tray
Porto-style Codfish in steaks	C	2	-	100g	Inadequate	No	Unreadable	Tray
Porto-style codfish	D	3	15	Without	Inadequate	No	SIF	Tray
Cod	E	4	15	100g	Inadequate	No	SIF	Tray
Frozen salted cod loin	A	5	730	60g	Suitable	No	SIF	Box
Frozen salted saithe loin	A	5	730	60g	Suitable	No	SIF	Box
Dried salted saithe [1]	B	1	15	100g - Tray 60g - Counter	Suitable	No	SIF	Tray
Dried salted saithe[2]	D	3	15	Without	Inadequate	No	SIF	Tray
Salted saithe	E	6	15	100g	Inadequate	No	Not on the package	Tray
Salted Zarbo	C	2	-	100g	Inadequate	No	Unreadable	Tray

* Salted cod dried in pieces (*Gadus macrocephalus*); dried salted cod, Porto-style cod in steak and cod (*Gadus morhua*); frozen salted cod loin (*Gadus macrocephalus*); frozen salted saithe loin and salted dried saithe[1] (*Pollachius virens*); salted dried saithe [2] and salted saithe (without species specification); salted zarbo (*Brosmius brosme*). ** Tray (fractionated in supermarket); vacuum (fractionated in industry).
Source: research data.

The construction of Tables 1 and 2 was based on the current legislation on mandatory labeling, presence of food additives and storage conditions of the products at their respective points of sale, as recommended by IN N° 92/2020 and IN N° 1/2019 (Brasil, 2019a; Brasil, 2020a).

The salted pork offals analyzed were belly, meat, rib, throat, knee, foot (trotter), tail, ear with

and without mask, leg and feijoada kit (salted pork ear, salted leg, salted pork tail, calabrese sausage, bacon). The salted fish and dried salted fish studied were dried salted cod (*Gadus morhua* and *Gadus macrocephalus*), frozen salted cod loin (*Gadus macrocephalus*), salted saithe and dried salted saithe (*Pollachius virens*), frozen salted saithe loin (*Pollachius virens*) and salted zarbo (*Brosmius brosme*).

The analysis of the salted pork offals labeling, salted fish and dried salted fish was carried out according to Normative Instruction N° 75/2020 of ANVISA, which establishes the size of the portions used for nutritional labeling of packaged foods (Brasil, 2020b). Although this standard does not specifically mention the salted porks and salted fish and dried salted fish, it was possible to frame them in the group of meats and eggs (Group V) of this normative instruction, whose average energy value of the portion is equivalent to 125 kcal.

The type of packaging used for the products marketing and shelf life were also observed. The inspection typology of salted porks and salted fish and dried salted fish based on the services coordinated by the Department of Animal Product Inspection (DIPOA) was also an analyzed factor.

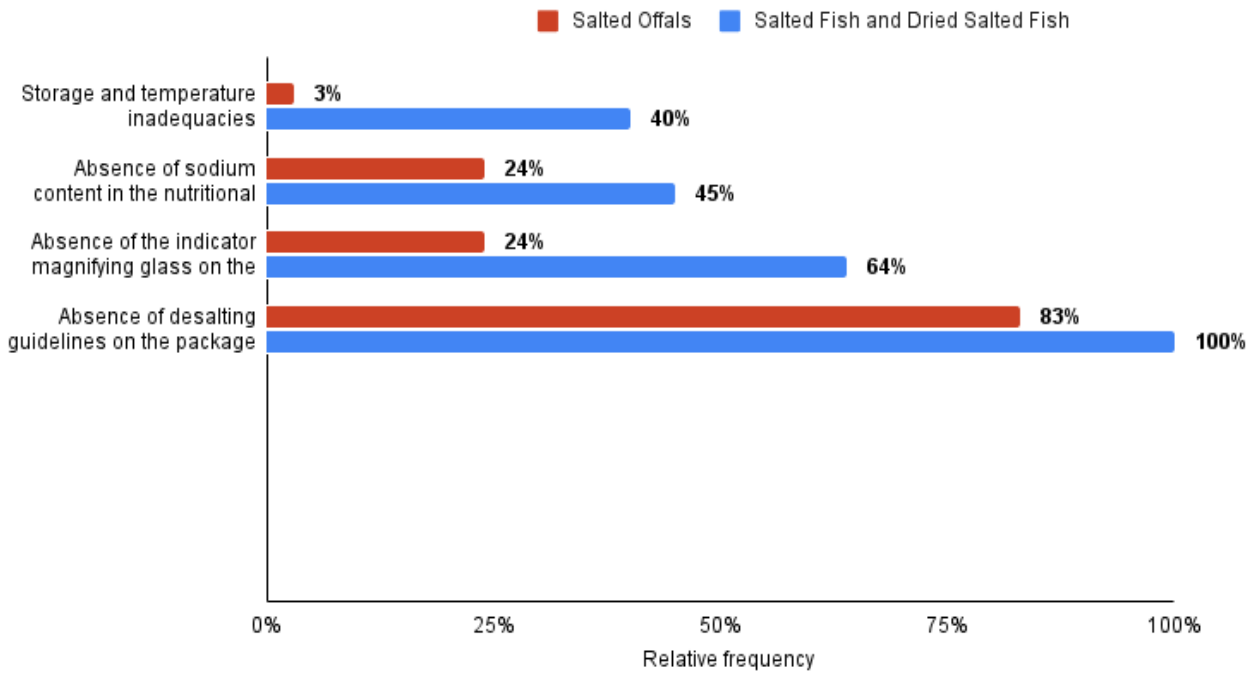
The type of inspection of animal products was analyzed considering two distinct seals found during the research: the Federal Inspection Seal (SIF) and the State Inspection Seal of Rio de Janeiro (SEI-RJ). SIF is issued by the Department of Inspection of Animal Products (DIPOA), linked to the Ministry of Agriculture, Livestock and Supply (MAPA), and ensures that the product has been inspected and approved for commercialization throughout the national territory, as well as for export. SEI-RJ, issued by the State Secretariat of Agriculture, Livestock, Fisheries and Supply of the State of Rio de Janeiro, certifies that the product was inspected for commercialization at the state level.

Both seals ensure the origin and hygienic-sanitary quality of the products, being important criteria for analysis and classification of salted porks and salted fish and dried salted fish during this research.

3 Results and Discussion

Based on the information collected and organized in Tables 1 and 2, inadequacies were identified in the marketing of salted porks, salted fish and dried salted fish in the 5 supermarket networks analyzed. The identified non-conformities refer mainly to storage conditions, nutritional labeling and the absence of desalting guidelines, as illustrated in Figure 1.

Figure 1 - Relative frequency (%) of nonconformities observed in salted porks, salted fish and dried salted fish marketed in the Southern Zone of the city of Rio de Janeiro



Source: research data.

Variations in shelf life associated with the type of packaging, presence of food additives, values of the portions declared on the labels and the sodium contents reported were also observed, in disagreement with the criteria of IN N° 75/2020 (Brasil, 2020b). These observations are detailed below.

3.1 Storage conditions and presence of vectors at points of sale

In supermarket E, 14% of the salted porks sold did not meet the cooling conditions indicated on the label, which recommended the storage of the product between 4°C and 7°C. These products were exposed to the ambient temperature of the supermarket, controlled only by fans.

A similar situation was described by Miranda and Barreto (2012), who identified inadequate storage outside the cooling temperature range from 6° to 15°C of jerked beef in 13% of the evaluated establishments.

RTIQ number 1/2019 defines that salted fish and dried salted fish are classified as cured fish, obtained from fresh, cold, frozen or thawed fish from fishing or aquaculture. These products are made with clean, eviscerated fish, with or without head, fins, scales and skin, and submitted to salting with sodium chloride, and may or may not contain additives. Salted fish is the one submitted only to the salting process and should present moisture between 53% and 58%. Whereas dried salted fish, in addition to salting, goes through a drying stage, by natural or artificial evaporation, and should contain

a maximum humidity of 52.9% (Brasil, 2019a).

In relation to salted fish and dried salted fish, 36% of the products sold in the 5 supermarkets analyzed were without refrigeration, contrary to that recommended by RTIQ N° 1/2019 (Brasil, 2019a). It determines that dried salted fish should be transported and stored at a temperature of 7°C.

Oliveira, Nunes and Vieira (2021) also observed that, in São Luis (MA), all three supermarkets evaluated stored dry salted fish above 7 °C.

Dry salted fish does not present good conservation in places with high humidity and high temperatures, ideally storage occurs at temperatures below 10°C. Temperatures above this limit favor the growth of halophilic bacteria, resistant to high salinity, which results in reddish coloration and bad odor in the fish (Costa *et al*., 2022).

The absence of adequate refrigeration is a critical factor for the microbiological and sanitary safety of food marketed in supermarket chains.

As for the presence of vectors and pests, the presence of flies flying over and landing on the packaging of salted porks disposed for sale in the supermarket E.

Assis *et al*. (2019) reported that 78% of the establishments visited in their study that produced and commercialized jerked beef in the municipality of Salinas (MG) did not have insect protection screens or Integrated Pest Control Program, favoring the constant presence of flies, cockroaches and rodents.

Penha *et al*. (2018) analyzed 23 samples of dried beef and 7 samples of jerked beef and observed the presence of foreign materials, such as mites and animal hair, in 10% of the total analyzed. Considering that salted porks undergo high handling from salting to packaging, it is even more important to ensure adequate storage conditions at points of sale.

The presence of vectors in meat product processing sites amplifies the spread of pathogens. Bacteria such as *Shigella* sp. and *Vibrio cholerae*, enteric virus, protozoan and helminths were isolated from flies, representing a serious risk to consumer health (Miranda; Barreto, 2012).

3.2 Type of packaging and shelf life

The type of packaging directly influences the quality and service life of meat products, since it modifies the environment around the food and favors conditions that delay deterioration reactions. Proper choice of packaging is crucial to prevent evaporation or absorption of moisture, product weight gain or loss and changes in odor, coloration, taste and texture (Oliveira, 2014).

In this study, the shelf life of salted pork offals ranged from 10 to 120 days, depending on the type of packaging used. The vacuum-packed products had validity between 45 and 120 days, with an average of 82.5 ± 31.22 days and a coefficient of variation of 37.85 %. The products packed in trays wrapped with PVC plastic film had validity between 10 to 30 days, with an average of 18.33 ± 10.41

days and a coefficient of variation of 56.78 %.

The vacuum-packed salted porks offered a longer shelf life and less variability in shelf life, evidencing a greater standardization in shelf life for this type of packaging.

Bagdatli and Kayaardi (2015), when comparing the shelf life of beef steaks subjected to 4 different conservation methods (tray, vacuum and modified atmosphere), observed that vacuum packaging provided the greatest preservative effect, maintaining a more reddish color and a better sensory evaluation of meat after 35 days of storage at 4 °C.

It was also found that 41.37% of the salted pork offals and 81.81% of the samples of salted fish and dried salted fish analyzed in this study were fractionated and packed by the supermarkets where they were sold.

Among these products fractionated by supermarkets, recurrent nonconformities were observed, such as the absence of sodium content declaration in the nutritional table and absence of the high sodium indicator magnifying glass in the frontal labeling. These two failures always occurred together, that is, the products that did not present the declaration of sodium content also did not contain the indicative magnifying glass. Thus, it was observed that 41.66% of the samples of the salted pork offals and 77.77% of the samples of salted fish and dried salted fish presented nonconformities regarding nutritional labeling.

Corrêa *et al* (2019) reported similar findings in supermarkets in Piauí, where they identified nonconformities in fractionated meat products, such as errors in the name and address of the manufacturer, name and sale of the food, list of ingredients, identification of origin, date of manufacture and expiration date.

In addition to the type of packaging, brands also influenced the shelf life. It was verified that the same type of salted pork offals, packaged in the same way, showed variations in shelf life between different brands. In supermarket D, for example, two vacuum-packed pork trotters of different brands, showed a difference of 15 days in the shelf life.

Similar situation was reported by Bittencourt *et al*. (2020), which identified a wide variation in shelf life of products manufactured by different companies, even following similar processes. According to the authors, these differences can be attributed to the different processing, packaging and storage technologies adopted by each company.

In relation to fish, salted fish and dried salted fish packed in trays covered with PVC film presented a shelf time of 15 days, while frozen salted fish reached up to 730 days of shelf life.

McNeish, Karlsdottir and Arason (2016) evaluated the quality and stability of salted red fish (*Sebastes marinus*) submitted to different methods of salting and storage temperature, concluding that the freezing preserved the physical and sensory characteristics of the fish even after 41 days of storage. On the other hand, the fillets submitted to dry salting and maintained at room temperature

showed higher lipid oxidation.

The choice of packaging should be associated with the use of adequate cooling to ensure the maintenance of the quality of salted meat products. Ideal storage temperature conditions are essential both to preserve the desired sensory characteristics and to extend the shelf life of these products (Bittencourt *et al*., 2020).

3.3 Presence of food additives

The addition of curing agents, classified as preservatives, associated with the salting process of meat products is also a widely used conservation technique, aiming not only the preservation of the product by increasing its osmotic pressure, but also the preservation of the product by increasing its osmotic pressure, but also obtaining a product of pinkish color and characteristic flavor (Brasil, 2023; Vasconcelos; Melo, 2010). When a preservative reacts with myoglobin, a pigment present in the meat, a color change occurs to reddish tones due to the formation of nitrosomioglobin (Rodrigues, 2021).

The Normative Instruction N° 92 authorizes, for cured salted offals, the use of the following curing salts: sodium nitrite (INS 250), potassium nitrite (INS 240), sodium nitrate (INS 251) and potassium nitrate (INS 252) (Brasil, 2020a, 2023).

Nitrite and nitrate have antioxidant function, being effective in preventing lipid rancidity by forming stable complexes with ferrous iron (Fe^{2+}), preventing its oxidation to ferric iron (Fe^{3+}), a potent catalyst for fat oxidation. During the curing process, nitrate is converted into nitrite by reducing bacteria, the latter being responsible for inhibiting the proliferation of *Clostridium botulinum* and the production of botulinum toxin, especially in vacuum-packed products (Oliveira, 2014).

In the five supermarkets visited, 72% of the salted pork offals had curing agents listed among their ingredients.

Mendes *et al*. (2020) evaluated the concentration of nitrites and nitrates in meat products marketed on the western border of Rio Grande do Sul and found that 25% of the analyzed brands exceeded the maximum limits allowed by the current legislation (Brasil, 2023), showing that it is not uncommon to consume nitrite and nitrates levels higher than acceptable daily intake (ADI).

The ADIs established for these preservatives are 0.06 mg/kg/body weight per day for nitrites and 3.7 mg/kg/body weight per day for nitrates, showing that nitrites have higher toxicity (EFSA, 2017).

RDC N° 211 (Brasil, 2023) sets the maximum limits for the addition of preservatives in salted products not subjected to heating process: up to 300 mg/kg of nitrite and up to 150 mg/kg nitrate in the product. However, the combined residual concentration of nitrites and nitrates may not exceed 150 mg/kg of product.

The establishment of these limits aims to control one of the main risks associated with the use

of curing agents: the formation of nitrosamines. These are carcinogenic compounds formed by the reaction of nitrous anhydrides arising out of nitrites with secondary amines present in meat proteins. When ingested, nitrosamines can form adducts with the DNA of intestinal cells, promoting genetic mutations that activate oncogenes, favoring cell proliferation and the emergence of neoplasms (Silveira, 2019).

Oliveira (2014) also warns of the mutagenic, carcinogenic and teratogenic potential of nitrosamines. These substances can be formed both during food processing and in the gastrointestinal tract, increasing the risk of gastric, hepatic and esophageal cancer, especially in individuals exposed to a high intake of cured products.

In the present study, 82.76% of salted porks contained preservatives in their composition, however the products without additives exhibited the same shelf life as the first ones, raising doubt about the omission of the presence of these preservatives on the label of these products.

In addition to curing agents, the use of additives such as stabilizers, acidifiers, acidity regulator and antioxidants is also authorized for dry and cured salted pork offals, as established by IN N° 92 (Brasil, 2020a). In the 5 supermarkets visited, the following additives were identified: sodium polyphosphate, pentasodium triphosphate and sodium erythrobate.

Sodium polyphosphate was identified in 41.37% of the salted pork offals analyzed, and pentasodium triphosphate in 6.89% of the samples.

Both act as stabilizers, promoting the dispersion of immiscible substances and increasing the capacity of water retention in food (Vasconcelos; Melo, 2010).

Sodium erythrobate, a salt derived from isoascorbic acid (vitamin C isomer), is a synthetic additive widely used in meat products as an antioxidant. Its main function is to delay the appearance of oxidative changes in food (Vasconcelos; Melo, 2010; Santos *et al*., 2024). Fifty-five percent of the salted pork offals analyzed contained sodium erythorbate in its composition.

Leijoto *et al*. (2022) analyzed 231 labels of ultra-processed foods marketed in supermarkets in Barbacena (MG) and observed sodium tripolyphosphate as the second most frequent additive (24.7%) and sodium isoascorbate as the fifth (12.6%) among ultra-processed foods. These results reinforce the findings of the present study regarding the wide presence of stabilizers (polyphosphate and sodium triphosphate) and antioxidants (sodium erythrobate) in the composition of the salted pork offals analyzed.

None of the fish observed in supermarkets had preservatives, such as nitrite, nitrate or food additives, in their list of ingredients. However, Marsico *et al* (2009), through laboratory analyzes carried out on 20 cod samples (*Gadus morhua*) marketed in retail markets, detected the presence of sodium sulfite, an additive with potential toxic effect. RDC number 329 (Brasil, 2019b) does not allow the use of sodium sulfite as an additive in fish, except for shrimp and lobster shortly after

capture to prevent enzymatic browning.

Although in this study the labels of salted fish and dried salted fish marketed did not indicate the use of additives, the laboratory findings of Marsico *et al.* (2009) show that there may be the use of prohibited additives without the proper declaration on the labels, showing serious non-conformity. The absence of additives declared in the packaging alone does not guarantee the conformity of the product, emphasizing the importance of complementary physico-chemical analysis to verify the veracity of the information provided to the consumer.

3.4 Compliance of the portion values declared by the manufacturers

On the labels of the salted pork offals, 5 different declared portions were identified, ranging from 30 ± g to 100 g, with an average of 62.80 g ± 25.87 g, coefficient of variation of 41.19%. This expressive variation may indicate inconsistencies in compliance with the provisions of IN N° 75/2020 and RDC N° 429/2020 (Brasil, 2020b, 2020c). This discrepancy compromises the standardization of energy values per portion, making it difficult to adapt to the parameters established for Group V (Brasil, 2020b).

According to current legislation, the portion must follow the values defined in Annex V of IN N° 75/2020. For foods that do not have a defined portion, RDC N° 429/2020, in Article 9 thereof, determines that the manufacturer must adopt the portion of a food of similar nutritional characteristics, or, in the absence of such a food, to define the portion based on the average energy value of the corresponding food group (Brasil, 2020c).

The variation of 41.19% in the portions observed in this study shows a possible inadequacy to the standardization required by the standards, which impairs the comparability between products and the clarity of the nutritional information provided to the consumer.

A similar result was found by Bernadino Filho *et al*. (2025), who when analyzing emulsified meat products, identified relevant nonconformities: 66.67% of the brands presented discrepancies in sodium contents between the label and laboratory analysis, and 45.45% showed divergence in total fat contents higher than the tolerance margin of 20% predicted in RDC N° 429/2020.

These data reinforce that the lack of standardization and accuracy in nutritional labeling can compromise conscious food choices and negatively impact the transparency of information made available to the public.

Inconsistencies were also identified in the fish analyzed. The portions declared on the labels ranged from 60 g and 100 g. IN N° 75/2020 establishes that the portion for tuna, sardines, fish, shellfish and other preserved fish, with or without sauces, should be 60 g (Brasil, 2020b). Although the standard does not specifically mention salted fish and dried salted fish, it is possible to frame them in this category, considering their nutritional characteristics similar to those of the other fish

mentioned.

The average values of the portions of salted fish and dried salted fish found is 80 g ± 28.28, with a coefficient of variation 35.36%. This wide variation makes it very unlikely to reach a portion corresponding to 125 kcal, as determined by IN N° 75/2020 for Group 5 foods (meat and eggs).

Fifty-four percent of the salted fish and dried salted fish evaluated presented labels with a portion indication of 100 g. All these products were fractionated and packed directly by the supermarkets themselves, which may have contributed to the divergence in the declaration of the portion with that established in the legislation.

In supermarket B, a variation was observed in the declared portions, depending on the place of the product exposure. The pieces previously fractioned and arranged in aluminum shelves had labels with a portion of 100g, while the pieces on the fractioning counter exhibited labels with a portion of 60g. These inconsistencies within the same establishment show the need for greater control and standardization in the labeling processes of fractional products at their points of sale.

It was also observed that 27% of salted fish and dried salted fish did not have a nutritional table in their packaging, which made it impossible to verify the value of their portion. This inadequacy was observed in supermarkets A and D.

3.5 Compliance of sodium content with IN number 75/2020

IN N° 75/2020 (Brasil, 2020b) determines the need for frontal nutrition labeling in packaged foods.

In this study, it was observed that 10% of salted pork offals, all from supermarket D, had an overlap of the price label on the “high sodium” magnifying glass. Although the original packaging, vacuum, had the nutritional warning correctly printed, its obstruction by the label compromises the visibility of the information, contrary to the objective of frontal labeling, which aims to clearly and directly alert the high content of ingredients critical to health.

It was also found that 24% of the salted pork offals evaluated did not contain the information of the sodium content in the nutritional table, which makes it difficult for the consumer to access essential data on the food. This absence also compromises the verification of the mandatory identification of the “high sodium” magnifying glass in packages that have sodium values higher than the established limit.

According to Annex XV of IN N° 75/2020, the presence of the warning magnifier for solid products whose quantity of sodium added is equal to or greater than 600 mg per 100g of product (Brasil, 2020b) is mandatory. All the products that presented this nonconformity were fractionated, packaged and marketed by the supermarket E.

In the study of Fioruci *et al*. (2024), the labeling of sliced cooked hams of 5 distinct brands

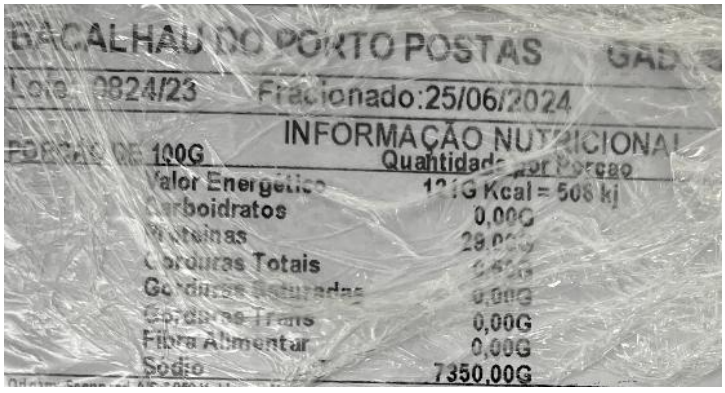
was analyzed. Of the evaluated brands, 2 presented sodium values above the established limit and correctly displayed the frontal magnifying glass indicating “high in sodium”, while the others, despite presenting values close to the limit, did not have the obligation to present the warning. The data from this research indicates compliance between the declared sodium content and the appropriate application of frontal labeling, contrasting with the scenario of nonconformity observed in the present study.

In relation to fish, 80% of those evaluated did not contain the identification of the “high sodium” magnifying glass in the packaging. This scenario was identified in supermarkets A, C, D and E, exclusively in salted fish and dried salted fish fractionated and packed by the establishment itself. The analysis of the nutritional tables of these fish revealed discrepancies in the statement of sodium content.

In Brazil, salted fish and dried salted fish are classified based on their physical and sensory characteristics in 2 groups: cod and cod-type fish. In order for a fish to be considered cod, it is necessary to belong, necessarily, to the species *Gadus morhua* (known as Atlantic cod), considered the noblest, or to the species *Gadus macrocephalus*, known as Pacific cod. The cod-type fish correspond to the species *Pollachius virens* (Saithe), *Brosmius brosme* (Zarbo) and *Molva molva* (Ling). This name, accompanied by the identification of the species to which the fish belongs, must be included on the product label at the point of sale (Brasil, 2007).

Figure 2 shows a dry salted cod (*Gadus morhua*) containing 7,350.00 g of sodium per 100 g of product, which corresponds to 7.35 kg of sodium, a value higher than the weight of the food itself.

Figure 2 - Label of a dried salted cod (*Gadus morhua*) with error in the unit and the declared value for the sodium content



Source: research data.

This practice, in addition to failing to comply with the requirement of frontal nutrition labeling provided for in the current legislation, compromises the consumer's right to accurate and clear

information on the nutritional content of the food.

Silva and Alves (2020), when analyzing labels of fish fillets and other fish, also observed nonconformities in the labels technical quality. Flaws were identified in both fillet and fish labels, such as information that is not visible, illegible or inconsistent with the current rules, emphasizing that the consumer may not be receiving accurate and sufficient data on the products purchased.

The absence of the nutritional table in the packaging consisting of tray and PVC plastic film was also an identified problem. In supermarkets A and D, salted fish and dried salted fish fractionated and packed by the establishments themselves did not have the nutritional table, in breach of the obligation provided for in RDC N° 429/2020 (Brasil, 2020c).

This scenario contrasts with the study of Silva and Alves. (2020), carried out in Caxias do Sul (RS), where 124 fish labels were analyzed and it was observed that 100% of the packages presented adequate nutritional information, showing that the non-compliance found in this study may be associated mainly with the practices of fractionation and labeling performed directly by the markets.

3.6 Desalting guidelines in the packaging

RDC N° 727/2022, which establishes the Technical Regulation on Good Practices for Labelling Packaged Food, determines that packaged products must contain, in addition to the list of ingredients and nutritional information, guidelines for use when the product requires prior preparation for safe and adequate consumption (Brasil, 2022).

Among the salted pork offals analyzed, only 17% presented desalting guidelines to the consumer, and 60% of these products belonged to the same brand, marketed exclusively by supermarket A. This scenario becomes even more worrying about salted fish and dried salted fish, since none of the products evaluated contained desalting guidelines on the packaging.

The absence of these guidelines can hinder not only the correct thawing of the product, but also the adequate reduction of sodium content in both fish and salted pork offals, compromising the food safety and nutritional quality.

In supermarket B, a plate with instructions for desalting was identified at the fish fractionation site. Whereas in supermarkets A and B, leaflets were found, provided by the manufacturer, with guidelines for the desalting of dried salted cod (*Gadus morhua*) in a domestic environment. Although this information is available at the points of sale, it is absent in the packaging of the products analyzed, which compromises the effectiveness of communication with the consumer and contravenes the legal requirements of labeling.

Sodium is an essential nutrient for normal physiological function, with its extracellular concentration rigidly regulated by complex physiological mechanisms. The main source of sodium in the diet is sodium chloride (salt), which represents approximately 95% of the daily intake, and

about 85% of this sodium is eliminated by the kidneys (O'Donnell; Mente; Yusuf, 2015).

However, excessive sodium intake is one of the most relevant risk factors for the development of cardiovascular diseases (CVD) and systemic arterial hypertension (SAH). RDC N° 429/2020, in accordance with the guidelines of the World Health Organization (WHO), establishes the daily reference intake for sodium in 2,000 mg of sodium per day, equivalent to 5,000 mg of salt (WHO, 2012; Brasil, 2014; Brasil, 2019c). However, the average intake of salt by the Brazilian population exceeds this value, especially due to the high consumption of ultra-processed and processed foods, which present high concentrations of sodium (Brasil, 2014).

Excessive sodium intake is directly associated with increased blood pressure and increased risk of SAH development. Hypertension is a multifactorial clinical condition prevalent in Brazil, characterized by a sustained increase in blood pressure (≥140 mmHg for systolic and/or 90 mmHg), being often asymptomatic and recognized only when already compromising target organs, as it occurs in cases of chronic kidney disease (CKD) (Rezende *et al*., 2021).

CKD, in turn, is a syndrome characterized by slow, progressive and irreversible loss of renal function, defined by the presence of structural or functional alterations in the kidneys over a period of more than 3 months and by the reduction of glomerular filtration rate to values below 60 ml/min/1.73 m². Maintenance of the hydro electrolytic balance and activation of the renin-angiotensin-aldosterone system are fundamental functions of the renal system, and changes in this balance due to excess sodium contribute to the progression of renal failure (Rezende *et al*., 2021; Vasconcelos *et al*., 2021).

The absence of desalting guidelines in the packaging of salted pork offals, salted fish and dried salted fish is a worrying factor. The consumption of these products without an adequate desalting process can result in a long-term high sodium intake, amplifying the risk of developing hypertension and worsening conditions such as CKD.

According to Vasconcelos *et al*. (2021), the dietary management of CKD should not only focus on the amount of nutrients, but also on the quality of the food standard, reinforcing the importance of strategies to reduce sodium intake as a preventive measure for chronic non-communicable diseases.

In view of the findings discussed, the absence of desalting guidelines was observed in the packaging of both salted pork offals and salted fish and dried salted fish, associated with the limitation of nutritional information as to the actual sodium content present in these products. These factors make it difficult to properly understand the instructions for consumption and can compromise safe food choices by the consumer.

From the comparison between the two groups, it was identified that salted fish and dried salted fish present an even more critical scenario of inadequacies, with greater frequency of failures in storage conditions at points of sale, more evident errors in nutrition labeling and the total absence of

desalting guidelines in packaging. This set of failures shows an even more marked commitment in the dissemination of clear, safe and compatible information with current standards, which increases the risks to consumer health.

4 Conclusion

The present study identified non-conformities in the labeling, conservation, storage conditions and consumer information on salted pork offals, salted fish and dried salted fish marketed in 5 distinct supermarkets in the Southern Zone of the city of Rio de Janeiro.

Most of the products analyzed presented sodium levels above the recommended limit for frontal labeling, without displaying the warning magnifying glass or declaring the sodium content in the nutritional table, not complying with IN N° 75/2020. The wide variation in validity periods and in the declared portions also compromises the standardization of nutritional information and hinders the clarity of information provided to the consumer.

The products fractionation directly by supermarkets is another sensitive aspect identified. Salted pork offals, salted fish and dried salted fish submitted to fractionation in supermarkets showed even more precarious storage and labeling conditions, with more serious failures in the presentation of mandatory information. This form of manipulation compromises the traceability and health safety of these products.

The use of additives in salted pork offals deserves attention, especially because similar products, without additives, presented equivalent shelf life, raising questions about the absence of these compounds in the labels of part of the products.

The absence of desalting guidelines on the packaging represents another critical failure, since consumption of these products without proper preparation can result in an excessive intake of sodium, increasing the risk of chronic diseases such as hypertension and kidney disease.

These findings highlight the need for greater supervision and training of establishments in compliance with the existing health and labeling standards.

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