

**UFRRJ
INSTITUTO DE TECNOLOGIA
PROGRAMA DE PÓS-GRADUAÇÃO EM CIÊNCIAS E TECNOLOGIA
DE ALIMENTOS**

TESE

**COMPREENSÃO E USO DA ROTULAGEM NUTRICIONAL FRONTAL
POR CONSUMIDORES BRASILEIROS: EVIDÊNCIAS AO LONGO DA
SUA IMPLEMENTAÇÃO**

LAUDIANE JUSTO SANT'ANNA

2025



**UNIVERSIDADE FEDERAL RURAL DO RIO DE JANEIRO
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POR CONSUMIDORES BRASILEIROS: EVIDÊNCIAS AO LONGO DA
SUA IMPLEMENTAÇÃO**

LAUDIANE JUSTO SANT'ANNA

Sob a orientação da
Prof. Dr^a. Rosires Deliza

e do
Prof. Dr. Gastón Ares

Tese submetida como requisito parcial
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TESE APROVADA EM 25/08/2025

ROSIRE DELIZA, (Dra) EMBRAPA (orientadora)

ELLEN MAYRA MENEZES AYRES, (Dra) UNIRIO

LAURO LUÍS MARTINS MEDEIROS DE MELO, (Dr) UFRJ,

SUZANA MARIA DELLA LUCIA, (Dra) UFES

MARÍA LUCÍA ANTÚNEZ NÚÑEZ, (Dra)

(Assinado digitalmente em 04/09/2025 11:18)

ROSIRE DELIZA
ASSINANTE EXTERNO
CPF: 024.950.088-44

(Assinado digitalmente em 04/09/2025 11:18)

SUZANA MARIA DELLA LUCIA
ASSINANTE EXTERNO
CPF: 042.803.916-29

(Assinado digitalmente em 04/09/2025 11:30)

LAURO LUÍS MARTINS MEDEIROS DE MELO
ASSINANTE EXTERNO
CPF: 043.556.297-59

(Assinado digitalmente em 04/09/2025 15:06)

MARÍA LUCÍA ANTÚNEZ NÚÑEZ
ASSINANTE EXTERNO
Passaporte: D420093

(Assinado digitalmente em 07/10/2025 09:39)

ELLEN MAYRA MENEZES AYRES
ASSINANTE EXTERNO
CPF: 052.833.877-39

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RESUMO

SANT'ANNA, Laudiane Justo. **Compreensão e uso da rotulagem nutricional frontal por consumidores brasileiros: evidências ao longo da sua implementação.** 2025. 130p. Tese (Doutorado em Ciência e Tecnologia de Alimentos). Instituto de Tecnologia, Departamento de Tecnologia de Alimentos, Universidade Federal Rural do Rio de Janeiro, Seropédica/RJ, 2025.

A rotulagem nutricional frontal é uma das estratégias regulatórias sugeridas para desestimular hábitos alimentares não saudáveis, o principal determinante comportamental das doenças não transmissíveis. Em 2020, a Agência Nacional de Vigilância Sanitária (Anvisa) regulamentou o modelo alerta nutricional no formato de lupa em alimentos com excesso de açúcares adicionados, gorduras saturadas e sódio. A implementação da política ocorreu de forma gradual, com início em outubro de 2022 para novos produtos, e prazos estendidos até 2025 para diferentes categorias de alimentos. Embora estudos prévios tenham apontado o potencial dos alertas nutricionais para influenciar o comportamento alimentar, ainda são escassas as evidências sobre a efetividade da lupa nos produtos brasileiros. Diante disso, a presente tese teve como objetivo explorar a interpretação e o uso da rotulagem nutricional em formato de lupa a partir da sua implementação. Três estudos foram conduzidos. O primeiro analisou a interpretação e as experiências dos consumidores brasileiros com a lupa em dois momentos da fase inicial da política (dez/2022–jan/2023 e dez/2023–jan/2024), por meio de coletas *online* com 1.762 participantes. O segundo estudo, realizado entre fev–mar/2024, examinou o uso da lupa em um ambiente real de compra em duas cidades brasileiras, com o auxílio de um equipamento de rastreamento ocular móvel (*eye-tracking*). Também foram analisados os dados autorrelatados sobre uso e compreensão da lupa. O terceiro estudo, conduzido em ago/2024, após o prazo final para a implementação da política para a maioria dos produtos, avaliou como diferentes tipos de mensagens destinadas a informar o consumidor sobre a lupa (com enquadramento de ganho, perda e neutro) influenciaram a importância atribuída à lupa em comparação aos outros elementos da embalagem. No primeiro estudo foi observado que os participantes identificaram corretamente o produto mais saudável em 63,6% das tarefas e os produtos com alto teor de nutrientes em 44,8% delas. Logo após a implementação, 36% dos participantes relataram ter visto a lupa em um produto que pretendiam comprar e, entre eles, 53% relataram ter mudado suas decisões de compra. Um ano depois, esses números aumentaram para 71% e 45%, respectivamente. As características individuais e o período de coleta de dados tiveram influência limitada sobre a capacidade dos participantes de interpretar os alertas. No estudo dois foi observado que, embora 60% dos participantes tenham relatado já ter visto a lupa nas embalagens, a busca ativa e uso no momento da compra foram limitados, com apenas 4% fixando o olhar na lupa e 15% relatando tê-la notado nos produtos que pretendiam comprar e, a maioria tendo informado que comprou os produtos mesmo assim. Apesar disso, 53% afirmaram ter modificado suas decisões de compra após a implementação da lupa. No estudo três foi observado que a exposição às mensagens aumentou a importância relativa dos alertas, principalmente no enquadramento de ganho, enquanto reduziu a influência da marca e das alegações sensoriais. No entanto, a marca e as alegações sensoriais foram os fatores mais relevantes que influenciaram as escolhas dos participantes em todas as condições experimentais. Os achados sugerem que, embora a lupa tenha potencial para promover escolhas alimentares mais saudáveis, campanhas de comunicação e medidas regulamentares adicionais,

como a regulamentação do marketing, ainda são necessárias para aumentar a conscientização e estimular os consumidores a considerarem a lupa em suas decisões de compra.

Palavras chaves: Rotulagem nutricional frontal, Alerta nutricional, Informação nutricional, Política públicas

ABSTRACT

SANT'ANNA, Laudiane Justo. **Brazilian Consumers' Understanding and Use of Front-of-Pack Nutrition Labeling: Evidence Across the Implementation Period.** 2025. 130p. Thesis (PhD in Food Science and Technology). Instituto de Tecnologia, Departamento de Tecnologia de Alimentos, Universidade Federal Rural do Rio de Janeiro, Seropédica/RJ, 2025.

Front-of-pack (FOP) nutrition labeling is one of the regulatory strategies proposed to discourage unhealthy eating habits, the main behavioral determinant of noncommunicable diseases. In 2020, the Brazilian Health Regulatory Agency (Anvisa) approved the adoption of a black magnifying-shaped nutritional warning label for packaged foods containing excessive amounts of added sugars, saturated fats, or sodium. The policy has been implemented gradually, starting in October 2022 for newly launched products, with extended deadlines until 2025 for different food categories. Although previous studies have demonstrated the potential of nutritional warnings to influence eating behavior, evidence regarding the effectiveness of the black magnifying label on Brazilian products remains scarce. Against this background, the present thesis aimed to explore the interpretation and use of the black magnifying FOP label following its implementation. Three studies were conducted. The first study investigated Brazilian consumers' understanding and experiences with the black magnifying label at two time points during the early phase of the policy (Dec 2022–Jan 2023 and Dec 2023–Jan 2024) through online surveys with 1,762 participants. The second study, conducted between Feb–Mar 2024, examined label use in a real shopping environment in two Brazilian cities, employing mobile eye-tracking technology. Self-reported data on label use and understanding were also collected. The third study, carried out in Aug 2024—after the final implementation deadline for most products—assessed how different types of consumer information messages about the black magnifying label (gain-framed, loss-framed, and neutral) influenced the relative importance attributed to the label compared with other packaging elements. In the first study, participants correctly identified the healthiest product in 63.6% of the tasks and products high in critical nutrients in 44.8% of the tasks. Shortly after policy implementation, 36% of participants reported noticing the black magnifying label on a product they intended to purchase, and among them, 53% stated that it changed their purchase decision. One year later, these figures increased to 71% and 45%, respectively. Individual characteristics and data collection period had limited influence on participants' ability to interpret the warnings. In the second study, while 60% of participants reported having previously seen the black magnifying on packages, active search and use at the point of purchase were limited: only 4% fixated their gaze on the label and 15% reported noticing it on products they intended to buy—most of whom still purchased the products. Nonetheless, 53% stated that they had changed their purchasing decisions after the black magnifying was implemented. The third study found that exposure to informational messages increased the relative importance of the black magnifying label—particularly in the gain-framed condition—while reducing the influence of brand and sensory claims. However, brand and sensory claims remained the most influential factors guiding participants' choices across all experimental conditions. Overall, the findings suggest that while the black magnifying label has the potential to promote healthier food choices, complementary measures—such as targeted communication campaigns and additional marketing regulations—are necessary to enhance consumer awareness and encourage consideration of the label during purchasing decisions.

Keywords: Front-of-package, Nutritional warnings, Nutritional information, Public policies

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INTRODUÇÃO

As doenças não transmissíveis (DNTs) representam uma das principais preocupações globais em saúde pública na atualidade, não apenas pelos elevados índices de óbitos associados a elas, mas também pelos impactos socioeconômicos que geram. Estima-se que anualmente 71% da mortalidade no mundo seja atribuído a elas, o que representa 41 milhões de óbitos (WHO, 2023, 2024a). A pandemia de COVID-19 acentuou ainda mais a gravidade desse cenário, uma vez que indivíduos com essas comorbidades apresentaram maior risco de desenvolver formas graves da doença (NIKOLOSKI *et al.*, 2021). No Brasil, as DNTs foram responsáveis por 54,7% dos óbitos em 2019, acarretando cerca de 1,8 milhão de internações e um custo de 8,8 bilhões de reais ao Sistema Único de Saúde (SUS) (BRASIL, 2021). Dentre os principais fatores de risco associados a essas doenças, destaca-se a adoção de dietas não saudáveis, marcada pelo crescente consumo de alimentos industrializados com alto teor energético e elevados níveis de gorduras saturadas, açúcares adicionados e sódio (WHO, 2024a, 2024b).

A rotulagem nutricional frontal (*front-of-package* (FOP)) é uma das políticas públicas recomendadas para promover hábitos alimentares saudáveis e mitigar os riscos relacionados às DNTs. Diversos países da América Latina têm adotado alertas nutricionais em formato de octógono na parte frontal das embalagens para incentivar escolhas alimentares mais saudáveis (CROSBIE *et al.*, 2023). No Chile, a combinação dos alertas nutricionais com restrições de marketing e controle da venda em escolas resultou em alto reconhecimento desses elementos por parte dos consumidores (MINISTERIO DE SALUD, 2017) e a redução no consumo de bebidas açucaradas um ano após a implementação da política (TAILLIE *et al.*, 2020a). No México, 44,8% dos adultos e 38,7% dos jovens relataram que os alertas os motivaram a reduzir o consumo de alimentos não saudáveis, especialmente bebidas açucaradas (CONTRERAS-MANZANO *et al.*, 2024). No Uruguai, o reconhecimento dos alertas nutricionais tem aumentado desde a sua introdução (ARES *et al.*, 2021a; MACHÍN *et al.*, 2023), embora estudos em ambientes reais de compra revelaram que poucos consumidores fixam o olhar nos rótulos ou buscam essas informações ativamente no momento da decisão (MACHÍN *et al.*, 2023). Esses achados ressaltam a necessidade de aprofundar o entendimento sobre a percepção e uso dos alertas nutricionais pelos consumidores após a implementação, de modo a desenvolver estratégias que ampliem a sua eficácia na promoção de escolhas alimentares mais saudáveis.

No Brasil, em outubro/2020 foi regulamentado pela Anvisa por meio da RDC 429/2020 e da Instrução Normativa (IN) 75/2020 o alerta nutricional de lupa preta. Ele consiste em retângulo branco contendo a imagem de uma lupa preta e a frase "Alto em", sobre um fundo preto, quando o produto apresenta excesso de açúcares adicionados, gorduras saturadas e/ou sódio. Sua implementação ocorreu de forma gradual, se tornando obrigatória para os novos produtos lançados no mercado a partir de outubro/2022. Para os demais produtos presentes no mercado o prazo dado foi outubro/2023; no entanto, foi prorrogado até abril/2024. Já para produtos de pequenos produtores e bebidas não alcoólicas em embalagens retornáveis, os prazos foram outubro de 2024 e outubro de 2025, respectivamente (BRASIL, 2020a, 2020b).

Estudos reportaram que o modelo em formato de lupa tem se mostrado eficiente em desencorajar o consumidor a escolher alimentos com alto teor de nutrientes críticos, ou seja, cujo consumo em excesso é associado às doenças não transmissíveis (BANDEIRA *et al.*, 2021, ALCANTARA; ARES; DELIZA, 2022; KHANPUR; MAIS; MARTINS, 2022). Prates *et al.* (2022) investigaram a influência de diferentes modelos de alertas nutricionais (lupa, triângulo e octógono) na compreensão da informação nutricional, percepção de saudabilidade e intenção de compra de diferentes produtos (barra de cereal, salgadinho e biscoito) pelos consumidores brasileiros. Foi observado que a presença dos alertas favoreceu a compreensão da informação nutricional, reduziu a intenção de compra e a percepção de saudabilidade. Em produtos com dois nutrientes críticos, o octógono e o triângulo tiveram um efeito maior do que a lupa na redução da percepção de saudabilidade. Também foi observado que os modelos não foram

capazes de anular o viés de saudabilidade gerado pelas alegações nutricionais (PRATES *et al.*, 2022). Esses achados reforçam a importância de se realizar mais estudos após o início da implementação da lupa, para melhor entender como os consumidores brasileiros compreendem e usam esse modelo. Tal compreensão pode subsidiar o aprimoramento da política pública e maximizar seu impacto na promoção de escolhas alimentares mais saudáveis.

OBJETIVOS

O presente trabalho teve como objetivo geral explorar a interpretação e o uso dos alertas nutricionais em formato de lupa durante o seu período de implementação. Os objetivos específicos foram:

- Explorar a interpretação e as experiências dos consumidores brasileiros com os alertas nutricionais em dois momentos a partir do início da implementação;
- Explorar o uso dos alertas nutricionais após a implementação no Brasil, se concentrando na interação do consumidor com a lupa no ponto de compra e nos efeitos autorrelatados retrospectivos sobre as intenções de compra;
- Avaliar como diferentes mensagens (enquadramento de ganho, perda ou neutra) influenciam a importância atribuída à lupa na escolha de produtos alimentícios.

ESTRUTURA DA TESE

A presente tese busca contribuir com a crescente literatura sobre os alertas nutricionais em formato de lupa, buscando compreender seu uso e interpretação pelos consumidores brasileiros durante a sua implementação. Ela inicia com uma introdução geral e objetivos. Em seguida, é apresentada uma revisão bibliográfica que inclui um panorama sobre as DNTs no Brasil e no mundo, dados sobre os hábitos alimentares dos brasileiros, além de informações sobre a rotulagem nutricional frontal, os alertas nutricionais e alguns fatores que podem modular sua eficiência.

A parte experimental foi desenvolvida em três etapas principais, sendo elas: dois estudos online, um que analisou as interpretações e experiências dos consumidores brasileiros com a lupa durante o início da implementação da política (Capítulo 1); o outro investigou como diferentes enquadramentos de mensagens (ganho, perda ou neutra) influenciam a importância atribuída à lupa na escolha de produtos alimentares (Capítulo 3). Um outro estudo foi realizado em um ambiente real de compra e teve como objetivo explorar o uso dos alertas nutricionais após sua implementação no Brasil, utilizando um equipamento de rastreamento ocular e dados autorrelatados (Capítulo 2).

O Capítulo 1 apresenta o estudo intitulado “Interpretação e experiências de consumidores brasileiros com os rótulos “alto em” durante o início da implementação da política”. Foi realizado para investigar, por meio de duas coletas online com consumidores (realizadas entre dezembro de 2022 e janeiro de 2023 e, posteriormente, entre dezembro de 2023 e janeiro de 2024), a familiaridade e uso da lupa durante os estágios iniciais da implementação da política. Também foi avaliada a influência das características individuais e o período de coleta na interpretação dos consumidores sobre a lupa e o efeito autorrelatado nas decisões de compra., que se demonstrou limitado.

O Capítulo 2 intitulado “Interpretação e uso dos rótulos “alto em” por consumidores brasileiros: Um estudo exploratório no ponto de compra em duas cidades”. Foi conduzido entre fevereiro e março de 2024 e buscou avaliar a interação do consumidor com a lupa em um ambiente real de compra. Também foram analisados os efeitos autorrelatados sobre as intenções de compra. Os resultados revelaram que a atenção do consumidor no ponto de compra foi limitada, evidenciando a necessidade de medidas complementares para aumentar a conscientização e incentivar o uso da lupa.

O Capítulo 3 denominado “O enquadramento importa: Como estratégias de comunicação potencializam a efetividade dos rótulos “alto em” foi realizado em agosto de 2024 e teve como objetivo avaliar o efeito de mensagens com diferentes enquadramentos (ganho, perda ou neutro) na importância atribuída à lupa pelos consumidores em relação a outros elementos da embalagem. O estudo reforça o potencial da lupa para desencorajar a seleção de produtos com excesso de nutrientes críticos, especialmente quando acompanhados de mensagens comunicacionais que destacam os benefícios de seu uso.

No final da tese é apresentada a conclusão geral, bem como recomendações finais.

As publicações redigidas a partir dos estudos mencionados e respectivos periódicos para publicação são mostrados abaixo:

Capítulo	Tema	Periódico	Situação
I	Interpretação e experiências de consumidores brasileiros com os rótulos "alto em" durante o início da implementação da política		Em revisão
	<i>Brazilian consumers' interpretation and experiences with high-in labels during the early implementation of the policy</i>		
	Rotulagem nutricional frontal: experiências do consumidor brasileiro	<i>Boletim de Pesquisa - Embrapa</i>	Aceito
II	Interpretação e uso dos rótulos "alto em" por consumidores brasileiros: Um estudo exploratório no ponto de compra em duas cidades		Publicado
	<i>Brazilian consumers' interpretation and use of high-in labels: An exploratory study at the point of purchase in two cities</i>	<i>Food Quality and Preference</i>	
III	O enquadramento importa: Como estratégias de comunicação potencializam a efetividade dos rótulos "alto em"		Submetido
	<i>Framing matters: How communication strategies enhance the effectiveness of high-in labels</i>	<i>Appetite</i>	

REVISÃO BIBLIOGRÁFICA

1. DOENÇAS NÃO TRANSMISSÍVEIS

Segundo a Organização Mundial da Saúde (OMS, 2024a) as doenças não transmissíveis (DNT) tendem a ser de longa duração, resultam de uma combinação de fatores genéticos, fisiológicos, ambientais e comportamentais, têm origem não infecciosa e podem resultar em incapacidades funcionais e óbito. Os principais tipos são as doenças cardiovasculares, cânceres, doenças respiratórias crônicas e diabetes (WHO, 2023a, 2024a). O envelhecimento populacional, a urbanização acelerada e a adoção de estilos de vida pouco saudáveis são fatores determinantes para o aumento da prevalência dessas condições (WHO, 2024a).

As DNT afetam indivíduos de todas as idades, regiões e países, com impactos especialmente severos sobre populações mais vulneráveis, como aquelas de baixa renda e escolaridade. Além de comprometerem a qualidade de vida, essas doenças limitam a capacidade para o trabalho e lazer, aumentam os custos com saúde e contribuem para perdas econômicas em nível familiar, comunitário e nacional (WHO, 2023a, 2024a). A pandemia de COVID-19, que atingiu todo o mundo, levantou um alerta em relação às DNT, uma vez que pacientes com tais comorbidades tinham maior probabilidade de ter a doença e mortalidade subsequente (NIKOLOSKI *et al.*, 2021).

Em 2021, elas foram responsáveis por 43 milhões de óbitos em todo o mundo, representando cerca de 75% dos óbitos não relacionados à pandemia. Desses, 18 milhões ocorreram antes dos 70 anos de idade — sendo que 82% da mortalidade prematura foi registrada em países de baixa e média renda, contribuindo para o aumento das desigualdades sociais e econômicas. As doenças cardiovasculares lideram essa estatística, com 19 milhões de óbitos, seguidas por cânceres (10 milhões), doenças respiratórias crônicas (4 milhões) e diabetes (mais de 2 milhões, incluindo óbitos por complicações renais relacionadas à doença) (WHO, 2024a). No Brasil, em 2019, as DNT causaram 54,4% dos óbitos, sendo 41,8% prematuros, com destaque para as doenças cardiovasculares e diabetes como responsáveis por grande parte deles (BRASIL, 2021). Em 2021, as doenças cardiovasculares representaram 21% de todos os óbitos no país (OLIVEIRA *et al.*, 2024). Em relação ao diabetes, a frequência do diagnóstico médico foi de 10,2% nas capitais brasileiras, sendo maior entre as mulheres (11,1%) do que entre os homens (9,1%). Em ambos os gêneros, a frequência aumentou intensamente com a idade e diminuiu com o nível de escolaridade (BRASIL, 2023).

As DNT estão associadas a fatores de risco relacionados ao estilo de vida e comportamentos, como o tabagismo, alimentação não saudável, sedentarismo e o consumo excessivo de álcool. Esses hábitos não saudáveis contribuem para o desenvolvimento de condições como hipertensão, hiperglicemia, dislipidemia e sobrepeso/obesidade, que estão diretamente ligados a diversas DNT. A alta prevalência dessas doenças na população representa um desafio contínuo para os sistemas de saúde, exigindo estratégias eficazes de prevenção, rastreamento precoce e manejo integrado (WHO, 2024a).

A hipertensão é um dos principais fatores de risco para doenças renais, cardiovasculares e neurológicas, afetando cerca de 1,28 bilhão de adultos (um em cada três) em todo o mundo (WHO, 2023b). No Brasil, estima-se que 27,9% da população adulta conviva com essa condição (BRASIL, 2023) gerando elevados custos ao sistema público de saúde, com gastos anuais que ultrapassam R\$ 2 bilhões apenas no tratamento da hipertensão no Sistema Único de Saúde (NILSON *et al.*, 2020). O excesso de peso e a obesidade também têm apresentado um aumento expressivo tanto em nível global quanto nacional. Em 2022, 43% dos adultos estavam com excesso de peso no mundo, dos quais 16% apresentavam obesidade. Além disso, cerca de 37 milhões de crianças menores de 5 anos (equivalente a 5,6% dessa população) estavam acima do peso (WHO, 2024c). No Brasil, esses índices são ainda mais elevados: 61,4% dos adultos

das capitais apresentavam excesso de peso e 22,4% obesidade, valores acima da média global (BRASIL, 2023). Outro fator de risco importante é a hiperglicemia, que além de ser precursora do diabetes tipo 2, está associada ao aumento do risco de desenvolvimento de diversos tipos de câncer (BARUA *et al.*, 2018; GOTO *et al.*, 2016; RAMTEKE *et al.*, 2019). Estima-se que, anualmente, 5 a 10% das pessoas que possuem a glicemia alterada progridam para diabetes mellitus tipo 2 (SEQUEIRA; POPPITT, 2017).

Apesar do rápido crescimento nos casos de DNT, seu impacto pode ser reduzindo através de ações abrangentes que incluam vários setores, como saúde, educação, agricultura e planejamento, trabalhando em conjunto para reduzir os riscos associados a essas doenças e promover intervenções para seu controle e prevenção. É importante monitorar o progresso, as tendências futuras e os riscos associados às DNT, para que políticas públicas que visam promoção de saúde, redução de fatores de risco, detecção precoce e tratamento adequado sejam subsidiadas (WHO, 2024a).

2. HÁBITOS ALIMENTARES

De acordo com a Organização Mundial da Saúde (OMS), uma alimentação saudável deve atender a quatro princípios fundamentais: adequação, equilíbrio, moderação e variedade. Isso implica fornecer, de forma suficiente, os nutrientes essenciais para a prevenção de deficiências nutricionais e a promoção da saúde, evitando excessos. A alimentação deve apresentar equilíbrio na ingestão energética e entre os macronutrientes — carboidratos, proteínas e gorduras — de modo a favorecer o crescimento, a manutenção do peso corporal saudável e a prevenção de doenças. Além disso, o consumo de alimentos, nutrientes ou compostos associados a efeitos adversos à saúde deve ocorrer de forma moderada. Por fim, a dieta deve contemplar uma ampla gama de alimentos nutritivos, tanto dentro quanto entre os diferentes grupos alimentares, contribuindo para a adequação nutricional e o fornecimento de compostos benéficos à saúde (WHO, 2024d).

Adotar uma alimentação saudável desempenha um papel essencial na prevenção de todas as formas de desnutrição, além de contribuir para a redução do risco de doenças não transmissíveis (WHO, 2024a). Nos últimos anos, observou-se uma mudança nos padrões de consumo alimentar, com o aumento da ingestão de produtos industrializados altamente calóricos e com excesso de gorduras, açúcares e sódio (ELIZABETH *et al.*, 2020; WHO, 2024b). Esse padrão alimentar tem sido amplamente associado à elevação dos índices de obesidade e ao desenvolvimento de diversas doenças não transmissíveis, conforme evidenciado por diferentes estudos (CHEN *et al.*, 2020; ELIZABETH *et al.*, 2020; GAKIDOU *et al.*, 2017).

A Organização Mundial da Saúde recomenda que crianças e adultos reduzam a ingestão de açúcares livres para menos de 10% da ingestão calórica total, sendo ideal que esse valor seja inferior a 5%, a fim de alcançar benefícios adicionais à saúde. Consideram-se açúcares livres aqueles adicionados a alimentos e bebidas — como glicose, galactose, frutose, sacarose ou açúcar de mesa — por fabricantes, cozinheiros ou consumidores, além dos açúcares naturalmente presentes em mel, xaropes, sucos de frutas e concentrados de suco de frutas. Em relação às gorduras totais, a recomendação é limitar o consumo a menos de 30% da ingestão energética total, com destaque para as gorduras saturadas, que devem representar menos de 10%. Quanto ao sódio, sugere-se uma ingestão diária inferior a 5 gramas de sal (equivalente a 2 gramas de sódio) (WHO, 2025).

De acordo com os dados da Pesquisa de Orçamentos Familiares (POF) de 2017-2018, conduzida pelo Instituto Brasileiro de Geografia e Estatística (IBGE, 2020) 13,5% da população relatou adicionar sal a preparações já prontas. Já o uso de açúcar adicionado foi referido por 85,4% da população (IBGE, 2020). Estima-se que os brasileiros consumam, em média, cerca

de 18 colheres de chá de açúcar por dia (aproximadamente 80 g de açúcar), sendo que 64% corresponde ao açúcar adicionado a alimentos e bebidas (BRASIL, 2022). Já para consumo de sódio estima-se cerca de 9,34 g por dia e que somente 2,4% da população consome menos de 5 g/dia de sal por dia (MILL *et al.*, 2019).

Os alimentos *in natura* ou minimamente processados são recomendados pelo Guia Alimentar para a População Brasileira como a base de uma alimentação saudável (BRASIL, 2014). Esses alimentos representam mais da metade das calorias consumidas pela população (53,4%), com destaque para itens como arroz, feijão, carnes, frutas, leite, verduras, legumes, raízes e tubérculos (IBGE, 2020). O guia também orienta que gorduras, sal e açúcar sejam utilizados com moderação no preparo e tempero dos alimentos e nas preparações culinárias (BRASIL, 2014). No entanto, uma pesquisa realizada nas 27 capitais brasileiras observou que apenas 21,1% da população estudada consome frutas e hortaliças na quantidade recomendada (400 g/dia). Além disso, 14,9% dos entrevistados relataram consumo de refrigerantes em cinco ou mais dias da semana, comportamento considerado um marcador de padrão alimentar não saudável (BRASIL, 2023).

As escolhas alimentares são complexas e podem ser afetadas por uma combinação de vários fatores, incluindo características individuais (por exemplo, idade, gênero, estilo de vida e grau de atividade física), contexto cultural, disponibilidade de alimentos, costumes alimentares, entre outros. No entanto, os princípios básicos de uma dieta saudável permanecem os mesmos (GAKIDOU *et al.*, 2017; WHO, 2020b). Os homens apresentaram menor frequência na ingestão da maioria das frutas, verduras e legumes, enquanto as mulheres demonstraram maior frequência de consumo de biscoitos, bolos, doces, leite e derivados, café e chá. Também é observado que indivíduos pertencentes às faixas de menor renda apresentaram maior consumo per capita tanto de alimentos associados a uma menor qualidade nutricional — como doces, pizzas, salgados fritos e assados e sanduíches — quanto de frutas, verduras e legumes (IBGE, 2020).

Com relação à faixa etária, aos adolescentes foi atribuído o menor consumo de frutas, verduras e legumes em comparação com os adultos e idosos. Por outro lado, foram os que apresentaram maior ingestão de macarrão instantâneo, biscoitos (recheados e doces), salgadinhos tipo chips, embutidos (linguiça, salsicha, mortadela, presunto), chocolates, achocolatados, sorvetes, sucos industrializados, refrigerantes, bebidas lácteas, pizzas, salgados fritos e assados, além de sanduíches (IBGE, 2020). No caso das crianças, dados do Estudo Nacional de Alimentação e Nutrição Infantil (ENANI, 2024) indicam que apenas 23,5% das menores de cinco anos consomem hortaliças e seus derivados, enquanto 47,1% consomem frutas e seus produtos. Já os doces, alimentos contraindicados para menores de dois anos, foram consumidos por 66,8% das crianças nessa faixa etária e por 82,5% daquelas com dois anos ou mais. Com o objetivo de melhorar o perfil alimentar da população brasileira, o Ministério da Saúde, em consonância com as diretrizes da Organização Mundial da Saúde, tem desenvolvido diversas estratégias voltadas à promoção de uma alimentação adequada e saudável (BRASIL, 2021).

3. POLÍTICAS PÚBLICAS DE ALIMENTAÇÃO E SAÚDE NO BRASIL

As políticas públicas desempenham papel fundamental na promoção da saúde e na prevenção de doenças, especialmente no que se refere à alimentação e nutrição. Por meio da implementação de medidas econômicas, educacionais, administrativas e legislativas, essas políticas incentivam mudanças na dieta, apoiam o acesso aos alimentos saudáveis e visam moldar os comportamentos alimentares da população. Ao reunir diferentes setores, contribuem para melhorar o bem-estar coletivo e reduzir as desigualdades em saúde (GORSKI; ROBERTO, 2015; WHITSEL, 2017).

No Brasil, diversas políticas públicas têm sido implementadas ao longo dos anos com o objetivo de promover uma alimentação adequada e saudável. Entre elas, destaca-se a Política Nacional de Alimentação e Nutrição (PNAN), que orienta ações intersetoriais voltadas à promoção da saúde, prevenção e controle de agravos relacionados à alimentação e nutrição (BRASIL, 2013a). Também merecem destaque os programas de educação alimentar e nutricional e a regulamentação da alimentação escolar por meio do Programa Nacional de Alimentação Escolar (PNAE), que assegura o direito à alimentação saudável para estudantes da rede pública de ensino (BRASIL, 2018a, 2024). Além disso, o Ministério da Saúde do Brasil e diversas associações de indústrias de alimentos (ABIA, ABIMAPI, ABIR, entre outras) assinaram diversos acordos estabelecendo metas para redução gradativa de sódio, açúcar e gordura de vários alimentos industrializados com o objetivo de melhorar a alimentação dos brasileiros (BRASIL, 2007, 2011, 2012, 2013b, 2017, 2018b).

Em 2020, o Ministério da Saúde elaborou o Plano de Ações Estratégicas para o Enfrentamento das Doenças e Agravos Não Transmissíveis no Brasil, 2021-2030, o qual reúne um conjunto de iniciativas voltadas à promoção da saúde, prevenção de doenças e organização do cuidado no sistema de saúde. Uma das estratégias centrais desse plano é a melhoria da qualidade da dieta da população, com foco na redução do consumo de alimentos com excesso de nutrientes críticos, como sódio, açúcares e gorduras saturadas (BRASIL, 2021). Para que essa meta seja alcançada, são necessárias transformações nos sistemas alimentares que possibilitem escolhas alimentares mais saudáveis, práticas e acessíveis (NILSON, 2022).

4. ROTULAGEM NUTRICIONAL FRONTAL (*FRONT OF PACK* – FOP)

A rotulagem nutricional visa informar os consumidores sobre as propriedades nutricionais dos alimentos, sendo regulamentada de forma específica por cada país (CAMPOS; DOXEY; HAMMOND, 2011). Diversos estudos indicam que muitos consumidores não leem ou têm dificuldade para compreender e aplicar essas informações no momento da escolha alimentar (BHAWRA *et al.*, 2022; COWBURN; STOCKLEY, 2005; PERSOSKIE; HENNESSY; NELSON, 2017; VAN DER HORST *et al.*, 2019). Nesse contexto, a rotulagem nutricional frontal surge como uma estratégia complementar, voltada à apresentação de informações nutricionais de forma clara, direta e de fácil visualização. Localizada na parte frontal da embalagem, essa rotulagem busca facilitar decisões rápidas sobre o conteúdo nutricional ou a saudabilidade de um produto, contribuindo para escolhas alimentares mais conscientes e saudáveis (KANTER; VANDERLEE; VANDEVIJVERE, 2018).

Diferentes modelos de rotulagem nutricional frontal vêm sendo adotados em diferentes países como estratégia para incentivar escolhas alimentares mais informadas e conscientes. Esses modelos têm ganhado crescente destaque nas agendas de saúde pública, sendo reconhecidos como uma importante ferramenta para o enfrentamento das doenças não transmissíveis (AFROZA *et al.*, 2024; KANTER; VANDERLEE; VANDEVIJVERE, 2018).

Atualmente, mais de 44 países adotam algum tipo de rotulagem nutricional frontal, seja de forma voluntária ou obrigatória (AFROZA *et al.*, 2024). Eles apresentam informações sobre nutrientes relacionados com às DNT, podendo ou não indicar de maneira geral a qualidade nutricional do produto. Os nutrientes que geralmente estão incluídos nos diferentes modelos FOP são sódio, gorduras e açúcares, além do valor energético (BRASIL, 2018c; KANTER; VANDERLEE; VANDEVIJVERE, 2018).

Os diferentes modelos podem ser divididos em interpretativos, semi-interpretativos, não interpretativos e híbridos. Os modelos interpretativos indicam a saudabilidade do produto, que pode ser baseado em um nutriente ou no produto de forma geral (AFROZA *et al.*, 2024). São exemplos desse tipo de modelo o Nutri-score (Figura 1a) da França (MINISTÈRE DE L'AGRICULTURE ET DE L'ALIMENTATION., 2017) e alertas nutricionais do Chile (Figura 1b) (MINISTERIO DE SALUD, 2015) e Uruguai (MINISTERIO DE SALUD PÚBLICA, 2018).



Figura 1. Modelo de rotulagem nutricional frontal interpretativos: (a) Nutri-score e (b) Alertas nutricionais

Os semi-interpretativos fornecem elementos interpretativos que possibilitam a identificação dos nutrientes presentes no alimento, mas não apresentam informações diretas sobre a qualidade nutricional do produto, como por exemplo, o semáforo nutricional (Figura 2)



Figura 2. Modelo de rotulagem nutricional frontal semi-interpretativos: Semáforo nutricional.

Já os não interpretativos apresentam informações quantitativas, sem qualquer tipo de julgamento ou orientação que auxilie na interpretação, como por exemplo, a diretriz de quantidade diária (Guideline Daily Amount – GDA) (Figura 3) que é utilizado em vários países. O modelo híbrido associa características dos modelos semi-interpretativos e não interpretativos, como por exemplo, GDA com cores (Figura 4) do Reino Unido (AFROZA *et al.*, 2024).

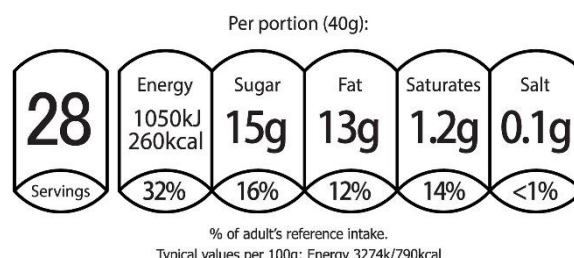


Figura 3. Modelo de rotulagem nutricional frontal não interpretativo: Diretriz de quantidade diária (Guideline Daily Amount – GDA).



Figura 4. Modelo de rotulagem nutricional frontal híbrido: GDA com cores.

Nos últimos anos, os sistemas interpretativos têm demonstrado ser mais eficazes para facilitar a compreensão dos consumidores e influenciar positivamente as escolhas alimentares (AFROZA *et al.*, 2024; JONES *et al.*, 2019; KELLY *et al.*, 2024; PETTIGREW *et al.*, 2023; TEMPLE, 2020). Entre eles, os alertas nutricionais se destacam pela capacidade de transmitir, de forma clara e fácil, informações sobre a presença de nutrientes críticos em excesso nos alimentos (ARES *et al.*, 2023). Evidências indicam que esse tipo de rotulagem exige menor esforço cognitivo do que modelos como o GDA, favorecendo uma tomada de decisão mais rápida e alinhada com as recomendações de saúde pública (CENTURIÓN; MACHÍN; ARES, 2019). Além disso, estudos comparativos mostram que os alertas captam melhor a atenção visual dos consumidores do que os sistemas de classificação por estrelas (Health Star Rating), que atribuem uma pontuação global de qualidade nutricional ao produto (ARES *et al.*, 2018a).

Essas vantagens se estendem às escolhas alimentares. Em comparação com modelos como o Nutri-Score e o de classificação por estrelas, os alertas têm se mostrado mais eficazes em desencorajar escolhas não saudáveis (ARES *et al.*, 2018a). Eles também se mostraram mais eficazes em orientar consumidores de diferentes níveis socioeconômicos a fazerem escolhas alimentares mais saudáveis do que os modelos baseados em informação numérica, como o GDA (SHRESTHA *et al.*, 2023). No Brasil, estudos empíricos confirmam a superioridade dos alertas nutricionais frente a outros sistemas. DELIZA *et al.* (2020) reportaram que os alertas superaram

o GDA e o semáforo na capacidade de ajudar os consumidores a identificar produtos com alto teor de nutrientes críticos. Resultados semelhantes foram encontrados por KHANDPUR *et al.* (2018), que demonstraram maior eficácia dos alertas tanto na identificação de nutrientes em excesso quanto na intenção de compra em comparação com o modelo semáforo. Tais achados reforçam o potencial dos alertas nutricionais como uma estratégia eficaz de saúde pública para incentivar hábitos alimentares mais saudáveis, especialmente em contextos marcados por elevada carga de doenças relacionadas à alimentação.

4.1 Alertas nutricionais

Dentre os modelos de rotulagem nutricional utilizados, destacam-se os alertas nutricionais que, conforme demonstrado por estudos experimentais realizados em diferentes países, têm se mostrado eficazes para desencorajar a escolha de alimentos com excesso de nutrientes associados às DNT (ADASME-BERRÍOS *et al.*, 2022; ARES *et al.*, 2023; CONTRERAS-MANZANO *et al.*, 2022; CROSBIE *et al.*, 2023; VILLAYERDE *et al.*, 2023). Esse modelo tem ganhado relevância especialmente na região das Américas, onde vem sendo adotado por vários países como uma das estratégias para incentivar os consumidores a fazerem escolhas alimentares mais saudáveis (CROSBIE *et al.*, 2023).

O Chile foi o primeiro país a implementar um sistema de rotulagem nutricional frontal obrigatória com alertas, em 2016, por meio da Lei de Rotulagem e Publicidade de Alimentos (Lei nº 20.606). Os alertas adotados consistem em placas octogonais de cor preta, com o texto “Alto en” (Figura 5), que devem ser exibidos na parte frontal de embalagens de produtos que, em seu processo de elaboração, contenham adição de, açúcares, gorduras saturadas e/ou sódio, e que excedam os limites estabelecidos na legislação para esses nutrientes ou para as calorias (Tabela 1). Caso o produto ultrapasse mais de um desses critérios, deve conter um alerta para cada nutriente em excesso. Além disso, a lei estabelece restrições de publicidade dirigida ao público infantil e proíbe a venda, promoção e distribuição desses produtos em ambientes escolares, com o intuito de reduzir a exposição das crianças a alimentos considerados não saudáveis (MINISTERIO DE SALUD, 2015).

Tabela 1. Limites de energia açúcares totais, gorduras saturadas e sódio segundo a Lei de Rotulagem e publicidade de Alimentos (Lei nº 20.606).

	Energia kcal/100g	Sódio mg/100g	Açúcares totais g/100g	Gorduras saturadas g/100g
Limites Alimentos sólidos				
Valores maiores que:	275	400	10	4
	Energia kcal/100g	Sódio mg/100g	Açúcares totais g/100g	Gorduras saturadas g/100g
Limites Alimentos líquidos				
Valores maiores que:	70	100	5	3



Figura 5. Modelo de Alertas nutricionais implementado no Chile, que devem vir na parte frontal das embalagens de alimentos industrializados quando apresentarem excessos de Açúcares, Gordura Saturada, Sódio e Energia.

O modelo implementado no Chile inspirou outros países da América Latina: Peru e Venezuela adotaram o mesmo formato chileno, enquanto Uruguai, México, Argentina e Colômbia implementaram versões semelhantes, utilizando “Excesso” nos alertas (Figura 6) (CROSBIE *et al.*, 2023). No Argentina e do México, além dos alertas para nutrientes críticos, os alimentos também devem indicar a presença de cafeína e de edulcorantes, sendo este último voltado a desencorajar a redução de açúcar em detrimento da adição de adoçantes (CROSBIE *et al.*, 2023; WHITE; BARQUERA, 2020).



Figura 6. Modelo de Alertas nutricionais implementado no Uruguai, que devem vir na parte frontal das embalagens de alimentos industrializados quando, em seu processo de elaboração, houver adição de sódio, açúcar, gorduras, resultando no excesso desses nutrientes.

No Brasil, a rotulagem nutricional frontal foi regulamentada em outubro de 2020 pela Agência Nacional de Vigilância Sanitária (Anvisa), por meio da Resolução da Diretoria Colegiada (RDC) nº 429/2020 e da Instrução Normativa (IN) nº 75/2020 (BRASIL, 2020a, 2020b). A implementação ocorreu de forma gradual, tornando-se obrigatória para os novos produtos lançados no mercado a partir de outubro de 2022. Para os demais produtos já disponíveis, o prazo inicialmente estabelecido era outubro de 2023, posteriormente prorrogado até 22 de abril de 2024. Para produtos de pequenos fabricantes e bebidas não alcoólicas comercializadas em embalagens retornáveis o prazo era até 9 de outubro de 2024 e 9 de outubro de 2025, respectivamente. Os fabricantes de alimentos e bebidas devem incluir nos rótulos dos alimentos embalados na ausência do consumidor um alerta na parte frontal das embalagens em formato de um retângulo branco contendo a imagem de uma lupa preta, acompanhada da expressão “Alto em”, posicionada sobre um fundo preto (Figura 7). Os alerta em formato de lupa devem ser inseridos sempre que o produto apresentar excesso de açúcares adicionados, gorduras saturadas e/ou sódio. Os limites definidos para caracterização do excesso desses nutrientes estão detalhados na Instrução Normativa nº 75/2020 (Tabela 2) (BRASIL, 2020a, 2020b). Em 2023, o Paraguai aprovou a implementação do mesmo modelo adotado no Brasil (MINISTERIO DE SALUD PÚBLICA Y BIENESTAR SOCIAL, 2023)

Tabela 2 - Limites de açúcares adicionados, gorduras saturadas e sódio segundo a Instrução Normativa (IN) 75/2020

Nutrientes	Alimentos sólidos ou semissólidos	Alimentos líquidos
Açúcares adicionados	Quantidade maior ou igual a 15 g de açúcares adicionados por 100 g do alimento	Quantidade maior ou igual a 7,5 g de açúcares adicionados por 100 mL do alimento
Gorduras saturadas	Quantidade maior ou igual a 6 g de gorduras saturadas por 100 g do alimento	Quantidade maior ou igual a 3 g de gorduras saturadas por 100 mL do alimento
Sódio	Quantidade maior ou igual a 600 mg de sódio por 100 g do alimento.	Quantidade maior ou igual a 300 mg de sódio por 100 mL do alimento.

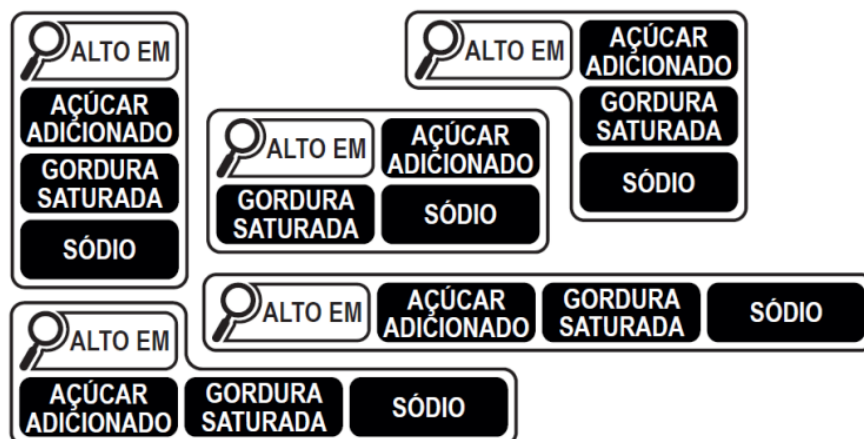


Figura 6. Modelo de rotulagem nutricional implementado no Brasil: Lupa preta

A seguir, serão apresentados estudos que investigaram o efeito dos alertas nutricionais no comportamento dos consumidores, considerando tanto contextos experimentais anteriores à implementação, quanto evidências observadas após a implementação dos alertas em países da América Latina.

4.2 - Efeitos dos alertas nutricionais no comportamento dos consumidores

Para que a rotulagem nutricional frontal seja eficaz a longo prazo, é fundamental que os consumidores estejam cientes da sua presença nas embalagens, sejam capazes de reconhecê-los e compreendê-los, o que pode ser facilitado por campanhas educativas e publicitárias associadas à implementação da rotulagem (ARES *et al.*, 2021a; VIDAL *et al.*, 2019). A compreensão das mensagens pode ser facilitada por modelos visuais simples e acessíveis, como os alertas nutricionais (KANTER; VANDERLEE; VANDEVIJVERE, 2018). Espera-se, assim, que os consumidores passem a utilizar esses alertas em suas decisões, incorporando-os gradualmente aos seus hábitos de compra. Com o tempo, esse padrão tende a se repetir, consolidando novos comportamentos alimentares, mesmo que não ocorra uma busca ativa por informações nutricionais (MACHÍN *et al.*, 2023). À medida que esse processo se amplia, a indústria tende a responder por meio da reformulação de produtos, visando atender às novas demandas do mercado. Essa dinâmica pode contribuir, a longo prazo, para a mudança nos padrões alimentares da população e, conseqüentemente, para a redução de doenças relacionadas à alimentação não saudáveis (WHITE; BARQUERA, 2020).

Diversos estudos vêm demonstrando que os alertas nutricionais impactam diretamente como os consumidores percebem a saudabilidade de produtos (CASTRONUOVO *et al.*, 2022; CENTURIÓN; MACHÍN; ARES, 2019; NOBREGA; ARES; DELIZA, 2020; TEMPLE, 2020). Nobrega *et al.* (2020) observaram que os alertas em formato de octógono foram mais influentes do que as alegações nutricionais na formação da percepção de saudabilidade, contribuindo para neutralizar as associações positivas de saúde geradas pelas alegações. De forma semelhante, Centurión *et al.* (2019) demonstraram que, mesmo em um contexto em que os consumidores ainda não estavam familiarizados com esse tipo de rotulagem, a maioria dos participantes fixou o olhar no octógono e os utilizou como principal critério para julgar a

saudabilidade das barras de cereais, sendo mais relevantes do que as alegações e imagens para influenciar a percepção do produto.

Os alertas nutricionais têm se mostrado eficientes em melhorar a capacidade dos consumidores de identificar produtos com excesso de nutrientes críticos, reconhecer a presença desses nutrientes nos alimentos e comparar diferentes opções disponíveis, facilitando escolhas mais conscientes (GOMES *et al.*, 2024, 2025a; 2025b; KROKER-LOBOS *et al.*, 2023). Evidências adicionais indicam que eles também contribuem para reduzir a intenção de compra de produtos menos saudáveis, desencorajando a escolha de alimentos com excesso de nutrientes críticos (ARES *et al.*, 2023; BERTORELLO *et al.*, 2023; CROKER *et al.*, 2020; SONG *et al.*, 2021). Além disso, a presença dos alertas tem se mostrado eficaz em estimular o abandono de determinadas categorias de produtos e promover sua substituição por alternativas mais saudáveis (ALCANTARA; ARES; DELIZA, 2022; ARES *et al.*, 2018b).

No Uruguai, um experimento com rastreamento ocular, que simulou uma prateleira de lanches semelhantes às encontradas em ambientes reais de compra, evidenciou que os alertas nutricionais em formato de octógono aumentaram significativamente a atenção visual dos consumidores: enquanto nenhum participante do grupo controle fixou o olhar nas informações nutricionais tradicionais, 50% daqueles expostos aos alertas dirigiram sua atenção diretamente a esses elementos durante a tomada de decisão (MACHÍN *et al.*, 2019). Resultados semelhantes foram encontrados por TÓRTORA, MACHÍN E ARES (2020), que observaram que a maioria dos participantes recorria aos alertas para realizar suas escolhas, mesmo na presença de outros elementos relacionados à saúde no rótulo, como alegações nutricionais, imagens ilustrativas, informações adicionais e marca.

Embora esses achados experimentais reforcem a efetividade dos alertas, estudos após a sua implementação ainda são escassos e limitados a alguns países da América Latina: Chile (MINISTERIO DE SALUD, 2017; TAILLIE *et al.*, 2020b), Uruguai (ARES *et al.*, 2021a; MACHÍN *et al.*, 2023) e México (CONTRERAS-MANZANO *et al.*, 2024). Um ano após a implementação dos alertas no Chile, observou-se elevada conscientização e aceitação por parte dos consumidores: 93% relataram ter notado os alertas nos produtos e 44% afirmaram que eles influenciaram suas decisões de compra (MINISTERIO DE SALUD, 2017). Além disso, foi registrada uma redução de 23,7% na aquisição de bebidas açucaradas após a implementação da lei de rotulagem e propaganda chilena (TAILLIE *et al.*, 2020b). No entanto, é importante destacar que, juntamente com os alertas nutricionais, o país adotou, restrições de marketing e proibição de vendas de produtos ricos em calorias, açúcar, gorduras saturadas e sódio em escolas (MINISTERIO DE SALUD, 2015). Assim, torna-se difícil isolar os efeitos específicos dos alertas nutricionais, uma vez que os diferentes componentes da política foram implementados de forma simultânea.

ARES *et al.* (2021) avaliaram os efeitos dos alertas nutricionais durante o primeiro mês após a implementação no Uruguai. Foi observado que 86% dos participantes afirmaram já ter ouvido falar deles antes do estudo e 94% classificou os alertas como bom ou muito bom. Quando questionados sobre já terem visto os alertas em um produto que pretendiam comprar, 67% afirmaram que sim, dos quais, 58% afirmaram modificar sua decisão de compra após perceberem a presença no produto. Em um estudo realizado mais de um ano após a implementação, 98% dos participantes afirmaram já ter visto o octógono em algum produto (MACHÍN *et al.*, 2023). Em outro estudo, foi investigado o efeito dos alertas nutricionais nas associações dos consumidores em relação ao rótulo de produtos. Antes da implementação, as principais associações foram relacionadas à descrição da categoria do produto, ocasiões de consumo, nomes de marcas, características hedônicas positivas e sensoriais esperadas. Após a implementação foram principalmente em relação aos nutrientes destacados pelos alertas (ARES *et al.*, 2020a).

No México, um ano após a implementação da política, 44,8% dos adultos e 38,7% dos jovens relataram que os alertas os motivaram a comprar menos alimentos não saudáveis, especialmente bebidas açucaradas (CONTRERAS-MANZANO *et al.*, 2024). Basto-Abreu *et al.* (2020) estimaram o potencial impacto da implementação dos alertas nutricionais em bebidas e lanches no México em relação à prevalência de obesidade e seus custos. Espera-se que em cinco anos os alertas sejam capazes de contribuir para uma redução no consumo de 36,8 kcal/dia, o que possibilitaria uma diminuição no índice de massa corporal e de 1,3 milhão de casos de obesidade em adultos com menos de 60 anos, sendo possível economizar cerca de US\$ 1,8 bilhão.

Além de compreender a influência da lupa no comportamento dos consumidores após a implementação, é fundamental investigar como afeta distintos grupos de consumidores, considerando a complexidade relacionada às escolhas alimentares (CHEN; ANTONELLI, 2020).

5. FATORES QUE PODEM MODULAR A EFETIVIDADE DA ROTULAGEM NUTRICIONAL FRONTAL

5.1 Características dos produtos

A experiência do consumidor durante o processo de compra é resultado da interação com múltiplos estímulos simultâneos, incluindo o ambiente de compra, o produto e as interações sociais. Esses estímulos moldam as percepções do consumidor e impactam suas decisões, especialmente em ambientes caracterizados por escolhas rápidas e exposição a variadas informações (HOCH, 2002; LANG; HOOKER, 2013). Nesse processo, a rotulagem desempenha um papel central ao oferecer múltiplas informações que orientam a decisão de compra (ASIOLI *et al.*, 2017; JAEGER, 2006). Entre essas informações, destacam-se os alertas nutricionais, cuja proposta é oferecer orientações rápidas e fáceis, auxiliando para escolhas mais conscientes e informadas (KANTER; VANDERLEE; VANDEVIVERE, 2018). No entanto, as empresas utilizam uma ampla gama de informações nos rótulos de alimentos para desencadear associações nas mentes dos consumidores, o que pode reduzir o impacto dos alertas nutricionais (NOBREGA *et al.*, 2020).

A marca, em particular, exerce um papel central nesse processo, funcionando como um importante elemento de diferenciação e fidelização (BRAKUS; SCHMITT; ZARANTONELLO, 2009; JAEGER, 2006). A familiaridade com a marca tende a fortalecer a percepção de valor do produto, influenciando positivamente a preferência do consumidor frente a alternativas menos conhecidas. Esse efeito está associado tanto ao valor simbólico construído ao longo do tempo quanto à redução do esforço cognitivo, decorrente de associações mentais previamente estabelecidas com a marca (BRAKUS; SCHMITT; ZARANTONELLO, 2009; GODDEN *et al.*, 2023; PONNAM; SREEJESH; BALAJI, 2015). Estudos indicam que consumidores demonstram maior lealdade às marcas consolidadas, mesmo diante de opções potencialmente mais saudáveis (CARRILLO; VARELA; FISZMAN, 2012; GREENLAND *et al.*, 2024; PELOZA; YE; MONTFORD, 2015; THOMA; WILLIAMS, 2013). Nesse contexto, a efetividade dos alertas nutricionais pode ser atenuada em produtos de marcas fortemente estabelecidas, uma vez que os consumidores tendem a reduzir a atenção ou a relevância atribuída a essas informações (ALCANTARA *et al.*, 2022; GODDEN *et al.*, 2023). Por outro lado, consumidores com menor apego às marcas demonstram maior propensão a considerar substituições por produtos com perfil nutricional mais favorável (GODDEN *et al.*, 2023).

Outro elemento que vem sendo bastante estudado nos últimos anos são as alegações (BALLCO; DE-MAGISTRIS; CAPUTO, 2019; NOBREGA; ARES; DELIZA, 2020; STEINHAUSER; JANSSEN; HAMM, 2019). As alegações buscam destacar os aspectos positivos dos produtos, o que nem sempre reflete a qualidade nutricional. Elas são pontuais, tendem a ser facilmente assimiladas e processadas pelos consumidores. Deste modo, podem competir com os alertas nutricionais contribuindo para que os consumidores sejam induzidos ao erro quanto à qualidade nutricional do alimento (BALLCO; DE-MAGISTRIS; CAPUTO, 2019; OOSTENBACH *et al.*, 2019). PRADA *et al.*, (2021) observaram que quando cereais matinais, iogurtes, sorvetes e biscoitos continham alegações relacionadas ao teor de açúcar (0% de açúcar, sem açúcar, sem adição de açúcar, baixo teor de açúcar) foram em geral classificados como mais saudáveis e menos calóricos do que as alternativas sem alegações, mas também como menos saborosos.

FRANÇA; ALCANTARA; DELIZA (2025) observaram que os alertas nutricionais auxiliaram na identificação do nutriente crítico em excesso e foi eficiente em influenciar os participantes a perceberem o produto como menos saudável. No entanto, a alegação nutricional e a marca tiveram maior influência na percepção de saudabilidade dos produtos. PRATES *et al.* (2022) observaram que apesar dos efeitos positivos dos alertas nutricionais, como o aumento da compreensão das informações nutricionais e a redução da percepção de saudabilidade e intenção de compra, essas informações não conseguiram anular o viés positivo gerado pelas alegações. Um estudo realizado com consumidores brasileiros com 60 anos ou mais observou que os alertas nutricionais foram eficientes em desencorajar escolhas pouco saudáveis. No entanto, a marca e a alegação nutricional foram os fatores mais relevantes nas escolhas dos consumidores. Já as alegações sensoriais apresentaram um impacto positivo nas escolhas, mas tiveram a menor importância relativa para todas as categorias de produtos estudados (MARTINS *et al.*, 2025).

5.2. Características individuais dos consumidores

As características individuais dos consumidores — como fatores sociodemográficos, atitudinais e comportamentais — influenciam significativamente a formação de preferências alimentares, atitudes frente aos alimentos e a capacidade de compreender e utilizar a rotulagem nutricional (DONGA; PATEL, 2018; STEINHAUSER; HAMM, 2018). Nesse sentido, espera-se que os alertas nutricionais apresentem efeitos semelhantes, sendo suas reações moduladas por essas mesmas características (ARES *et al.*, 2021b). Entretanto, a literatura ainda apresenta resultados contraditórios sobre o impacto das características individuais na efetividade e utilização da rotulagem nutricional (SHRESTHA *et al.*, 2023; TAILLIE *et al.*, 2020a; VARGAS-MEZA *et al.*, 2019).

Os estudos sugerem que as mulheres tendem a demonstrar maior interesse por uma alimentação saudável, compreendem melhor as informações nutricionais, confiam nessas informações e são influenciadas por elas. Elas demonstram maior capacidade de classificar o produto corretamente de acordo com as características nutricionais utilizando diferentes modelos de rotulagem nutricional frontal (DUCROT *et al.*, 2015b, 2015a; EGNELL *et al.*, 2018). Adasme-Berrios *et al.* (2020) observaram que as mulheres mostraram maior tendência a evitar alimentos com alertas nutricionais, enquanto em pessoas de baixa renda foi constatado o oposto.

No caso da escolaridade, diversos trabalhos relatam que consumidores com maior nível educacional demonstram maior capacidade de compreender corretamente a rotulagem nutricional frontal (DUCROT *et al.*, 2015b, 2015a; EGNELL *et al.*, 2018; PACKER *et al.*, 2021; SANTOS *et al.*, 2020). PACKER *et al.* (2021) observaram que todos os modelos de

rotulagem aumentaram a identificação correta de alimentos mais saudáveis, mas esse efeito foi mais acentuado entre pessoas com maior escolaridade. No Chile, um estudo reportou a redução de 23,7% no consumo de bebidas açucaradas após a implementação da Lei Chilena de Rotulagem e Publicidade de Alimentos, com famílias com alto nível de escolaridade apresentando reduções maiores (TAILLIE *et al.*, 2020a). Por outro lado, TAILLIE *et al.* (2020b) não observaram uma interação significativa entre o tipo de alerta nutricional e o nível educacional dos colombianos, sugerindo que independente do modelo dos alertas (Octógono, triângulo e círculo preto), eles foram eficientes em ajudar a promover a equidade em saúde, uma vez que têm impactos semelhantes em todos os níveis educacionais.

A renda também aparece como um fator importante. MACHÍN *et al.* (2017) observaram que consumidores de baixa renda classificaram a saudabilidade de todos os produtos analisados significativamente mais alto do que os participantes de média e alta renda, independentemente do esquema da FOP (GDA, semáforo nutricional e semáforo monocromático) incluído nos rótulos. Um estudo no México com consumidores de média e baixa renda observou que mesmo quando a rotulagem nutricional frontal promove decisões alimentares mais saudáveis, como observado com o uso de alertas e semáforos, consumidores com menor renda e escolaridade ainda tendem a fazer escolhas de menor qualidade nutricional (JÁUREGUI *et al.*, 2020).

Quanto à idade, os mais velhos geralmente demonstram maior uso da rotulagem nutricional frontal. No Uruguai, participantes com mais de 55 anos e entre 26 e 35 anos foram mais propensos a evitar produtos com alertas, em comparação aos mais jovens, enquanto outras variáveis — como escolaridade, renda e estado de saúde — não foram significativas (ARES *et al.*, 2021b). No Brasil, um estudo conduzido antes da implementação da rotulagem nutricional frontal mostrou que os pais foram mais influenciados pelos alertas nutricionais em formato de octógono do que as crianças, especialmente entre aqueles com filhos em escolas particulares, sugerindo um efeito mediado por fatores socioeconômicos (LIMA; ARES; DELIZA, 2018). Estudos no Chile e no Peru indicam que os alertas não impactaram significativamente o comportamento de compra de crianças e adolescentes (FRETES *et al.*, 2025; SAAVEDRA-GARCIA; MOSCOSO-PORRAS; DIEZ-CANSECO, 2022). Por outro lado, CASTRONUOVO *et al.* (2022), em um estudo realizado com biscoitos, iogurtes e queijo cremoso, observaram que o octógono foi eficaz em reduzir a percepção de saudabilidade dos produtos; no entanto, essa percepção não foi significativamente influenciada pelo gênero e pela idade.

Outro aspecto relevante diz respeito à condição de saúde do consumidor. Um estudo realizado no México relatou que aqueles que autorrelatavam possuir duas ou mais condições de saúde ligadas à alimentação (obesidade, dislipidemia, hipertensão e diabetes melitos tipo II) tiveram duas ou três vezes mais chances de classificar corretamente os produtos em relação à saudabilidade ao utilizar os alertas nutricionais em formato de octógono, comparada com o GDA. Sendo essa probabilidade maior entre aqueles com três ou mais condições de saúde relacionadas a alimentação (SAGACETA-MEJÍA *et al.*, 2022). EGNELL *et al.* (2022) observaram que a rotulagem nutricional frontal contribuiu para melhorar o perfil nutricional geral das intenções de compra de alimentos em indivíduos com doenças relacionadas a alimentação, levando à seleção de produtos com menor teor energético e de gorduras saturadas.

De forma geral, a rotulagem nutricional frontal tem se mostrado eficaz em incentivar escolhas alimentares mais conscientes e informadas. No entanto, características individuais dos consumidores influenciam a forma como essa ferramenta é percebida, compreendida e utilizada (SHRESTHA *et al.*, 2023). Nesse contexto, torna-se essencial investir em medidas complementares, como campanhas de comunicação, com o objetivo de ampliar o alcance e o impacto da rotulagem nutricional frontal (VIDAL *et al.*, 2019). Para que essas ações sejam mais eficazes na promoção de escolhas alimentares saudáveis, é necessário que considerem as especificidades dos diferentes grupos sociodemográficos (ARES *et al.*, 2021c).

6. ESTRATÉGIAS DE COMUNICAÇÃO E CAMPANHAS EDUCATIVAS

A efetividade dos alertas nutricionais não depende apenas da presença nas embalagens, mas também da capacidade dos consumidores de reconhecê-los, compreender a informação transmitida e estarem motivados a utilizá-los durante o processo de escolha alimentar (ARES *et al.*, 2021a; WHO, 2019). Nessa perspectiva, ações de comunicação e educação em saúde têm sido apontadas como complementares e essenciais para a implementação da rotulagem nutricional frontal, possibilitando, assim, aumentar a conscientização sobre os modelos e incentivar os consumidores a leva-los em consideração ao fazer suas escolhas alimentares (ARES *et al.*, 2018c).

Campanhas educativas e estratégias de comunicação têm se mostrado capazes de aumentar o impacto da rotulagem nutricional frontal nas decisões de consumo (MØRK *et al.*, 2017; SCHRUFF-LIM *et al.*, 2023; VIDAL *et al.*, 2019). No Chile a Lei de Rotulagem e Publicidade incluiu campanhas de comunicação em massa para informar a população sobre a nova política e incentivar hábitos de consumo mais saudáveis. Como resultado, observou-se alta taxa de conscientização e reconhecimento dos alertas nutricionais. No entanto, é importante destacar que o entusiasmo inicial gerado pelas campanhas precisa ser mantido ao longo do tempo, com estratégias específicas voltadas para públicos menos familiarizados com a política (MINISTERIO DE SALUD, 2017).

No Uruguai, em um questionário online aplicado antes da implementação da rotulagem nutricional frontal, os participantes expressaram a necessidade de campanhas educativas que expliquem como interpretar os alertas e os riscos do consumo excessivo de açúcar, gordura e sódio (ARES *et al.*, 2018c). Um aspecto central dessas estratégias é o enquadramento das mensagens, ou seja, a forma como a informação é apresentada para moldar percepções e comportamentos (AINIWAER *et al.*, 2021; FLORENCE *et al.*, 2022; GALLAGHER; UPDEGRAFF, 2012; GIER; KRAMPE; KENNING, 2023). Nesse contexto, mensagens com foco em ganhos destacam benefícios de escolhas saudáveis, como maior qualidade de vida e prevenção de doenças, enquanto mensagens com foco em perdas enfatizam riscos associados a dietas não saudáveis, como o aumento das doenças não transmissíveis. Evidências sugerem que mensagens de ganho tendem a atrair indivíduos orientados por recompensas positivas, enquanto as de perda podem ter maior impacto sobre aqueles mais avessos ao risco (ARES *et al.*, 2020b, 2020c; GALLAGHER; UPDEGRAFF, 2012; OTTERBRING; FESTILA; FOLWARCZNY, 2021).

A percepção das mensagens das campanhas também pode variar conforme características sociodemográficas. Por exemplo, mensagens que enfatizam as consequências negativas para a saúde foram mais bem recebidas por mulheres, jovens e pessoas com obesidade, enquanto mensagens focadas em alimentação saudável foram preferidas por adultos mais velhos e indivíduos com peso considerado normal. Essa heterogeneidade aponta para o potencial da segmentação do público-alvo como estratégia para aumentar a efetividade dos alertas nutricionais (ARES *et al.*, 2021c). No Brasil, um estudo de simulação de compra de produtos para um lanche com consumidores acima de 60 anos indicou que fornecer informações sobre a política de rotulagem nutricional anteriormente à realização da tarefa aumentou a importância atribuída aos alertas nas escolhas hipotéticas, ao mesmo tempo que reduziu o valor da marca na decisão (MARTINS *et al.*, 2025).

Resultados semelhantes foram relatados por Vidal *et al.* (2019) com consumidores uruguaios em uma tarefa de escolha real. Os resultados indicaram que tanto mensagens com enquadramento de ganho quanto de perda aumentaram a atenção dos participantes aos alertas nutricionais presentes nas embalagens durante a escolha de um lanche, em comparação ao grupo controle exposto a mensagens não relacionadas à nutrição. No entanto, o enquadramento de perda mostrou-se mais eficaz, pois gerou maior atenção visual aos alertas e levou à redução da

escolha de produtos menos saudáveis. Resultados semelhantes foram observados por Eguren *et al.* (2021) ratificando a efetividade do enquadramento de perda.

A aplicação de estratégias educativas em pontos de venda também tem mostrado efeitos positivos. Na Austrália, cartazes com o sistema de Estrela (*Guiding Stars*) e a mensagem “Todas as frutas e vegetais frescos são uma escolha saudável” resultaram em aumento na venda de produtos mais saudáveis e redução nos níveis médios de energia, gorduras e sódio dos alimentos adquiridos nas lojas com as informações, em comparação com lojas sem as informações (CAMERON *et al.*, 2022). De forma semelhante, uma campanha multimídia realizada na Dinamarca para promover o selo de fechadura (*Keyhole*) - selo nórdico comum para destacar alimentos mais saudáveis dentro de uma categoria - levou ao aumento da participação de mercado de produtos com o selo em algumas redes de varejo, embora os efeitos tenham variado conforme a penetração prévia do selo nas diferentes redes (MØRK *et al.*, 2017).

Na Colômbia, um estudo randomizado em um refeitório universitário avaliou o impacto de cartazes informativos sobre o sistema Nutri-Score. Os consumidores expostos à informação sobre o selo apresentaram maior probabilidade de adquirir produtos com o rótulo verde (classificados como mais saudáveis), resultando em compras com maior conteúdo proteico. O grupo com informações sobre o modelo também apresentou aumento no gasto total, impulsionado pelo consumo de itens mais saudáveis. Esses achados indicam que a simples exposição às informações claras e visuais sobre o sistema de rotulagem pode promover mudanças imediatas no comportamento alimentar (MORA-GARCÍA; TOBAR; YOUNG, 2019).

Também foram observados efeitos positivos em intervenções com vídeos educativos. No México, FERNANDEZ *et al.* (2023) relataram que pais e filhos expostos a vídeos explicativos sobre o sistema de classificação por estrelas escolheram alimentos com mais estrelas do que aqueles que apenas visualizaram o selo sem orientação. No entanto, a diferença entre o grupo que assistiu ao vídeo e o grupo controle (sem exposição) não foi estatisticamente significativa, sugerindo que o impacto da comunicação pode variar conforme o contexto e o público-alvo. Esses achados reforçam que estratégias de comunicação e campanhas educativas são componentes fundamentais para o sucesso da rotulagem nutricional frontal. Sua eficácia depende não apenas do conteúdo, mas também da forma como as mensagens são transmitidas e adaptadas aos diferentes perfis da população. Diante disso, torna-se essencial aprofundar os estudos sobre as melhores abordagens comunicacionais, de modo a maximizar o alcance, a compreensão e o uso das informações nutricionais pelos consumidores.

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INTERPRETAÇÃO E EXPERIÊNCIAS DE CONSUMIDORES BRASILEIROS COM OS RÓTULOS "ALTO EM" DURANTE O INÍCIO DA IMPLEMENTAÇÃO DA POLÍTICA*

* Artigo em revisão

RESUMO

A rotulagem nutricional frontal tem sido implementada em diversos países como uma das formas de enfrentamento as doenças não transmissíveis (DNT), por incentivar os consumidores a realizarem escolhas alimentares mais informadas e saudáveis. No Brasil, foi adotado um modelo de rotulagem frontal do tipo "alto em", composto pela lupa preta que sinaliza produtos com altos teores de nutrientes associados às DNT. O presente estudo explorou a interpretação e as experiências de consumidores brasileiros com os alertas "alto em" durante os primeiros períodos de implementação da política. Foram realizados dois estudos online com 1.762 participantes recrutados por meio de agência de marketing em dois momentos distintos: dezembro de 2022 a janeiro de 2023 e dezembro de 2023 a janeiro de 2024. O estudo avaliou as associações evocadas pelos alertas "alto em", a capacidade dos participantes para identificar o produto mais saudável e aqueles com altos teores de nutrientes associados às DNT, bem como experiências autorrelatadas sobre o uso dos alertas nas decisões de compra de alimentos. Os dados foram analisados por meio de estatísticas descritivas e testes inferenciais. Nos dois estudos, os participantes identificaram corretamente o produto mais saudável em 63,6% das tarefas e os produtos com alto teor de nutrientes em 44,8% das tarefas. Logo após a implementação da medida, 36% dos participantes relataram ter visto o alerta em um produto que pretendiam comprar, e, entre esses, 53% afirmaram ter mudado a decisão de compra. Um ano depois, esses números aumentaram para 71% e 45%, respectivamente. As características individuais e o período de coleta de dados exerceram influência limitada sobre a capacidade dos participantes de interpretar os alertas. Esses achados ressaltam a necessidade de desenvolver campanhas de comunicação para aumentar a conscientização e incentivar o uso dos alertas "alto em" nas decisões de compra.

Palavras chaves: rotulagem nutricional frontal, alerta nutricional, embalagens, informação nutricional, rótulo alto em

Brazilian consumers' interpretation and experiences with high-in labels during the early implementation of the policy

Abstract

Front-of-package nutrition labelling has been implemented in several countries to tackle non-communicable diseases (NCDs) by encouraging consumers to make more informed and healthier food choices. In Brazil, a front-of-package (FOP) "high in" labeling model was adopted, consisting of a black magnifying glass that signals products high in nutrients associated with NCDs. The present study explored Brazilian consumers' interpretation and experiences with high-in labels during the early implementation of the policy. Two online studies were conducted with 1,762 participants recruited through a marketing agency at two time points: December 2022-January 2023 and December 2023-January 2024. The study assessed associations elicited by high-in labels, participants' ability to identify the healthiest product and those high in nutrients associated with NCDs, as well as self-reported experiences with high-in labels when making food purchasing decisions. Data were analyzed using descriptive statistics and inferential tests. Across the two studies, participants correctly identified the healthiest product in 63.6% of the tasks and products high in nutrients in 44.8% of the tasks. Shortly after the implementation, 36% of participants reported having seen the warning label on a product they intended to buy, and among them, 53% reported changing their purchase decisions. One year later, these figures increased to 71% and 45%, respectively. Individual characteristics and the data collection period had limited influence on participants' ability to interpret the labels. These findings highlight the need to develop communication campaigns to raise awareness and promote the use of high-in labels when making purchasing decisions.

Keywords: front-of-package, nutritional warnings, packaging, nutritional information, high-in label

INTRODUCTION

The implementation of public policies to encourage healthier dietary habits has been identified as a priority for tackling non-communicable diseases (NCDs) ⁽¹⁾. One of such public policies is front-of-package (FOP) nutrition labeling, a tool that provides consumers with information about the nutritional composition of foods and, consequently, can encourage healthier food choices ⁽²⁾. Warning labels are one of several FOP nutrition labeling schemes implemented worldwide ⁽³⁾. Warning labels have been applied to highlight products high in nutrients associated with NCDs (sugars, total fat, saturated fat, and/or sodium) ⁽⁴⁾. Experimental studies conducted in different countries have demonstrated the efficacy of this FOP nutrition labeling scheme to improve consumer ability to understand nutrition information and to dissuade them from choosing foods high in nutrients associated with NCDs ⁽⁵⁻⁸⁾. Nevertheless, studies after the implementation of warnings labels are still scarce and limited to a few Latin American countries: Chile ^(9,10), Uruguay ^(11,12) and Mexico ⁽¹³⁾.

Research conducted in Chile and Uruguay have shown a high level of awareness, understanding and acceptance of octagonal warning labels after their implementation ^(11,14,15). A study conducted 10 days after the entry into force of the policy in Uruguay revealed that 67% of the participants had already seen warnings on a product they intended to buy and that 58% of them claimed that they had changed their purchase decision after seeing the symbol. In addition, the inclusion of warning labels led to an improvement in participants' ability to correctly identify the healthiest product among a series of alternatives, as well as products containing an excessive amount of nutrients associated with NCDs ⁽¹¹⁾. In the case of Chile, warning labels were implemented together with marketing regulations and a ban on the sales of products high in nutrients associated with NCDs in education centers ⁽¹⁶⁾. This makes it difficult to disentangle the effects of the different components of the regulation. However, a 23.7% reduction in the consumption of sugary drinks was observed in the post-regulation period of the Chilean Food Labeling and Advertising Law, with families with a high level of education showing greater reductions ⁽¹⁰⁾. A study conducted in Mexico one year after the implementation of nutritional warnings found that 44.8% of adults and 38.7% of young participants reported reducing their purchase of various unhealthy food products due to the warnings ⁽¹³⁾.

Warning labels have been implemented using a variety of graphic designs, that are expected to influence their visibility and impact ^(17,18). Most Latin American countries have implemented black octagonal warning labels ⁽¹⁹⁾. In Brazil, the National Health Surveillance Agency (ANVISA), mandated the inclusion of a black magnifying glass featuring the expression 'High in', followed by the corresponding nutrient on products high in added sugar, saturated fat and/or sodium. The graphic design and the thresholds of the Brazilian FOP nutrition labeling policy are shown in the Supplementary Material (Figure 1 and table 1) is provided in Appendix I of this thesis. A gradual entry into force of the policy was defined. In October 2022, only products launched to the market after October 2020 had to feature the high-in label if the content of added sugar, saturated fat and/or sodium was higher than the thresholds established in the regulation ^(20,21). For the rest of the products already available in the market before the implementation of the policy, the date of full compliance was April 22nd, 2024. Small producers were given a longer deadline to comply with the regulation (October 9th, 2024), whereas the deadline for beverages in returnable packaging will be October 9th, 2025. During policy implementation, no mass communication campaigns led by the government were conducted to inform consumers about the high-in label. Communication efforts were largely limited to actions promoted by civil organizations (e.g., the Brazilian Institute for Consumer Defense, IDEC).

Understanding Brazilian consumers' experiences with the nutrition labeling regulation is essential for developing strategies that enhance comprehension and promote the use of the

high-in labels in food purchasing decisions, thereby contributing to the effectiveness of the policy. In particular, analyzing the experiences and opinions of different consumer groups and across different stages of implementation can help identify specific needs and challenges related to the interpretation and use of the high-in labels. Such insights can support the development of targeted communication strategies. In this context, the present study aimed to explore Brazilian consumers' interpretation and experiences with the high-in labels in two moments during their early implementation. In particular, this exploratory study aimed to evaluate: i) the associations generated by the high-in label ii) consumers' ability to interpret the information provided by the high-in label, iii) the influence of individual characteristics and time after implementation on consumers' interpretation of the high-in label and self-reported effect on purchasing decisions.

MATERIALS AND METHODS

The study involved two online surveys conducted in two distinct data collection periods. The first took place between December 2022 and January 2023, shortly after the gradual implementation of front-of-package (FOP) nutrition labeling began in Brazil. At that time, the use of the high-in labels was mandatory only for newly launched products. As a result, these labels appeared on a limited number of items on the market. The second data collection occurred approximately one year later, between December 2023 and January 2024, coinciding with the initial deadline for mandatory use of high-in labels (October 2023) for most products available on the market. Although this deadline was subsequently extended to April 2024, by the time of the second survey consumers were already increasingly exposed to labeled products in the marketplace. The questions included in the two surveys were identical.

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by the Brazilian Research Ethics Committee (CAAE: 67186223.8.0000.5282, Plataforma Brasil). Written informed consent was obtained from all subjects.

Participants

Brazilian participants were recruited by a marketing agency specialized in consumer studies. People over the age of 18 years living in the southeast region of the country (the largest in terms of population ⁽²²⁾) registered in the agency's database were invited to participate by email. They were informed that they would participate in a survey about food. All participants provided written informed consent to take part in the study. Different participants were recruited in each survey, with no repetition of participants between the two data collections.

Sample size calculations were performed to estimate the minimum number of participants to be included in each wave. For this purpose, participants were assumed to be randomly drawn from an infinite population, and the key outcome was defined as a proportion. The most conservative criterion was used for the estimation: the expected value of the outcome was set at 50%. Using this criterion, a minimum sample size of 597 participants was required in each survey to estimate the proportion with a margin of error of 4% and a confidence level of 95%.

Stimuli

Six product categories were used as stimuli to assess the participants' ability to interpret the information provided by the high-in labels: ready-made cake, orange nectar, frozen lasagna, cereal bars, yogurt and potato chips. These categories are frequently consumed by Brazilians⁽²³⁾ and are usually high in critical nutrients. For each category, three packages differing in graphic design and nutritional compositions were created based on the characteristics of products available on the Brazilian market. For each category, one product was considered "the healthiest" (product 3 in Supplementary Table 2 is provided in Appendix I of this thesis) as it contained fewer high-in than the other two. High-in labels were included on the packages according to the criteria established in Collegiate Board Resolution (RDC) 429/2020(20).

Packages were developed by a professional from the Brazilian Agricultural Research Corporation (EMBRAPA) Food Technology, considering the characteristics of commercial products and the requirements of the Brazilian labeling legislation. Fictitious brands were used to avoid the influence of participants' previous experiences with commercial products. Examples of the products included in the research are shown in Supplementary Figure 2. The same visual stimuli were used in both data collection periods to ensure consistency and comparability between time points.

Questionnaire

The questionnaire was divided into five sections. Questions within each of the sections were adapted from previous studies^(11,24). The first section intended to explore the associations raised by packages featuring high-in labels through a word association task. This task enables to identify the associations raised by a stimulus, which are expected to determine individuals' purchase decisions⁽²⁵⁾. Three products were used as stimuli, corresponding to the products regarded as the least healthy options within the following categories: yogurt, cereal bars and orange nectar (Product 2 in Supplementary Table 2). Stimuli were presented in a monadic and random order. Participants were asked to look at each of the packages and to write down the first four words, associations, thoughts or feelings that came to their mind.

The second task aimed at evaluating participants' ability to use high-in labels to identify the healthiest alternative in a series of three products. Three series of three products (one per category) were shown (Supplementary Table 2). The order of the products within each series was also balanced to avoid order effects. Participants were asked to indicate which of the three products they considered the healthiest.

The third section evaluated participants' ability to use high-in labels to identify products high in nutrients associated with NCDs. Two products within each of the categories were used as stimuli, which corresponded to the least healthy product (Product 1 in Supplementary Table 2 is provided in Appendix I of this thesis) and the healthiest product (Product 3 in Supplementary Table 2 is provided in Appendix I of this thesis). The healthiest product for each category did not contain high-in label, whereas the least healthy product included between 1 and 2 high-in labels. Each participant evaluated three of the products, one by one, following a random presentation order. For each of the products, participants were asked to indicate whether it contained any nutrients above the recommended level for a healthy diet. Four response options were presented: no; yes, sugar; yes, saturated fat and yes, sodium. Participants could select more than one nutrient.

The fourth section intended to explore participants' actual experiences with high-in labels on products available in the marketplace. First, the participants had to indicate whether they had seen the high-in labels during the study (Yes/No) and whether they took this

information into account in their evaluation (Yes/No). They were also asked if they had already received any explanation or information about the high-in labels prior to the study and, if so, where. Then, they were then asked whether they had ever seen a product with a high-in label when making their food purchases (Yes/No/I don't remember) and whether they had seen them on any product they intended to purchase (Yes/No/I don't remember). Those who answered affirmatively were asked about their purchase decisions using a multiple-choice question: "I purchased the product anyway", "I purchased a similar product without the black magnifying glass", "I didn't purchase the product".

The last section of the questionnaire included a series of sociodemographic questions, including gender, age, education, income, and the frequency with which food labels are observed. Participants were also asked to self-report non-communicable diseases (hypertension, diabetes, hyperglycemia, kidney disease, heart disease) and to indicate whether they had already received any guidance regarding nutrition. The same questionnaire was applied in both data collection periods.

Data Analysis

Data from both collection periods were aggregated and analyzed jointly. Data were analyzed using descriptive and inferential statistics in R software ⁽²⁶⁾. A significance level of 5% was considered for inferential tests.

Word association. Responses were analyzed using content analysis based on inductive coding ⁽²⁷⁾. Participants' responses were coded into categories independently by three researchers. Then, a series of meetings were conducted to define the final categories by consensus. All identified categories were considered in the analysis, without applying cut-off criteria, in order to preserve the diversity of participants' associations and avoid excluding less frequent but potentially meaningful responses. The categories were then grouped into dimensions using the same procedure. The percentage of participants providing responses within each category and dimension was calculated. For each health-related dimension, a generalized linear model (GLM) was used to assess associations between the responses and participants' individual characteristics and data collection time point. A binary variable indicating whether each participant provided responses related to the dimension or not (1/0) was considered as dependent variable, while data collection time point and individual characteristics (gender, income, age, education, frequency of reading food labels, self-reported non-communicable diseases, and prior nutrition guidance) were considered as independent variables in the model.

Identification of the healthiest product. For each category, 0 was assigned when participants chose the "least healthy" products and 1 when they chose the "healthiest" option. The percentage of participants who correctly identified the healthiest product for each product category was calculated. Analysis of variance (ANOVA) was used to evaluate the existence of significant differences in the mean number of correct answers according to participants' individual characteristics and data collection time point.

Identification of products high in critical nutrients. For each category, a value of 0 was assigned when the answer was incorrect and a value of 1 for the correct answer. The content of all nutrients was considered for assigning a correct answer. The percentage of participants who correctly identified nutrients above nutritional recommendations for each product category was calculated. Analysis of variance (ANOVA) was used to evaluate significant differences in the mean number of correct answers in relation to individual characteristics and data collection

time point. In both analyses, when significant differences were found, Tukey's test was used for post-hoc comparison of means.

Participants' experiences with high-in labels. The percentage of participants who reported having seen the high-in labels on a product they intended to buy was calculated. For those participants who answered affirmatively, the percentage who gave each responses option was calculated. These descriptive analyses were conducted separately for each data collection period to preserve the temporal context of consumer exposure to the high-in label. Additionally, a univariate multinomial logistic regression model was run considering participants' reaction toward the high-in label as the dependent variable (purchased the product anyway, purchased a similar product without the high-in label and did not purchase the product), and individual characteristics and data collection time point as independent variables. Results were presented as odds ratios, with 95% confidence intervals.

RESULTS

The sociodemographic characteristics of the 1,762 participants who completed the surveys —946 recruited during the first data collection period (December 2022 to January 2023) and 816 during the second (December 2023 to January 2024)— are presented in Table 1. The sample was relatively balanced in terms of gender and age between 18 and 55 years. Compared to the Brazilian population, participants over the age of 56 and those with lower levels of education (up to primary school) were underrepresented. No statistically significant differences were observed between the two data collection periods in terms of sociodemographic characteristics ($p > 0.05$ for all variables).

Table 1. Socio-Demographic Characteristics of The Participants (n= 1762)

Characteristic	Participant	Percentage of participants (%)
<i>Gender</i>		
Female	822	47
Male	940	53
<i>Age (years)</i>		
18 – 25	310	17
26-35	471	27
36-45	462	26
46-55	333	19
>56	186	11
<i>Education level</i>		
Primary education	188	11
Secondary education	551	31
Incomplete University	237	14
Complete University	601	34
Post-graduate studies	185	10
<i>Income</i>		
Up to 5 minimum wages (Up to USD 1,084)	1169	66
From 5 to 10 minimum wages (From USD 1,085 to USD 2,168)	409	23
More than 10 minimum wages (More than USD 2,168)	184	11
<i>Percentage of participants who self-reported different non-communicable diseases</i>		
Hypertension	416	24
Diabetes	300	17
Hyperglycemia	414	23
Kidney disease	94	5
Heart disease	94	5
<i>Whether they had already received any guidance about nutrition</i>		
Yes	1316	75
No	446	25
<i>Frequency of reading food labels</i>		
Always	228	13
Frequently	447	25
Sometimes	696	40
Never	391	22

Associations With Labels Featuring High-in Labels

Responses to the word association task were coded into 52 categories, which were subsequently grouped into 14 dimensions (Table 2). For all products, responses were mainly related to the following categories: “positive hedonic”, “health and well-being”, “product denomination”, “desire to consume”, and “natural”. Different health-related associations were mentioned by participants, which were both positive and negative. Positive references to health included “easy digestion”, “physical exercise”, “health and well-being”, “satiety”, “low in sugar content”, “energy” and “nutrients”. Meanwhile, the negative health-related associations included “sugar and excess sugar”, “fat and excess fat”, “sodium and excess sodium”, “calories”, “high-in labels”, “Illness and physical discomfort” and “unhealthy”. For all products, positive health-related associations were more frequent than negative associations (Table 2). In particular, references to nutrients associated with NCDs were mentioned by no more than 14% of the participants (Table 2).

Table 2. Dimensions and Categories Identified in The Content Analysis and Examples of Individual Responses and How Frequently They Were Mentioned For Orange Nectar, Yogurt and Cereal Bars.

Dimension	Category	Examples	Frequency of mentions %		
			Orange nectar (n= 868)	Cereal bar (n= 846)	Yogurt (n= 845)
<i>Positive hedonic and emotional associations</i>	Positive hedonic	Tasty, good, delicious, very good, sensational	38	32	51
	Desire to consume	Willing to try, I want to try it, I would buy it	12	8	14
	Positive feeling and emotions	Satisfaction, happiness, love, pleasure, joy, trust	5	5	5
<i>Positive effects on health</i>	Health and well-being	Health, healthy, life, good for you, well-being	23	41	22
	Easy digestion	Light	1	1	3
	Satiety	Satiety, sustain	3	9	4
	Physical exercise	Gym, running, athlete, exercise, training, walking	1	16	0
<i>Product description</i>	Product denomination	Juice, nectar, bar, yogurt	32	15	19
	Orange	Orange, eat orange, lots of orange	19	0	0
	Strawberry	Strawberry, pieces of strawberry	0	0	23
	Chocolate	Chocolate, felt like eating chocolate	0	3	0
	Nuts	Peanuts, nuts	0	6	0
<i>Sensory characteristics</i>	Sweet	Sweet, a little sweet, sweet, very sweet	13	8	13
	Flavor	Flavor, flavors, natural flavor	6	5	10
	Refreshing	Refreshing drink, refreshing, refreshes	13	0	5
	Other sensory attributes	Lightness, bitter, astringent, aroma, weak	6	4	3
	Acid	Citric, bitter, acidity	4	0	2
	Crunchy	Crunchy, crunchiness	0	5	0

	Creamy	Creamy, creaminess, dense, consistence	0	0	8
<i>Positive nutrients</i>	Energy	Energy, willingness, energetic	5	33	3
	Nutrients	Fibers, nutrients, protein	12	9	3
	Low sugar and fat content	Low sugar content	1	2	1
<i>Product characteristics</i>	Artificial	Artificial, artificial flavor, not natural, artificial taste	6	1	2
	Industrialized	Industrial, industrialized	3	1	1
	Natural	Natural, very natural, original flavor, no preservatives	14	16	10
<i>Other foods and beverages</i>	Fruit	Fruit, best fruit, my fruit of the day	7	0	15
	Other foods and drinks	Candy, cake, jelly, dessert, food	5	6	5
	Dairy products	Milk	0	0	4
	Grains and cereals	Cereal, seeds, oatmeal, grains	0	13	0
<i>Nutrients associated with NCDs</i>	Sugar and excess sugar	A lot of sugar, high in sugar, too much sugar	14	10	11
	Fat and excess fat	High in fat, fats, saturated fat, too much fat	0	3	0
	Calories	Calories, caloric	2	3	2
	High-in labels	Warning, magnifier, high in	1	1	1
	Brand	Del Valle, Kapo, Tang	1	2	8
<i>Other product features</i>	Innovation	Innovation, unique, modern, novelty	2	2	3
	Practicality	Practical, practical snack, easy	4	9	4
	Quality	Quality, quality product	5	2	5
	Cost	Cheap, cost, money, expensive, value	3	3	3
	Packaging	Carton, plastic, recipient, pack	5	2	6
<i>Package characteristics</i>	Information	Informative, a lot of information, information	1	1	1
	Context of consumption	Snack, open air, beach, breakfast, lunch	6	4	10
<i>Consumption occasion</i>	Temperature	Chilled, chilled and delicious, put in the fridge,	4	0	5
	No desire to consume	Hard to consume, would not recommend it, would avoid it	2	1	2
<i>Negative hedonic and emotional associations</i>	Negative hedonic	Bad, bad taste, don't like it, weird, horrible	7	5	6
	Negative feeling and emotions	Sadness, fear	0	1	0
<i>Negative effects on health</i>	Illness and physical discomfort	Disease, high glucose, diabetes, carcinogenic	2	3	2
	Unhealthy	Unhealthy, not very healthy, harmful	6	4	4

<i>Others</i>	Diet	Diet, fitness	2	12	3
	Doubt and ignorance	Will it be good? Will it be dear? I don't know what it is.	3	2	2
	Indifferent	Normal, nothing, none	1	1	1
	Agriculture	Agriculture, agribusiness, plantation	1	0	0
	Others	Seed, bee, book, nature, vintage, dynamic	7	7	6

The influence of participant individual characteristics and data collection time point on the likelihood of providing responses within health-related dimensions were analyzed using a GLM (Supplementary Table 3). For the “Nutrients associated with NCDs” dimension, a significant effect of gender and income was identified for yogurt, with these nutrients being mentioned less frequently by men and individuals with lower income levels. Additionally, the data collection period had a significant effect for all three products, with a higher frequency of mentions among participants from the second collection period. In the “Negative effects on health” dimension, a significant association was observed for cereal bars, with these aspects being more frequently mentioned by participants who reported never reading food labels.

Regarding the “Positive effects on health” dimension, younger participants (18–25 years old) tended to mention these effects less frequently for yogurt, while older participants (over 56 years) mentioned these effects less frequently in the case of cereal bars. This dimension was also more frequently mentioned by participants who reported having received prior nutrition guidance, in the case of cereal bars. In addition, education level had a significant effect for this product, although no clear trend was observed. With respect to the data collection period, positive effects on health were more often cited in the first period for orange nectar and cereal bars, and in the second period for yogurt. Moreover, in the “Positive nutrients” dimension, younger participants and those from the second data collection period mentioned these aspects more frequently for cereal bars. For orange nectar, education level had a significant effect, although once again, no consistent trend was observed (Supplementary Table 3 in Appendix I of this thesis).

Interpretation of High-in Labels

On average, participants correctly identified the healthiest product in 64.6% of the tasks. Table 3 shows the percentage of correct responses in the task of identifying the healthiest product within different product categories. The highest percentage of correct answers regarding which was the healthiest was orange nectar followed by yogurt, frozen lasagna, ready-made cake, potato chips, and cereal bar.

Table 3. Percentage of Participants Who Answered Correctly in the Tasks of Identifying the Healthiest Product Among Sets and Identifying of High in Critical Nutrients for Different product Categories

Product category	Percentage of correct answers (%)		
	Identifying the healthiest product	Identifying of High in Nutrient	
		“Unhealthful” version	“Healthful” version
Orange nectar	73.8	45.0	56.6
Yogurt	67.9	40.5	54.8
Frozen lasagna	67.9	30.3	58.1
Ready-made cake	67.1	25.5	31.7
Potato chips	57.7	39.6	61.8
Cereal bar	54.2	39.5	53.6

When evaluating participants' ability to identify the healthiest product in the set based on individual characteristics and data collection time point, significant differences were found in relation to gender ($p = 0.03$), education level ($p = 0.03$) and frequency with which food labels are observed ($p = 0.001$) (Supplementary Table 4 in Appendix I of this thesis). Women showed a greater ability to correctly identify the healthiest product compared to men (66.4% vs 62.8%). Additionally, individuals who reported never reading food labels and those with only a primary education level showed the lowest percentages of correct responses. The remaining individual characteristics, as well as the data collection period, did not have a statistically significant effect on participants' performance.

In the task of identifying products with nutrients associated with NCDs above nutritional recommendations, participants answered correctly an average of 44.8% questions: 36.5% for the least healthy products and 53.2% for the healthiest products. Table 3 shows the percentage of correct answers in the task of identifying the product high in nutrient for different product categories. When evaluating products with high-in label, orange nectar had the highest score, followed by yogurt, potato snacks, cereal bars, frozen lasagna and ready-made cake. Regarding products without high-in label, the potato chips had the highest score, followed by frozen lasagna, orange nectar, yogurt, cereal bar and ready-made cake.

When dealing with the evaluation of the “least healthy” product, only household income had a significant effect on the percentage of correct responses ($p = 0.03$) (Supplementary Table 5 in Appendix I of this thesis). Participants with income higher than 10 minimum wages had a significantly higher percentage of correct responses (44.1%) than those with household income lower than 5 minimum wages (34.9%) or between 5 and 10 minimum wages (36.5%). Regarding products without a high-in label, women (55.9% vs. 50.8%; $p = 0.02$) and individuals who reported not having any diet-related health conditions (55.9% vs. 50.7%; $p = 0.007$) had the highest mean percentages of correct responses in identifying the absence of excessive nutrients.

Participants' Experiences with High-in Labels

When asked whether they had received any explanation about the high-in label prior to the study, 34% of participants in the first data collection period responded affirmatively. In the second period, this proportion increased significantly to 42% ($p < 0.001$). In both periods, the majority of participants who had received some explanation (84% in the first and 88% in the second) reported recalling the high-in label when answering the survey, and of these, 93% stated

that they took this information into account in their responses. Among those who did not receive any explanation, most also reported noticing the high-in labels during the survey (71% in the first and 69% in the second), and 93% of them stated that they took this information into account when responding.

Additionally, during the first data collection period, 40% of participants reported having seen the high-in label on a food package prior to the study, and 36% had noticed it on products they intended to purchase. Among these participants, 48% said they proceeded with the purchase, 27% opted for a similar product without the high-in label, and 26% decided not to buy the product. In the second data collection period, the proportion of participants who reported having seen the high-in label on food packaging rose significantly to 76% ($p < 0.001$), and 71% had noticed it on products they intended to buy. Among these, 54% ($p < 0.05$) said they purchased the product, 19% ($p < 0.05$) chose a similar product without the high-in label, and 26% ($p > 0.05$) decided not to make the purchase.

A univariate multinomial logistic regression analysis was performed using aggregated data from both collection periods to explore the influence of individual characteristics and the data collection period on the likelihood of making different decisions after seeing high-in labels (Table 4). Significant effects were found for the following individual characteristics: age, education level, income, presence of comorbidities, prior nutrition guidance, and frequency of reading food labels. No significant effect was observed for the data collection period.

Participants over 56 years old, those with an income between 5 and 10 minimum wages, individuals who reported reading food labels more frequently, and those with diabetes were more likely to change their purchase decision by choosing a similar product without high-in labels, compared to younger participants, those with lower income, individuals who read labels less often, and those without non-communicable diseases.

In contrast, younger participants, those who had not received prior nutrition guidance, and those who rarely or never read food labels were less likely to report either purchasing a similar product without high-in labels or not purchasing any product. Additionally, participants with incomplete university education and those with diabetes, hypertension, hyperglycemia, or heart disease were more likely to report either buying a similar product without high-in labels or not purchasing any product, compared to individuals with only primary education and those without non-communicable diseases.

Table 4. Results of the Univariate Multinomial Logistic Regression Models for the Influence of Individual Characteristics and Data Collection period on the Likelihood of Participants Making Different Decisions When Looking at the Black Magnifying on a Product They Intended to Buy (n = 919)

Characteristics	Odds ratio (95% confidence interval)	
	Purchased a similar product without the high-in label	Not purchased any product
<i>Gender</i>		
Male	0.76 (0.54 – 1.06)	0.73 (0.53 – 1.00)
<i>Age</i>		
26-35	1.14 (0.70 – 1.84)	1.84 (0.98 – 3.43)
36-45	0.96 (0.57 – 1.58)	2.75 (1.49 – 5.06)
46-55	1.23 (0.70 – 2.13)	5.24 (2.83 – 9.86)
> 56	2.24 (1.11 – 4.48)	11.76 (5.74 – 24.05)
<i>Education level</i>		
Secondary education	0.57 (0.30 – 1.07)	0.69 (0.40 – 1.16)
Incomplete University	1.03 (0.51 – 2.02)	0.48 (0.24 – 0.91)
Completed University	0.99 (0.54 – 1.79)	0.59 (0.34 – 1.00)
Post-graduate studies	1.50 (0.74 – 3.00)	0.88 (0.45 – 1.67)
<i>Income</i>		
From 5 to 10 minimum wages (From USD 1.085 to R\$ 2.168)	1.51 (1.02 – 2.21)	1.11 (0.76 – 1.60)
More than 10 minimum wages (More than USD 2.168)	1.44 (0.86 – 2.41)	0.92 (0.54 – 1.55)
<i>Self-reported non-communicable diseases</i>		
Hypertension	1.35 (0.66 – 2.56)	1.58 (0.61 – 2.55)
Diabetes	1.68 (0.75 – 3.20)	2.04 (1.08 – 4.41)
Hyperglycemia	1.08 (0.85 – 3.24)	1.68 (1.11 – 4.16)
Kidney disease	0.73 (3.34 – 4.52)	1.07 (0.81 – 7.63)
Heart disease	1.77 (0.70 – 10.75)	2.99 (1.41 – 17.64)
<i>Previous guidance about nutrition</i>		
Yes	1.32 (0.88 – 1.97)	1.76 (1.17 – 2.64)
<i>Frequency of reading food labels</i>		
Sometimes	1.37 (0.80 – 2.33)	1.71 (0.99 – 2.93)
Frequently	3.10 (1.81 – 5.29)	3.26 (1.87 – 5.67)
Always	2.77 (1.49 – 5.13)	5.56 (3.14 – 10.17)
<i>Data collection period</i>		
Collection period 2 (Dec 2023 – Jan 2024)	0.88 (0.52 – 1.46)	1.09 (0.67 – 1.77)

Notes: The reference category in the model was purchase of the product with the black magnifying anyway. The reference levels for the independent variables were: Gender (Female), Age (18-25 years), Level of education (Primary education), Socio-economic level (Up to 5 minimum wages (Up to USD 1.084)), Percentage of participants who self-reported different health conditions (No), Whether they had already received any guidance regarding nutrition (No) and Frequency with which food labels are observed (Never) and Data Collection period (Collection period 1 (Dec 2024 – Jan 2023)). Significant odd ratios have been highlighted in bold.

DISCUSSION

The present work evaluated Brazilian consumers' experiences with high-in labels after their implementation. Focus was placed on interpretation and self-reported experiences with the warnings when making purchase decisions. Results contribute to the increasing body of literature reporting consumer experiences with this FOP nutrition labeling after the entry into force of the policy.

Associations Raised by Packages Featuring High-in Labels

Packages featuring high-in labels raised associations related to the content of critical nutrients, as well as negative health effects associated with product consumption. This result agrees with a previous study conducted in Uruguay, another Latin American country, showing that the inclusion of octagonal warnings created a salience bias, i.e. made associations related to the excessive content of nutrients associated with NCDs and negative health effects more salient in consumers' mind ⁽²⁴⁾. A similar effect was also reported for the inclusion of octagonal warnings on advertisements ⁽²⁸⁾.

A significant increase in the frequency of negative associations was observed in the second data collection period, suggesting that, over time, greater familiarity with the labels may enhance their effectiveness. During this period, no mass communication campaigns were promoted by the government to inform consumers about the new labeling system. Therefore, this change is likely to reflect consumers' direct experiences with labelled products and the influence of social discussions on the topic, including news coverage and debates on social media. Additionally, although limited in scope, some communication efforts promoted by civil society organizations (e.g., IDEC) may have contributed to gradually increasing awareness of the new labels. However, even with this increase, the percentage of consumers mentioning negative health-related associations in the present work was lower than that reported in previous studies ^(24,28). Differences in the graphic design of the Brazilian and Uruguayan warning labels may help explain this finding. Octagonal warnings are expected to raise more negative health-related associations than the black magnifying due to their previous associations with traffic warnings ^(29,30).

In addition, it is worth mentioning that health-related positive associations were mentioned for all the evaluated products, even when they featured high-in labels. The frequency of mention of these associations was higher than that of negative ones. This result suggests that the presence of high-in labels did not cancel out the positive associations generated by the evaluated product categories. In this sense, previous studies have shown that nutrition marketing claims and other visual elements conveying positive health-related associations can have a larger effect on consumers' healthiness perception and food purchase decisions ^(6,31)

Interpretation of High-in Labels

Participants showed a moderate ability to use the high-in labels to make inferences about the products' nutritional composition. They correctly identified the healthiest product in 2 out of 3 tasks and were able to correctly identify products high in nutrients associated with NCDs in 1 out of 3 tasks. According to participants' self-report, high-in labels were seen on the package during the study and considered for answering questions. However, the results obtained in the present study were lower than those observed in Uruguay one month after the implementation of warning labels, where accuracy rates reached 78% or more across all product categories in a task assessing identification of the healthiest product in a set ⁽¹¹⁾. A possible explanation lies in

the graphic design of the black magnifying glass adopted in Brazil, which may be visually less impactful than the octagonal warnings used in other countries ^(18,33).

Participants' ability to correctly identify the healthiest product in a set differed across product categories, which could be attributed to previous health-related associations that could introduce bias in the responses. These previous associations could also explain why participants were less able to answer correctly when evaluating products with high-in labels. Similar results were reported by Deliza et al. ⁽¹⁸⁾.

The data collection period did not have a significant effect on participants' ability to identify the healthiest product in the set or the presence of excessive nutrients. This suggests that familiarity with the labels did not improve participants' ability to interpret them. This highlights the need to implement complementary communication and nutrition education strategies to strengthen the informative role of labels and increase their effectiveness across different population groups ⁽³²⁾.

Regarding individual characteristics, some had a small effect on participants' ability to interpret high-in labels. In the task of identifying the healthiest product in the set, women performed better than men, in line with previous studies involving different FOP nutrition labelling schemes ^(34,35). This can be explained by the fact that women generally possess greater nutritional knowledge ⁽³⁶⁾ and exhibit a higher interest in healthy foods ⁽³⁷⁾. Additionally, participants who reported never reading food labels and those with only primary education showed the lowest percentage of correct answers. An effect of income was also observed in the task of identifying excessive nutrients, with participants from lower-income households achieving the lowest average scores. These findings are in line with other studies that demonstrate education and income as key variables influencing the understanding of nutritional information—individuals with lower socioeconomic status tend to show lower comprehension and use of front-of-pack labeling ^(38–40).

However, there is still no consensus on the effect of individual characteristics on the ability to interpret FOP nutrition labeling. A study conducted in Mexico also found that participants' individual characteristics did not significantly influence their ability to identify the healthiest product using products with different FOP nutrition labeling schemes (Warning Labels, Multiple Traffic Lights and guideline daily amounts) ⁽⁴¹⁾. On the contrary, other studies have shown a significant effect of age and education on the ability to identify healthier products, with younger and more educated people being more likely to respond correctly for different FOP nutrition labeling schemes (Nutri-Score, simplified nutrition labeling system (SENS), Multiple Traffic Lights and guideline daily amounts, Health Star Rating) ^(34,38).

Experiences with high-in Labels

The results of this study showed that, although participants reported considering the high-in labels in their responses, actual familiarity with and exposure to these labels were limited at the beginning of data collection. In the first data collection period, only 34% of participants stated that they had previously received information about the high-in label, and 40% reported having seen the black magnifying on food packages. These percentages increased significantly in the second data collection period, reaching 42% among those who received information and 76% among those who reported having seen the label. This growth may reflect both greater consumer attention and the gradual increase in the presence of these labels on the market, as the food industry adapts to regulatory requirements.

However, recent data indicate that industry compliance remains limited. A study conducted 12 months after the implementation of the black magnifying in Brazil revealed that only 12.9% of eligible products displayed the high-in label, in addition to reporting issues related to readability and standardization ⁽⁴²⁾. This helps explain why, even after one year of

implementation, the levels of exposure and knowledge observed in Brazil remain lower than those reported in countries such as Uruguay and Chile. For instance, in Uruguay, 86% of consumers noticed the warnings 10 days after implementation, and 98% after 19 months ^(11,12). In Chile, this figure was 93% one year after regulation came into force ⁽⁹⁾. Beyond compliance issues, the less striking design of the Brazilian warning labels may also contribute to this discrepancy ^(18,30).

Regarding the impact of the labels on purchasing decisions, in the first period, 52.3% of participants who saw the high-in label reported changing their behavior, with similar percentages stating that they replaced (substitution effect) or did not purchase the product (abandonment effect). The percentage of participants who were influenced by the warnings are similar to those reported in Chile (44%) ⁽⁹⁾ and Uruguay (58%) ⁽¹¹⁾, confirming the potential effectiveness of this FOP nutrition labeling to encourage healthier food choices. However, in the second period, a decrease was observed in the proportion of participants who changed their decisions after seeing the labels (45.4%), especially regarding product substitution. This decline may indicate a desensitization effect due to repeated exposure to the high-in label, as previously described in studies on cigarette packaging ⁽⁴³⁾. In addition, contextual factors such as food preferences, availability of alternatives, and pricing may also have limited the effectiveness of the labels ⁽⁴⁴⁾.

Individual characteristics significantly influenced the likelihood of being influenced by the high-in label. Among participants who had seen the black magnifying on a product they intended to buy, women, participants older than 36 years, those who self-reported NCDs and those who claimed to frequently read food labels were more likely to report having changed their purchase decision as a consequence of the high-in label. These results can be explained considering that these population groups have been extensively reported to be more health conscious and to attach more relevance to health when making their food choices ^(34,36,45).

Limitations

The study has a series of limitations. First, it was based on a convenience sample of participants registered in the database of a marketing agency, which limits the generalizability of the findings. Participants involved in the study could have been more interested in food and nutrition than the average Brazilian population. In addition, although the sample was diverse in terms of most socio-demographic characteristics, it underrepresented older and low educated consumers. Regarding the task, participants' interpretation of high-in labels was assessed in a limited number of categories and products. The evaluated products corresponded to hypothetical brands. The effect of warnings on consumer perception and purchase decisions is expected to be smaller for commercial products ⁽⁴⁶⁾, due to the habitual nature of food choices, which motivates superficial information search ⁽⁴⁷⁾. Finally, results on the effect of the high-in label on purchase decisions were based on self-reported measures of responses to the high-in labels and, consequently, they do not necessarily reflect their actual behavior in a real food purchase situation.

CONCLUSIONS

The results of the present study demonstrate that high-in labels have the potential to promote more conscious and informed food choices, even in a context of initially limited exposure. Although only a small proportion of participants reported familiarity with the magnifying glass symbol at the beginning of data collection, a significant increase in the visibility of these labels was observed over time. This trend may reflect both the gradual adaptation of the food industry to regulatory requirements and increased visual recognition by consumers. However, the effectiveness observed in Brazil remains lower than that reported in countries such as Chile and Uruguay, where more prominent models, such as black octagons, have been implemented.

This scenario highlights the need for complementary strategies to enhance both the reach and understanding of high-in labels. Communication and nutrition education initiatives, as implemented in other countries, could help strengthen the informative role of these labels in consumers' purchase decision-making processes. However, further research is still needed to understand which type of messaging would be most effective in the Brazilian context ^(32,48). In the present work, participants' individual characteristics and data collection period did not have a large effect on consumers' interpretation. Nevertheless, differences in self-reported reactions indicate that certain population groups are less likely to change their behavior based on high-in labels. Among these groups, younger consumers stood out, showing a clear tendency not to alter their purchasing decisions in response to the black magnifying. Therefore, it is recommended that future communication and nutrition education strategies be specifically targeted toward this demographic, with the aim of increasing the effectiveness of the policy and reducing inequalities in access to and use of nutritional information. Additional qualitative research with different segments of the Brazilian population is needed to support the development of more effective communication campaigns.

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CAPÍTULO II

INTERPRETAÇÃO E USO DOS RÓTULOS "ALTO EM" POR CONSUMIDORES BRASILEIROS: UM ESTUDO EXPLORATÓRIO NO PONTO DE COMPRA EM DUAS CIDADES*

* Artigo publicado no periódico **Food Quality and Preference**, v. 129, p. 105528, 2025 (Apêndice II)

RESUMO

Alertas nutricionais têm sido implementados em diversos países com o objetivo de incentivar escolhas alimentares mais saudáveis. No entanto, as pesquisas realizadas após a implementação desses alertas ainda são escassas em todo o mundo, especialmente em ambientes reais de compra. O presente estudo explorou o uso dos alertas “alto em” após a implementação no Brasil, utilizando medidas de rastreamento ocular (*eye-tracking*) e dados autorreferidos. O estudo foi conduzido em três supermercados localizados em duas cidades brasileiras. Um total de 165 participantes foi abordado na entrada dos estabelecimentos e convidado a utilizar um dispositivo móvel de rastreamento ocular durante as compras. Em seguida, responderam a uma série de perguntas sobre o conhecimento e uso dos alertas “alto em”. Sessenta por cento dos participantes relataram tê-los visto nas embalagens dos alimentos, tendo sido observada compreensão adequada do significado. No entanto, a busca ativa e o uso da lupa no ponto de venda foram pouco frequentes, com apenas 4% dos consumidores fixando o olhar sobre os alertas “alto em”. Apenas 15% dos participantes relataram ter notado os alertas em produtos que pretendiam comprar, e a maioria afirmou ter adquirido os produtos independentemente disso, citando fatores como necessidade e preferência alimentar. Por outro lado, 53% dos participantes relataram ter mudado suas decisões de compra após a implementação dos alertas “alto em”, o que sugere seu potencial para incentivar escolhas alimentares mais saudáveis. Considerando que apenas 40% dos participantes haviam visto os alertas antes do estudo, campanhas de comunicação parecem necessárias para aumentar a conscientização e estimular os consumidores a considerarem essas informações ao realizar suas compras.

Palavras-chave: Rotulagem frontal, Alertas nutricionais, Política pública, Decisão de compra de alimentos, Rastreamento ocular

O ENQUADRAMENTO IMPORTA: COMO ESTRATÉGIAS DE COMUNICAÇÃO POTENCIALIZAM A EFETIVIDADE DOS RÓTULOS "ALTO EM"*

* Artigo submetido ao periódico **Appetite**

RESUMO

Campanhas de comunicação têm o potencial de ampliar a efetividade dos alertas nutricionais ao incentivar os consumidores a considerarem essas informações durante o processo de compra. Este estudo teve como objetivo avaliar como três tipos de mensagens (com enquadramento positivo, negativo e neutro) influenciam a importância relativa dos alertas “alto em” nas escolhas alimentares, em comparação com outros elementos da embalagem do produto. Um total de 1.043 adultos brasileiros foi recrutado por meio de agência de marketing. Foi conduzido um ensaio randomizado, no qual os participantes foram alocados aleatoriamente em um dos quatro grupos experimentais: controle (n = 259), enquadramento positivo (n = 271), enquadramento negativo (n = 263) e mensagem neutra (n = 250). Os participantes realizaram uma tarefa de escolha baseada em análise conjunta (*choice-based conjoint*), envolvendo embalagens de duas categorias de produtos: sorvete e requeijão. As embalagens foram elaboradas considerando três fatores: presença ou ausência do alerta “alto em”, presença ou ausência de alegação sensorial e marca (familiar ou não familiar). Foram apresentados aos participantes oito pares de embalagens para cada categoria de produto, e solicitado que indicassem qual produto escolheriam, tendo sido incluída a opção “Nenhum”. Os dados foram analisados por meio de modelos logit mistos. A exposição às mensagens aumentou a importância relativa dos alertas “alto em”, especialmente na condição com enquadramento positivo, ao mesmo tempo em que reduziu a influência da marca e das alegações sensoriais. No entanto, a marca e as alegações sensoriais foram os fatores mais relevantes nas escolhas dos participantes em todas as condições experimentais. Esses resultados sugerem que o enquadramento das mensagens pode amplificar o impacto dos alertas “alto em”, especialmente quando apresentado de forma positiva, e reforçam a necessidade de políticas complementares para fortalecer a efetividade e o alcance dessa estratégia de rotulagem.

Palavras-chave: Rotulagem frontal, Alertas nutricionais, Enquadramento de mensagens, Comunicação em saúde, Política pública

Framing matters: How communication strategies enhance the effectiveness of high-in labels

Abstract

Communication campaigns have the potential to enhance the effectiveness of nutritional warnings by encouraging consumers to take this information into account during the decision-making process. This study aimed to assess how three types of messages (gain-framed, loss-framed, and neutral) influence the relative importance of high-in labels on food choices, compared to other packaging elements. A total of 1,043 Brazilian adults were recruited by a marketing agency. A randomized controlled trial was conducted, in which participants were randomly allocated to one of four experimental groups: control ($n = 259$), gain-framed message ($n = 271$), loss-framed message ($n = 263$), and neutral message ($n = 250$). They completed a choice-conjoint task involving packages of two product categories: ice cream and cream cheese. The packages were designed considering three factors: high-in label (present vs. absent), sensory claim (present vs. absent), and brand (familiar vs. unfamiliar). Participants were shown eight pairs of packages for each product categories and were asked to indicate which product they would purchase, with the option to select "None" available. Data were analyzed using mixed logit models. Exposure to the messages increased the relative importance of high-in labels, particularly in the gain-framed condition, while reducing the influence of brand and sensory claims. However, brand and sensory claims were the most relevant factors influencing participants' choices across all experimental conditions. These results suggest that message framing can amplify the impact of high-in labels, especially when positively framed, and underscores the need for complementary policies to strengthen the effectiveness and reach of high-in labels.

Keywords: Front-of-package, Nutritional warnings, Message framing, Health communication, Public policy

INTRODUCTION

Unhealthy diets are one of the main risk factors for non-communicable diseases (NCDs), which represent a growing challenge for public health globally (WHO, 2024a). In Brazil, NCDs account for more than half of all deaths, including a large proportion of premature deaths, with cardiovascular diseases and diabetes among the leading causes (Brasil, 2021; Oliveira et al., 2024). Overweight and obesity are also highly prevalent, affecting a significant share of the population (World Obesity Federation, 2025). Excessive consumption of foods high in added sugars, saturated fats, and sodium has been consistently associated with an increased risk of developing such conditions (WHO, 2024a, 2024b).

In Latin America, food environments have undergone significant transformations over the past decade, marked by increased availability and accessibility of products with unfavorable nutritional profiles (Matos et al., 2021). In Brazil, foods high in critical nutrients account for nearly 20% of total caloric intake (Cacau et al., 2025). Average sodium intake is almost twice the WHO recommendation, reaching 9.34 g/day (Mill et al., 2019). Sugar consumption is also elevated, largely driven by sugar-sweetened beverages, with adults consuming on average 52 liters per year and children and adolescents about 87.6 liters (Perelli et al., 2023). These consumption patterns highlight the urgent need for comprehensive evidence-based policy actions are needed to promote healthier eating habits and reduce the intake of these nutrients of concern, including front-of-package nutrition labeling (FOPNL), marketing regulations, and fiscal measures (WHO, 2019, 2020).

The implementation of front-of-package nutrition labelling (FOPNL) has been shown to encourage informed and healthier food choices (Kelly et al., 2024). Warning labels are one of several schemes implemented globally (Kühne et al., 2022; WHO, 2020). This scheme has emerged as a prominent scheme, particularly in the Americas, due to their simplicity, visibility, and effectiveness in discouraging the consumption of products high in critical nutrients (Ares et al., 2023b; Crosbie et al., 2023; Deliza et al., 2020; Kühne et al., 2022; Thrasher et al., 2024; Villaverde et al., 2023).

In Brazil, a high-in label was implemented (Figure 1, Supplementary Material) in the form of a rectangle containing the image of a black magnifying glass alongside the expression “Alto em” (“High in”) when the product exceeds thresholds for added sugars, saturated fat, and/or sodium according to the criteria established in Collegiate Board Resolution (RDC) 429/2020. Implementation began gradually in October 2022 and is currently mandatory for most products on the market, except for non-alcoholic beverages in returnable packaging, for which the deadline is October 2025 (Brasil, 2020a, 2020b).

A study conducted one and a half years after policy implementation found that 60% of participants reported having seen the high-in labels prior to the study (Sant’Anna et al., 2025). Another study evaluating the influence of the high-in label on adolescents’ choices of sugar-sweetened beverages in a simulated environment revealed that the Brazilian model was generally ineffective in altering purchasing decisions. Furthermore, it did not significantly improve adolescents’ perception of such beverages as harmful to health (Soares et al., 2025). These findings highlight the need for complementary communication and nutrition education strategies to improve and promote the effective use of the high-in label among the Brazilian population.

Communication campaigns can enhance the visibility and comprehension of nutritional warnings, making them more salient in consumers' minds during the purchase decision-making process (Ares et al., 2020a; Mørk et al., 2017). However, the way messages are framed in communication efforts is crucial for triggering changes in consumer perception and behavior (Ainiwaer et al., 2021; Florence et al., 2022; Gallagher; Updegraff, 2012; Gier; Krampe; Kenning, 2023). Framing refers to the way information is presented to shape consumers’

attitudes, emotions, and behaviors. Messages may emphasize the outcomes of the advocated health behavior in terms of the benefits of adopting it (i.e., gain-framed messages) or the costs of not adopting it (i.e., loss-framed messages) (Gallagher; Updegraff, 2012; Rothman; Updegraff, 2011). Gain-framed messages, which highlight the benefits of making healthy food choices, such as improved quality of life and disease prevention, tend to appeal to individuals motivated by positive rewards. Conversely, loss-framed messages, which emphasize the negative consequences of unhealthy diets, such as increased risk of noncommunicable diseases, may have a greater impact on individuals who are more risk-averse (Ares *et al.*, 2020b, 2020c; Otterbring; Festila; Folwarczny, 2021).

The evidence regarding the effectiveness of different types of messages in promoting the use of warning labels and driving broader changes in eating behavior remains inconclusive and subject to ongoing debate (Florence *et al.*, 2022; Gallagher; Updegraff, 2012; Rothman; Updegraff, 2011). Some studies suggest that loss-framed messages are more effective in encouraging the use of warning labels (Eguren *et al.*, 2021; Rosenblatt *et al.*, 2018; Vidal *et al.*, 2019), whereas others indicate that positively framed messages may be perceived as more appropriate by consumers (Ares *et al.*, 2020b, 2021c). Understanding which communication strategies are best suited to the Brazilian public is essential to strengthening public health policies and maximizing the impact of the high-in label. In addition, considering Brazil's large and diverse consumer market, marked by frequent consumption of foods with unfavorable nutritional profiles and persistent diet-related health challenges, investigating communication strategies that may enhance the effectiveness of the high-in label is particularly relevant. Such evidence contributes not only to the Brazilian context but also provides valuable insights for other Latin American countries facing similar challenges. Identifying which communication strategies are most suitable for the Brazilian public is essential to strengthening public health policies and maximizing the impact of front-of-pack nutrition labeling. In this context, this study aimed to assess how three types of messages (gain-framed, loss-framed, and neutral) influence the relative importance of high-in labels on food choices, compared to other packaging elements.

MATERIALS AND METHODS

A randomized controlled trial was implemented in August 2024, after the deadline for the full implementation of the high-in label in Brazil. Participants were randomly assigned to one of four groups: control, loss-framed, gain-framed, and neutral message. After having been exposed to the corresponding type of message, they completed a choice task, evaluating eight product pairs (ice cream and cream cheese) that varied in terms of: high-in labels (present vs. absent), brand (familiar vs. unfamiliar), and sensory claims (present vs. absent). The study was approved by the Brazilian Research Ethics Committee (CAAE: 67186223.8.0000.5282, Plataforma Brasil).

2.1. Participants

Participants (n=1043) were recruited by a marketing agency specializing in consumer research, which was contracted exclusively for recruitment and data collection purposes. The agency was not involved in the study design, development of stimuli, data analysis, or interpretation of results. Brazilians over the age of 18 who reported consuming cream cheese and ice cream and were registered in the agency's database were invited via email. They were

informed that the study was about eating habits and received compensation for their participation in the form of points that could be redeemed for discounts on various online shopping websites.

2.2 Graphic pieces to encourage the use of high-in labels

Three graphic pieces were developed based on previous studies that co-created messages with consumers to promote the use of warning labels (Ares *et al.*, 2020b, 2020c, 2021c). The first used a loss-framed, highlighting the negative health consequences associated with the excessive consumption of critical nutrients. The second adopted a gain-framed, stressing the benefits of healthy eating. The third presented a neutral message, providing information about the high-in label without associating it with either positive or negative outcomes.

The graphic pieces were designed by a graphic designer from the Brazilian Agricultural Research Corporation (EMBRAPA) Food Technology. As shown in Figure 1, the graphic pieces were composed of text, an image, the slogan “Sua alimentação. Colocamos uma lupa sobre o assunto” (“Your diet. We put a magnifying glass on the subject”), the high-in label indicating high levels of added sugar, saturated fat, and sodium, and the logo of ANVISA (Brazilian Health Regulatory Agency).



Figure 1. Graphic pieces encouraging the use of high-in label in decision making featuring, (a) loss-framed message — “Consuming products with these symbols reduces your quality and length of life”, (b) gain-framed message — “Avoiding products with these symbols increases your quality and length of life”, and (c) neutral message — “Be aware when consuming products with these symbols”.

2.3 Choice-based conjoint task

Two product categories were used as stimuli for the choice-conjoint task: ice cream and cream cheese. Ice cream is considered an indulgent food with strong sensory appeal, typically consumed for pleasure (Bullock; Lahne; Pope, 2020; Sipple *et al.*, 2022). Conversely, cream cheese, on the other hand, is a staple food in Brazil, present in 64.5% of household (Sobral *et al.*, 2023). Differences between the two categories were also expected in terms of acceptance

and health perception, with cream cheese perceived as healthier and ice cream showing higher acceptance. Both products are widely consumed in Brazil (ABRAS, 2024; ABRASORVETE, 2024) and often exceed the legal thresholds for critical nutrients, making them eligible for high-in label (Brasil, 2020b, 2020a).

The packages differed in two other elements: sensory claims and brand, which typically exert larger influence on food choice than warning labels (De Alcantara *et al.*, 2025; França; De Alcantara; Deliza, 2025). Sensory claims are frequently used on food labels to trigger mental associations in consumers, which can reduce the impact of nutritional warnings (Nobrega; Ares; Deliza, 2020). Regarding brand, consumers tend to prefer familiar brands and are drawn to claims that increase product appeal (Godden *et al.*, 2023a; Hall *et al.*, 2020; Symmank, 2023; Ursu *et al.*, 2024).

For each product category, a series of packages was developed following a 2³ factorial experimental design, with the following variables: brand (familiar vs. unfamiliar), high-in label (present vs. absent), and sensory claim (present vs. absent). Brands with the largest market share in each product category were considered familiar and those with a low market share were considered unfamiliar (ABRAS, 2024). Based on the nutritional composition of commercially available products in the Brazilian market and the front-of-package labeling regulation in Brazil (Brasil, 2020b, 2020a), high-in labels for added sugar or saturated fat content were included. The sensory claims used were “cremoso e saboroso” (creamy and tasty) for cream cheese and “muito mais cremoso” (much creamier) for ice cream. These claims were selected based on the characteristics of products available on the website of one of the most popular supermarket chains in Rio de Janeiro.

Based on the eight products developed for each category (i.e., all possible combinations of the variable levels), choice sets were generated using the mix-and-match procedure (Johnson *et al.*, 2007). A description of the alternatives included in each of the choice sets is provided in Table 1 of the Supplementary Material. Examples of the choice sets for each product category are shown in Figure 2.





Figure 2. Example of choice sets for the two categories in the experimental conditions: (a) Ice cream and (b) Cream cheese. Brands are blurred for publication.

2.4 Data collection

Initially, participants provided their informed consent via an online form. Then, they were randomly allocated to one of four experimental groups, each corresponding to one type of message: (i) control (no graphic piece) ($n = 259$); (ii) gain-framed ($n = 271$); (iii) loss-framed ($n = 263$); and (iv) neutral message ($n = 250$). Participants were then exposed to the corresponding message encouraging the use of high-in labels for 15 seconds, according to their experimental group. During this time, they were instructed to read the message before proceeding to the next screen. The control group was not exposed to any message. After reading the corresponding message, participants were asked to imagine they were in a supermarket and needed to purchase cream cheese and ice cream. They were shown eight pairs of each product, in monadic sequence, following a Williams' Latin Square design. For each pair, participants were asked to look at the packages and indicate which one they would purchase. The option "None" was also available.

After completing the choice experiment, participants were asked whether they noticed and considered the high-in labels when making their choices during the experimental task, and whether they had seen these symbols on any food or beverage products before the study. For all these questions, the response options were: "Yes" / "No" / "Not sure." Then, they were also asked to evaluate the products in terms of liking (1 = dislike extremely, 5 = neither like nor dislike, 9 = like extremely) and perceived healthiness (1 = not healthy at all, 7 = very healthy). These data confirmed differences in the perceived healthiness and liking of the two categories (Table 2; Supplementary Material provided in Appendix I of this thesis). Finally, they answered a series of nine socioeconomic questions, including gender, age, region of residence, education level, monthly income and presence of food-related health conditions: diabetes or high blood sugar / high blood pressure / high cholesterol / any heart disease / any kidney disease / overweight.

2.5 Data analyses

Data were analyzed using R software (R CORE TEAM, 2022) considering a 95 % confidence level.

Choice-conjoint task

A mixed logit model with random parameters was used to analyze the choice-based conjoint data (Scarpa; Ferrini; Willis, 2005). Data were analyzed separately for each product category. The main effects of the experimental design variables (brand, high-in label, and sensory claim) and their interactions with the experimental group (control, gain-framed, loss-framed, and neutral message) were included in the model. The experimental variables were coded as follows: brand (0 = unfamiliar, 1 = familiar), high-in label (0 = absent, 1 = present), and sensory claim (0 = absent, 1 = present). For the message framing variable, the control group (no message) was used as the reference category in the model. In addition, data were also analyzed separately for each experimental group, considering only the main effects of the variables of the experimental design.

The relative importance of the variables was estimated based on partial log-likelihood (Lancsar; Louviere; Flynn, 2007). Partial mixed logit models were estimated by removing each variable individually and their respective log-likelihood was recorded. The relative importance of each variable was estimated as the quotient of the difference between the log-likelihood of the full and partial models and the sum of the differences between the partial models and the full model.

RESULTS

3.1. Participant characteristics

A total of 1,043 participants were involved in the study. As shown in Table 1, they were diverse in terms of gender, age, educational level, and household income. No significant differences ($p > 0.05$) were found in sociodemographic characteristics or in the self-reported presence of diet-related health conditions across the four experimental groups, suggesting similarity among the participants. For contextualization, according to the most recent Brazilian national census (Instituto Brasileiro de Geografia e Estatística, 2023) the Brazilian population is composed of approximately 51.5% women and 48.5% men, similar to our sample (49% women, 51% men). Regional distribution was also comparable, with 41.8% of the population living in the Southeast (vs. 44% in our sample) and 26.9% in the Northeast (vs. 26% in our sample). Differences are more difficult to assess for age and education, as IBGE categories do not align with those used in our study. However, national data indicate that individuals with lower educational attainment may be underrepresented in the sample.

Table 1. Sociodemographic characteristics of the participants (n = 1043).

Characteristic	Percentage of participants (%)				
	Total (n = 1043)	Control (n = 259)	Gain-framed (n = 271)	Loss-framed (n = 263)	Neutral message (n = 250)
<i>Gender</i>					
Female	49	49	48	48	51
Male	51	51	52	52	49
p-value				0.91	
<i>Age (years)</i>					
18 - 24	18	17	19	19	17
25 - 29	13	13	13	13	14
30 - 39	24	24	25	24	24
40 - 49	19	19	18	19	20
Over 50	26	27	26	25	26
p-value				1.00	
<i>Region of residence</i>					
North	7	7	7	8	7
Northeast	26	26	26	25	24
Midwest	9	9	9	10	8
Southeast	44	44	42	42	46
South	15	15	16	15	14
p-value				0.99	
<i>Education level</i>					
Primary school	4	6	3	5	3
High school	41	39	40	41	45
University degree	31	29	34	31	30
Post-graduate	23	26	23	22	22
p-value				0.48	
<i>Food-related health conditions*</i>					
Yes	46	45	45	48	48
No	54	55	55	52	52
p-value				0.79	
<i>Number of people in the household</i>					
1	8	9	8	7	8
2	27	29	29	28	22
3	29	27	28	30	31
4	23	22	24	21	27
5 or more	12	13	11	14	12
p-value				0.82	
<i>Number of children and teenagers (up to age 18) in the home</i>					
0	53	51	55	53	51
1	29	28	27	28	32
2	15	18	14	14	14
3	3	1	3	4	2
4	1	2	0	1	1
p-value				0.54	
<i>Household income</i>					
Up to US\$ 255.20	14	15	13	14	15
US\$ 255.21 - US\$ 510.40	38	37	39	37	38
US\$ 510.41 - US\$ 765.00	16	14	17	15	17
US\$ 765.01 - US\$ 1276.00	20	22	19	22	17
US\$ 1276.01 - US\$ 2552.00	8	7	7	8	8
> US\$ 2552.01	5	5	5	4	5
p-value				0.99	
<i>Frequency of physical activity</i>					
Once or twice a week	32	29	30	35	33
3 or 4 times a week	31	34	32	29	30
4–7 times a week	16	17	16	16	16
None	21	20	23	21	21
p-value				0.93	

* Self-reported chronic diseases related to unhealthy diets, including overweight, obesity, hypertension, diabetes, hyperglycemia, kidney disease, and heart disease.

When asked about whether they noticed the high-in labels during the study, 90% of participants responded affirmatively; of these, 68% reported having taken this information into account when answering the questions. Regarding prior exposure to high-in labels, 86% of participants indicated that they had seen them before the study.

3.2. Influence of Message Framing on Consumer Choices

The effect of the packaging variables on participants' choices was firstly evaluated using the aggregated sample, regardless of the experimental condition. The results, presented in Table 2, indicate that for both products, the average coefficient of the brand was positive and significant, suggesting that the presence of a familiar brand increased choice likelihood compared to an unfamiliar brand. For the high-in label, the coefficient was negative and significant, indicating that the presence of the high-in label discouraged participants from choosing products carrying this warning. In contrast, the sensory claim showed a positive and significant effect, suggesting that emphasizing sensory attributes encouraged consumer choice for these products.

Table 2. Average coefficients and standard error of the effects included in the mixed logit model used to estimate the influence of the experimental variables on participants' choices and their interaction with the type of message shown to participants before the task.

Effect	Cream cheese			Ice cream		
	Coefficient	Standard error	p-value	Coefficient	Standard error	p-value
<i>Main effects</i>						
Brand	2.57***	0.14	≤0.001	4.32***	0.31	≤0.001
High-in label	-0.40***	0.10	0.0001	-0.83***	0.18	≤0.001
Sensory claim	1.27***	0.08	≤0.001	2.03***	0.12	≤0.001
<i>Interactions</i>						
Brand * Loss-framed messages	-0.62***	0.15	≤0.001	-1.03***	0.25	≤0.001
Brand * Gain-framed messages	-0.56***	0.15	≤0.001	-0.81**	0.26	≤0.001
Brand * Neutral message	-0.53***	0.15	≤0.001	-1.13***	0.25	≤0.001
High-in label * Loss-framed messages	-0.89***	0.15	≤0.001	-1.50***	0.25	≤0.001
High-in label * Gain-framed messages	-1.38***	0.16	≤0.001	-2.16***	0.28	≤0.001
High-in label * neutral message	-0.96***	0.15	≤0.001	-1.46***	0.26	≤0.001
Sensory claim* Loss-framed messages	0.08 ^{ns}	0.11	0.444	-0.19 ^{ns}	0.14	0.179
Sensory claim * Gain-framed messages	-0.36**	0.11	0.002	-0.17 ^{ns}	0.15	0.594
Sensory claim * neutral message	0.08 ^{ns}	0.12	0.464	-0.08 ^{ns}	0.15	0.241

Coefficients highlighted with * are significant at a significance level of 0.05; coefficients highlighted with ** are significant at a significance level of 0.01; coefficients highlighted with *** are significant at a significance level of 0.001 and coefficients highlighted with ^{ns} are not significant (p > 0.05). Levels of the variables in the model: brand (0 = unfamiliar, 1 = familiar), high-in label (0 = absent, 1 = present), sensory claims (0 = absent, 1 = present)

Regarding the interactions, it was observed that the presence of the messages influenced how consumers responded to other packaging elements. The messages enhanced the effect of the high-in labels, regardless of the framing (loss, gain, neutral), as evidenced by the negative and significant interactions between the high-in labels and the messages across both product categories. This finding suggests that participants exposed to the messages were more sensitive to the high-in labels, which may have increased the perceived risk associated with consuming products high in critical nutrients. Similarly, the messages reduced the positive impact of a familiar brand on participants' choices. The negative and significant interactions indicate a reduced influence of brand familiarity when the packaging was accompanied by the messages, regardless of their content.

Moreover, the messages also influenced the perception of the sensory benefits highlighted on the packaging. For cream cheese, a negative and significant interaction was observed between the sensory claim and the gain-framed message, suggesting that the health-related positive aspects communicated by the message may have competed with the sensory attributes, thereby reducing their impact. For ice cream, no significant interactions were identified between the sensory claim and the messages, indicating a lower susceptibility of this product to the influence of the messages.

The data from each experimental condition were analyzed separately for each product. It was observed that, regardless of the message type, the main effects were statistically significant and showed the same sign for both cream cheese and ice cream (Table 3). These results suggest that the messages, despite their different contents, consistently modulate the influence of other packaging elements on consumers' choices

Table 3. Average coefficients and standard error of the main effects from the mixed logit

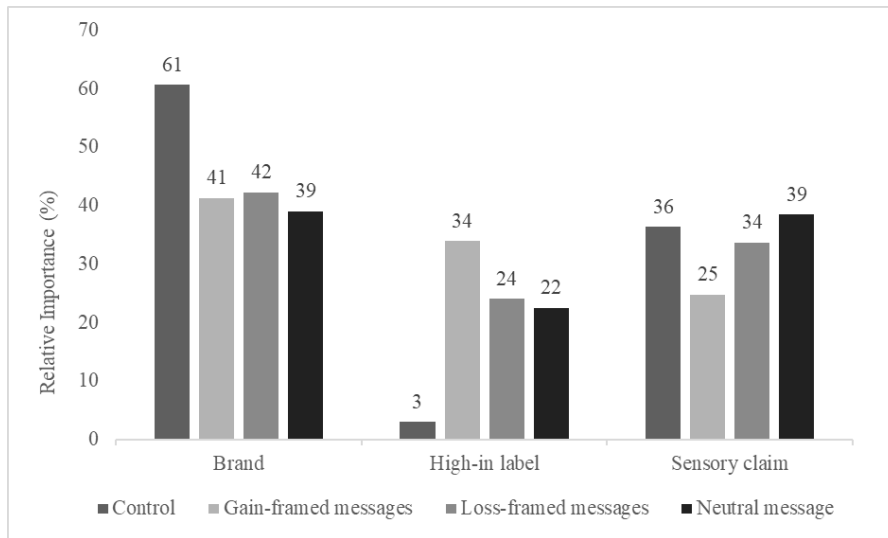
Experimental condition	Main effects					
	High-in label	Standard error	Brand	Standard error	Sensory claim	Standard error
<i>Cream cheese</i>						
Control (n=259)	-0.35***	0.10	2.20***	0.18	1.18***	0.09
Gain-framed messages (n = 271)	-2.03***	0.20	2.23***	0.22	0.94***	0.09
Loss-framed messages (n = 263)	-1.36***	0.15	2.05***	0.19	1.23***	0.10
Neutral message (n= 250)	-1.37***	0.15	2.05***	0.19	1.37***	0.11
<i>Ice cream</i>						
Control (n=259)	-0.57***	0.16	3.81***	0.46	1.86***	0.16
Gain-framed messages (n = 271)	-3.65***	0.53	4.17***	0.60	2.00***	0.19
Loss-framed messages (n = 263)	-2.03***	0.28	3.01***	0.40	1.67***	0.15
Neutral message (n= 250)	-1.43***	0.28	2.17***	0.35	1.54***	0.16

model for participants exposed to different types of messages prior to evaluating cream cheese and ice cream packages in the choice-based conjoint task.

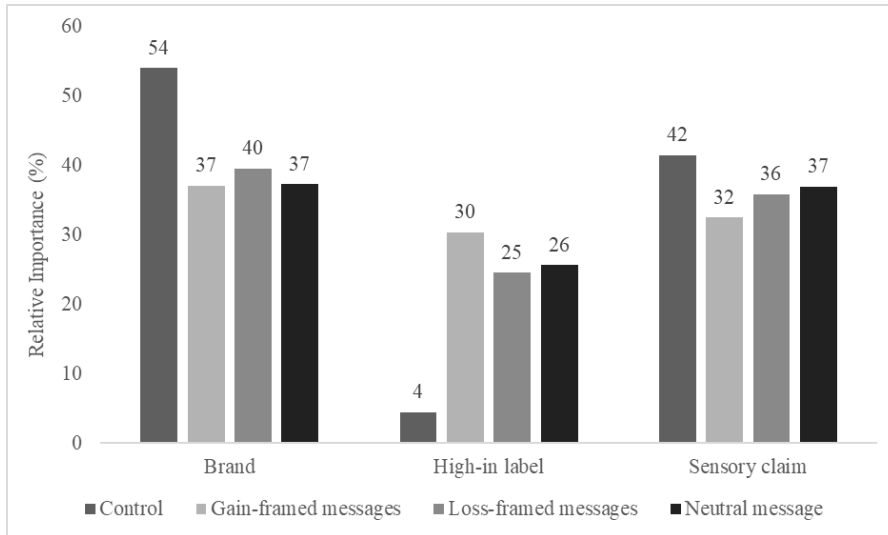
Coefficients highlighted with *** are statistically significantly at a significance level of 0.001

Figure 3 shows how the messages influenced the relative importance that consumers attributed to packaging elements. In both product categories, it was observed that in the absence

of messages (control condition), Brand was the most important variable influencing choice, while the high-in label had the lowest relative importance. However, the introduction of the messages caused variations in the relative importance of each factor. For both products, the messages increased the relative importance of the high-in label and consequently reduced the relative importance of the brand. The largest change was observed in the gain framing, where the importance of the high-in label increased from 3% to 34% for cream cheese and from 4% to 30% for ice cream. Additionally, a decrease in the relative importance of sensory claims was observed with the introduction of messages, except in the neutral condition, which resulted in a slight increase for cream cheese. These results indicate that the messages, especially those emphasizing benefits (gain), redirect consumer attention, reinforcing the role of high-in labels in the choice process.



(a)



(b)

Figure 3. Relative importance of the experimental design variables, calculated as the partial contribution to the fit of the mixed logit model (log-likelihood), based on the choices of participants exposed to different types of messages encouraging the use of high-in labels, for two product categories: (a) Cream cheese and (b) Ice cream.

DISCUSSION

Exposure to the messages proved effective in enhancing the impact of high-in labels on consumer choices. In both product categories, an increase in the relative importance attributed to high-in labels was observed among participants who were exposed to the messages prior to the task. This increase was accompanied by a decrease in the relative importance of brand and sensory claims, indicating that the messages redirected consumers' attention toward the high-in labels, reinforcing their role in communicating health risks associated with the products. These findings are consistent with results from a study conducted in Uruguay, which reported that the use of both gain- and loss-framed messages increased participants' attention to nutritional warnings during snack selection compared to a control group exposed to non-nutrition-related messages (Vidal *et al.*, 2019).

However, even with the enhanced effect of the messages on the high-in labels, sensory claims and brand remained the most influential factors guiding consumer choices. This finding aligns with previous studies that have also identified these packaging elements as the most impactful in shaping purchase decisions (De Alcantara *et al.*, 2025; França; De Alcantara; Deliza, 2025; Martins *et al.*, 2025b). These results suggest that, although the messages were effective in redirecting attention toward front-of-package nutritional warnings, other visual and informational elements of the packaging continued to exert a strong influence. This underscores the challenge of mitigating the persuasive power of familiar or appealing marketing features and reinforces the need to combine labeling strategies with broader regulatory measures and communication efforts.

Differences were also observed between the types of message framing used. The gain-framed was the one that led to the greatest increase in the relative importance of the high-in labels compared to the control group, thus demonstrating greater effectiveness in redirecting consumers' attention to the high-in labels. These results are consistent with previous studies, which have shown that gain-framed messages can be more effective than loss-framed ones (Binder; Naderer; Matthes, 2020; Gallagher; Updegraff, 2012; Gong *et al.*, 2025). In general, gain-framed messages tend to be more effective in promoting preventive health behaviors, particularly those involving low-risk actions. However, the advantage of positive framing is usually modest and may vary upon both the type of behavior and the context in which the message is presented (O'Keefe; Jensen, 2007).

Studies conducted in Uruguay suggest that messages aimed at promoting healthy eating habits tend to be perceived as more appropriate by consumers (Ares *et al.*, 2020b, 2021c). These studies reported that consumers more frequently mentioned gain-framed messages—highlighting the benefits of avoiding foods high in critical nutrients—compared to loss-framed messages.

Exposure to the gain-framed message also influenced the relative importance attached to the sensory claim, particularly in the case of cream cheese. The positive impact of the sensory claim was reduced when participants had been previously exposed to the message, suggesting that communications emphasizing nutritional benefits may compete for attention with sensory appeals on the package, thereby weakening their influence on purchase decisions (Gitungwa; Gustafson; Rose, 2024; Papoutsis; Klonaris; Drichoutis, 2019). Previous studies have shown that the presence of nutritional warnings can reduce the influence of other visual and informational packaging elements, such as claims (Centurión; Machín; Ares, 2019; Eguren *et al.*, 2021; Mediano Stoltze *et al.*, 2021; Nobrega; Ares; Deliza, 2020). This effect tends to be amplified when consumers are exposed to messages that reinforce the role of front-of-package labeling, competing for attention with other package components (Vidal *et al.*, 2019).

For ice cream, no statistically significant interactions were observed between the messages and the sensory claim, suggesting that in this case, the influence of the sensory claim

was less susceptible to the effect of the messages. This may be related to the indulgent nature of ice cream, which tends to be associated with pleasure and reward, making its sensory attributes predominant even in the presence of risk communications (Bullock; Lahne; Pope, 2020; Mai; Trendel; Basil, 2025). Moreover, ice cream is typically not perceived as an everyday food but rather as an occasional treat (Prinsen *et al.*, 2019; Rishika; Feurer; Haws, 2022), which may lead consumers to be less concerned about the high-in label when making their choices (Ares *et al.*, 2023a). Studies suggest that nutritional information has a greater influence when products are perceived as healthy by consumers (Alcantara; Ares; Deliza, 2022; Ares *et al.*, 2018a; Barahona; Otero; Otero, 2023; De Alcantara *et al.*, 2025). These findings reinforce the need for regulatory and communication strategies to take the product context into account, as the effectiveness of high-in labels or informational campaigns may vary depending on the hedonic or functional motivations that drive purchase decisions.

Although the gain-framed message led to the greatest increase in the relative importance of high-in labels, the other framing types, loss and neutral, also had significant effects, compared to the control. This suggests that messages which contextualize or emphasize the purpose of labels can enhance their effectiveness. Our results are consistent with previous studies showing that the effectiveness of message framing may vary depending on the context and consumers' motivations. However, there is still no consensus in the literature regarding which type of framing is most effective. Some studies suggest that loss framing is more effective in encouraging behavioral change (Eguren *et al.*, 2021; Godinho *et al.*, 2016; Rosenblatt *et al.*, 2018), while others indicate that positively framed messages can also be effective (Binder *et al.*, 2020; Gong *et al.*, 2025; O'Keefe & Jensen, 2007). The present findings contribute to this debate by showing that all message framings had positive effects, with gain framing being particularly more effective (Eguren *et al.*, 2021; Godinho *et al.*, 2016; Rosenblatt *et al.*, 2018).

These effects highlight the potential of messages as complementary strategies to enhance the impact of high-in labels in communicating nutritional risks. Considering the country's extensive cultural, regional, and socioeconomic diversity, the effectiveness of different message framings may vary across specific population segments. Given Brazil's large and developing food market, characterized by high consumption of products with unfavorable nutritional profiles (Cacau *et al.*, 2025). and persistent diet-related health challenges (Brasil, 2021), understanding which message framings are most effective is particularly relevant for designing public health campaigns. Adopting multiple message framings could therefore represent a promising approach for more inclusive and effective public campaigns. Future studies are needed to explore how different population groups respond to such messages, contributing to the refinement of communication strategies aimed at promoting healthier food choices.

In closing, the limitations of the study should be acknowledged. First, participants were exposed to the messages only once, unlike real-world campaigns that involve repeated exposure over time and through multiple channels. This single, immediate exposure—delivered just before the choice tasks—may have introduced a response bias, temporarily influenced participants' attention and not necessarily reflecting their behavior in real-life purchasing situations. In addition, food choices were made in an experimental setting, using hypothetical scenarios and without financial involvement, which may not fully capture actual purchasing behavior. The number of graphic pieces tested and product categories included was limited - a common constraint in experimental studies - which consequently restricts the scope of visual and textual communication approaches analyzed.

Another important point is that different population groups, such as individuals of varying age ranges, income levels, education levels, or genders, may perceive and respond to messages and nutritional warnings in different ways (Ares *et al.*, 2021b). While our sample

included participants with some variation across these characteristics, it may not fully capture the broader cultural, regional, and socioeconomic diversity of Brazil. This diversity of responses was not explored in depth in the present study. Therefore, future investigations that consider prolonged exposure, more realistic shopping environments, and larger and more diverse samples could provide a more comprehensive understanding of the effectiveness of communication campaigns and their ability to reach different population segments effectively.

CONCLUSIONS

The results of this study reinforce the potential of high-in labels to discourage the selection of products high in critical nutrients, especially when accompanied by promotional messages that highlight the benefits of their use. The gain-framed message led to the greatest increase in the relative importance of high-in labels, suggesting that communication strategies with a positive tone may be particularly effective in redirecting consumer attention. Additionally, the effect of the messages varied depending on the type of product, indicating that hedonic or functional motivations associated with different food categories modulate how consumers process labeling information. This differentiation is essential for the development of more effective regulatory strategies tailored to the consumption context.

Finally, the findings highlight the importance of implementing high-in labels alongside complementary measures, such as educational campaigns, to enhance their reach and effectiveness. Well-designed communication campaigns can be a valuable tool for raising public awareness about the risks associated with excessive consumption of added sugars, sodium, and saturated fats, and for supporting healthier food choices.

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DISCUSSÃO GERAL, CONCLUSÕES E RECOMENDAÇÕES

Os estudos conduzidos no presente trabalho fornecem evidências relevantes sobre o uso e a compreensão do alerta nutricional em formato de lupa pelos consumidores durante a implementação no Brasil. Esses resultados são de grande importância, pois podem contribuir para o desenvolvimento de estratégias complementares que visem maximizar a efetividade, fortalecendo seu papel como instrumento de promoção da saúde pública.

Os achados evidenciam que a rotulagem nutricional frontal no formato de lupa tem potencial para favorecer escolhas alimentares mais conscientes e saudáveis entre os consumidores brasileiros, mesmo diante de um cenário inicial de baixa familiaridade com os alertas nutricionais. Foi possível observar um aumento na visibilidade da lupa ao longo do tempo, indicando tanto um processo de adaptação por parte da indústria como um aumento do reconhecimento visual dos próprios consumidores.

Apesar desse avanço, os resultados apresentados sugerem que a efetividade dessa política de nutrição no Brasil ainda se mostra inferior àquela reportada em países que adotaram outros modelos, como o octógono preto. Além disso, o Capítulo II demonstrou limitada atenção dos consumidores no ponto de compra, além de evidenciar que uma parcela significativa da população não percebe os alertas nutricionais nas embalagens. Esse cenário reforça a necessidade de medidas complementares que ampliem o uso e a compreensão da rotulagem nutricional frontal.

Dentre essas medidas, destacam-se as estratégias de comunicação e as campanhas educativas como ferramentas fundamentais para ampliar o alcance da política e reduzir desigualdades quanto ao acesso à informação nutricional. O Capítulo III demonstrou que mensagens com enquadramento positivo, por exemplo, podem aumentar a importância atribuída aos alertas nutricionais e reduzir a influência de outros elementos da embalagem, como a marca e as alegações sensoriais. Além disso, verificou-se que as características dos produtos e as motivações hedônicas ou funcionais modulam a forma como os consumidores processam essas informações, indicando a necessidade de adaptar as estratégias regulatórias ao contexto de consumo.

Embora o Capítulo I tenha mostrado que as características individuais dos consumidores tenham exercido influência limitada sobre a capacidade de interpretação dos alertas, diferenças autorrelatadas nas reações dos participantes indicam que determinados grupos populacionais — especialmente os mais jovens — tendem a apresentar menor propensão para modificar seus comportamentos. Dessa forma, recomenda-se que futuras ações de comunicação considerem essas particularidades e sejam direcionadas de forma segmentada, com o objetivo de ampliar a efetividade da rotulagem nutricional frontal no Brasil.

Além das estratégias de comunicação, os achados da presente tese também evidenciam a necessidade de implementar medidas regulatórias adicionais. No Capítulo III, observou-se que as alegações sensoriais apresentaram maior importância relativa do que os alertas nutricionais (exceto no enquadramento de ganho), sugerindo a necessidade de restringir seu uso em produtos com perfil nutricional desfavorável, a fim de evitar a geração de associações positivas que possam comprometer a efetividade dos alertas “alto em”. A marca também teve importante efeito nas escolhas dos consumidores, reforçando a necessidade de regulamentar práticas de marketing na embalagem para mitigar o impacto de elementos persuasivos. Já no Capítulo II, o preço se destacou como um dos fatores mais observados, apontando para a relevância de políticas fiscais, como a taxa de alimentos não saudáveis e subsídios para alimentos mais saudáveis, como medidas complementares à rotulagem nutricional.

Como perspectivas futuras, recomenda-se a realização de novos estudos com diferentes segmentos da população brasileira, a fim de compreender de forma mais aprofundada as barreiras e motivações associadas ao uso da rotulagem nutricional. Investigações adicionais

para identificar os tipos de mensagens mais eficazes — considerando as especificidades de distintos perfis populacionais — também poderão contribuir para o aprimoramento das estratégias de comunicação e para a promoção de escolhas alimentares mais saudáveis. Além disso, são necessários mais estudos conduzidos em ambientes reais de compra, visando compreender os efeitos dos alertas sobre as decisões de compra e o consumo de nutrientes críticos, bem como avaliar a eficácia das estratégias de comunicação nesse contexto. Pesquisas que investiguem o impacto da rotulagem na reformulação de produtos pela indústria também se mostram essenciais para avaliar o potencial dessa política em induzir melhorias no perfil nutricional da oferta de alimentos no país. Esses esforços poderão subsidiar o fortalecimento das estratégias regulatórias e contribuir para a construção de ambientes alimentares mais saudáveis.

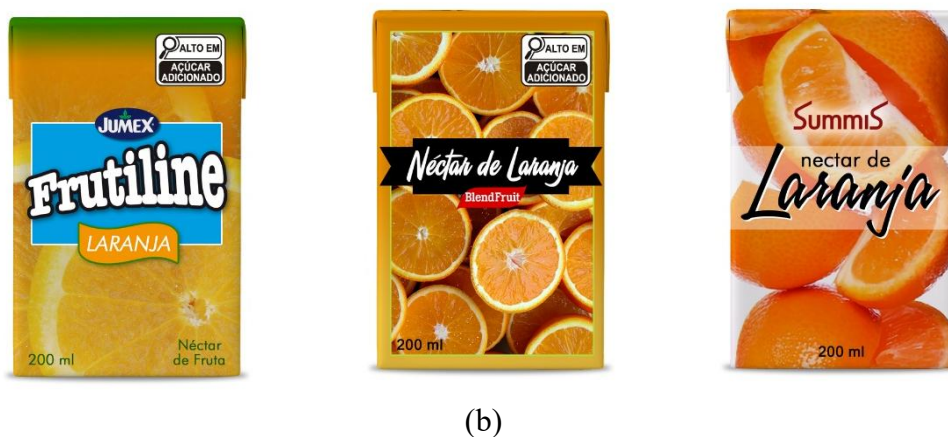
APÊNDICE I*

*Material suplementar capítulo I

SUPPLEMENTARY MATERIAL



Figure 1. Black magnifying glass implemented in Brazil under Collegiate Board Resolution (RDC) No. 429/2020.





(c)



(d)



(e)



Figure 2. Packages included in the study: (f) t, (b) orange nectar, (c) ready-made cake, (d) frozen lasagna, (e) potato snacks, and (f) cereal bar

Table 1. Criteria established by National Health Surveillance Agency's (Anvisa) RDC 429 for the use of the magnifying glass

Nutrients	Solid or semi-solid foods	Liquid food
Added sugars	≥ 15 g of added sugars per 100 g of food	≥ 7.5 g of added sugars per 100 ml of food.
Saturated fat	≥ 6 g of saturated fat per 100 g of food	≥ 3 g of saturated fat per 100 ml of food.
Sodium	≥ 600 mg of sodium per 100 g of food	≥ 300 mg of sodium per 100 ml of food.

Table 2. Nutritional composition of the different products included in the study and high-in labels included in the package, following the criteria established by National Health Surveillance Agency's (Anvisa) RDC 429. For each product, the section of the questionnaire where it was included is shown.

Category	Product	Portion size (g)	Nutrient content per portion						High-in labels	Section *
			Calories (Kcal)	Total sugar (g)	Added sugar(g)	Total fat (g)	Saturated fat (g)	Sodium (mg)		
Orange nectar	1	200	100	25	16.3	0	0	0	High in added sugar	2, 3
	2	200	96	24	15.6	0	0	0	High in added sugar	1, 2
	3	200	87	21.5	11.6	0	0	0		2,3
Cereal bar	1	20	74	4.2	3.2	3.0	0.3	28.8	High in added sugar	2, 3
	2	20	94.4	8.4	6.0	4.8	1.6	41.6	High in added sugar and High in saturated fat	1, 2
	3	20	58.4	0	0	1.3	0.6	28		2,3
Yogurt	1	200	149	38.0	30.0	3.8	2.2	71.0	High in added sugar	2, 3
	2	200	162	39.0	30.2	3.6	2.0	114.0	High in added sugar	1, 2
	3	200	80	12.0	0	0.0	0.0	100.0		2,3
Frozen lasagna	1	300	348	6.0	6.0	14.4	8.1	1862.0	High in sodium	2,3
	2	300	281	5.0	5.0	11.0	6.5	1800.0	High in sodium	2
	3	300	124	2.0	2.0	4.4	1.9	680.0		2,3
Ready-made cake	1	60	198	8.7	8.7	11.5	7.6	54.0	High in saturated fat	2,3
	2	60	355.5	36.0	36.0	14.4	7.7	208.5	High in added sugar and High in saturated fat	2
	3	60	147	0	0	8.5	3.0	78.0		2,3
Potato snacks	1	25	114	1.0	0.0	4.2	0.8	157.0	High in sodium	2,3
	2	25	112	1.0	0.0	5.3	1.6	221.0	High in sodium and High in saturated fat	2
	3	25	114	1.0	0.0	4.2	0.8	98.0		2,3

*Section 1 = Word Association; Section 2 = Identifying the healthiest product; Section 3 = Identification of product high in nutrients associated with NCD.

Table 3. Frequency of mention of health-related dimensions according to participants' individual characteristics

Characteristic	Nutrients associated with NCDs			Negative effects on health			Positive effects on health			Positive nutrients		
	Orange nectar (n= 868)	Cereal bar (n= 846)	Yogurt (n= 845)	Orange nectar (n= 868)	Cereal bar (n= 846)	Yogurt (n= 845)	Orange nectar (n= 868)	Cereal bar (n= 846)	Yogurt (n= 845)	Orange nectar (n= 868)	Cereal bar (n= 846)	Yogurt (n= 845)
<i>Gender</i>												
Female	19.2a	16.4a	17.3a	8.9a	8.0a	5.4a	24.5a	53.0a	36.8a	16.8a	42.4a	5.4a
Male	14.4a	12.8a	10.0b	7.3a	5.1a	5.5a	26.1a	56.4a	31.1a	21.0a	38.7a	6.8a
p-value	0.05	0.13	0.001	0.38	0.09	0.98	0.58	0.31	0.07	0.11	0.26	0.4
<i>Age (years)</i>												
18 – 25	12.2a	13.2a	11.2a	2.4a	8.1a	4.2a	21.1a	64.7a	24.5b	13.0a	53.7a	2.8a
26-35	16.4a	17.8a	15.6a	7.3a	4.7a	4.1a	24.2a	49.8b	28.4b	19.6a	36.6b	5.0a
36-45	19.9a	15.0a	15.6a	8.7a	6.0a	7.3a	23.4a	56.2ab	39.4a	20.8a	40.3ab	6.9a
46-55	15.3a	11.0a	8.9a	11.8a	5.8a	5.7a	26.5a	56.5ab	43.3a	20.0a	38.3ab	8.9a
>56	17.6a	13.6a	14.7a	8.8a	10a	5.5a	33.6a	46.4b	32.1ab	19.2a	35.5b	7.3a
p-value	0.41	0.4	0.15	0.07	0.39	0.61	0.14	0.02	0.01	0.43	0.01	0.19
<i>Education level</i>												
Primary education	10.3a	5.1a	5.2a	4.6a	3.8a	3.1a	24.1a	44.9b	28.1a	25.3ab	38.5a	5.2a
Secondary education	15.2a	15.4a	13.9a	7.6a	4.1a	4.9a	22.5a	57.1ab	32.0a	22.1ab	41.0a	7.0a
Incomplete University	13.3a	11.6a	10.8a	5.0a	5.4a	5.8a	34.2a	66.1a	36.7a	26.7a	43.8a	5.8a
Complete University	20.5a	17.6a	15.7a	9.6a	8.6a	5.8a	24.1a	50.8ab	35.5a	12.8b	41.5a	6.1a
Post-graduate studies	19.4a	13.5a	17.4a	11.7a	10.1a	7.6a	27.2a	55.1ab	35.9a	13.6ab	33.7a	5.4a
p-value	0.47	0.12	0.4	0.35	0.09	0.79	0.17	0.02	0.5	0.01	0.72	0.93
<i>Income</i>												
Up to 5 minimum wages (Up to USD 1,084)	15.0a	13.4a	10.5b	7.3a	5.9a	5.0a	25.7a	55.4a	35.1a	22.3a	42.1a	7.1a
From 5 to 10 minimum wages (From USD 1,085 to USD 2,168)	21.5a	14.0a	21.4a	11.2a	7.5a	4.8a	22.9a	49.5a	38.1a	11.7a	32.3a	4.8a
More than 10 minimum wages (More than USD 2,168)	17.0a	18.2a	18.6a	5.7a	7.8a	7.0a	28.4a	55.2a	28.6a	14.8a	40.1a	4.0a
p-value	0.16	0.27	0.001	0.13	0.56	0.62	0.60	0.69	0.11	0.05	0.35	0.15
<i>Percentage of participants who self-reported different health conditions</i>												
Yes	16.1a	14.4a	13.4a	8.3a	7.1a	5.3a	26.0a	51.8a	34.8a	20.4a	39.2a	5.8a
No	17.3a	14.7a	13.6a	7.8a	5.9a	5.6a	24.7a	57.7a	32.9a	17.6a	41.8a	6.5a
p-value	0.22	0.85	0.38	0.57	0.93	0.33	0.80	0.11	0.5	0.22	0.42	0.4
<i>Whether they had already received any guidance regarding nutrition</i>												
Yes	17.5a	15.6a	14.3a	8.6a	6.9a	6.1a	26.0a	56.2a	33.8a	19.2a	41.3a	6.9a
No	14.2a	11.3a	11.2a	6.4a	5.4a	3.6a	23.4a	50.0b	34.1a	18.3a	38.2a	4.0a
p-value	0.27	0.17	0.33	0.36	0.75	0.15	0.48	0.01	0.4	0.89	0.2	0.07
<i>Frequency with which food labels are observed</i>												
Always	23.1a	14.0a	20.6a	13.9a	6.5ab	5.9a	28.7a	53.3a	34.3a	19.4a	41.1a	8.8a
Sometimes	14.5a	14.9a	11.3a	8.4a	3.9b	5.8a	28.0a	57.0a	36.8a	22.3a	42.4a	4.6a
Frequently	20.9a	19.1a	18.1a	8.5a	8.3ab	7.0a	20.1a	55.4a	30.8a	12.8a	35.3a	6.2a
Never	11.7a	9.5a	7.9a	3.3a	9.0a	2.6a	25.0a	51.0a	32.1a	20.6a	42.5a	7.4a
p-value	0.08	0.13	0.15	0.05	0.04	0.49	0.12	0.6	0.34	0.16	0.41	0.32
<i>Data collection period</i>												
Collection period 1 (Dec 2022 – Jan 2023)	13.9b	11.7b	8.7b	8.5a	7.6a	4.6a	20.7b	51.8b	36.4a	20.3a	31.0b	5.7a
Collection period 2 (Dec 2023 – Jan 2024)	19.8a	17.6a	18.7a	7.6a	5.4a	6.4a	30.6a	57.8a	31.0b	17.6a	50.7a	6.7a
p-value	0.04	0.04	0.001	0.45	0.11	0.34	0.001	0.04	0.03	0.54	0.001	0.71

Table 4. Average percentage of responses when identifying the healthiest product in relation to consumers' individual characteristics and data collection time point.

Characteristics	Average percentage of correct answers	p-Value
<i>Gender</i>		
Female	66.4a	0.03
Male	62.8b	
<i>Age</i>		
18 – 25	64.4a	0.05
26-35	67.5a	
36-45	66.1a	
46-55	60.8a	
>56	61.5a	
<i>Education level</i>		
Primary education	58.7b	0.18
Secondary education	67.3a	
Incomplete University	62.3ab	
Complete University	64.1ab	
Post-graduate studies	67.3ab	
<i>Income *</i>		
Up to 5 minimum wages (Up to USD 1,084)	65.4a	0.31
From 5 to 10 minimum wages (From USD 1,085 to USD 2,168)	64.1a	
More than 10 minimum wages (More than USD 2,168)	60.5a	
<i>Percentage of participants who self-reported different health conditions</i>		
Yes	63.6a	0.29
No	65.6a	
<i>Whether they had already received any guidance regarding nutrition</i>		
Yes	64.9a	0.47
No	63.7a	
<i>Frequency with which food labels are observed</i>		
Always	67.8a	0.001
Sometimes	65.5a	
Frequently	66.8a	
Never	58.5b	
<i>Data collection period</i>		
Collection period 1 (Dec 2022 – Jan 2023)	63.4	0.1
Collection period 2 (Dec 2023 – Jan 2024)	66.3	

Note: Percentages with different letters in the same column for each individual consumer characteristic are significantly different according to Tukey's test

Table 5. Average percentage of correct answers in correctly identifying the products high in nutrients associated with NCDs in relation to individual consumer characteristics, for the less healthy and healthy products

Characteristics	Average percentage of correct answers	
	Products without high-in labels	Products with high in labels
<i>Gender</i>		
Female	55.9a	36.2a
Male	50.8b	36.4a
p_value	0.02	0.91
<i>Age</i>		
18 – 25	52.2a	34.0a
26-35	54.9a	35.4a
36-45	53.5a	38.2a
46-55	53.4a	39.1a
>56	50.8a	33.2a
p_value	0.8	0.41
<i>Education level</i>		
Primary education	48.9a	32.9a
Secondary education	54.2a	35.7a
Incomplete University	54.0a	37.1a
Complete University	52.3a	35.5a
Post-graduate studies	58.0a	42.8a
p_value	0.37	0.6
<i>Income</i>		
Up to 5 minimum wages (Up to USD 1,084)	53.1a	34.9b
From 5 to 10 minimum wages (From USD 1,085 to USD 2,168)	55.5a	36.5ab
More than 10 minimum wages (More than USD 2,168)	49.9a	44.1a
p_value	0.41	0.03
<i>Percentage of participants who self-reported different health conditions</i>		
Yes	50.7b	36.0a
No	55.9a	36.5a
p_value	0.007	0.71
<i>Whether they had already received any guidance regarding nutrition</i>		
Yes	53.6a	37.0a
No	52.4a	34.1a
p_value	0.27	0.27
<i>Frequency with which food labels are observed</i>		
Always	57.4a	35.2a
Sometimes	51.8a	38.8a
Frequently	56.7a	36.6a
Never	50.0a	32.1a
p_value	0.11	0.21
<i>Data collection period</i>		
Collection period 1 (Dec 2022 – Jan 2023)	52.4a	39.2a
Collection period 2 (Dec 2023 – Jan 2024)	53.2a	33.9a
p_value	0.86	0.05

Note: Percentages with different letters in the same column for each individual consumer characteristic are significantly different according to Tukey's test

APÊNDICE II

Brazilian consumers' interpretation and use of high-in labels: An exploratory study at the point of purchase in two cities

Laudiane Justo Sant'Anna^{a*}, Marcela de Alcantara^b, Inayara Beatriz Araujo Martins^b, Leandro Machín^c, Gastón Ares^d, Rosires Deliza^e

^aTechnology Department, Technology Institute, Federal Rural University of Rio de Janeiro, Rodovia BR 456, km 7, Seropédica, RJ, Brazil. Email: laudianejusto@gmail.com. *Corresponding author

^b Postdoctoral Program Nota 10-FAPERJ, Embrapa Food Technology, Brazil

^c Facultad de Psicología, Universidad de la República, Uruguay

^d Sensometrics and Consumer Science, Instituto Polo Tecnológico de Pando, Facultad de Química, Universidad de la República, Pando, Uruguay

^eEmbrapa Food Technology, Av. das Américas, 29501, CEP 23.020-470 Rio de Janeiro/RJ, Brazil.

Reference

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ABSTRACT

Warning labels have been implemented in several countries to encourage healthier food choices. However, research following their implementation remains scarce worldwide, especially in real shopping environments. The present study explored the use of high-in labels after their implementation in Brazil using eye-tracking measurements and self-reported data. The study was conducted in three supermarkets located in two cities in Brazil. A total of 165 participants were intercepted upon entering the supermarket and asked to wear a mobile eye tracker while shopping. They then answered a series of questions about their knowledge and use of high-in labels. Sixty percent participants reported having seen the high-in labels on food packaging. Adequate understanding of their meaning was observed. However, active searches and use at the point of purchase were infrequent, with only 4% of consumers having fixated their gaze on the high-in labels. Only 15% of the participants reported noticing the high-in labels on products they intended to buy, and most said they purchased the products irrespective of this, citing factors such as need and dietary preference. However, 53% of the participants reported having changed their purchase decisions after the implementation of the high-in labels, suggesting their potential to encourage healthier food choices. Given that only 40% of participants had seen the high-in labels before the study, communication campaigns seem necessary to raise awareness and encourage consumers to consider them when making their food purchase decisions.

Keywords: Front-of-package, Nutritional warnings, public policy, food purchase decisions, eye-tracking

1. Introduction

A healthy diet is essential for maintaining health and well-being, playing a crucial role in protecting against all forms of malnutrition and non-communicable diseases (NCDs) (Kumanyika *et al.*, 2020). The rise in unhealthy diets around the world, characterized by an excessive consumption of foods high in calories, added sugars, saturated fats and sodium, has contributed to the increasing prevalence of non-communicable diseases. This change in dietary patterns, driven by rapid urbanization, globalization and increased availability of industrialized products, constitutes a major challenge in terms of global public health (WHO, 2024b).

These global trends have been particularly pronounced in Brazil. In 2019, NCDs accounted for 54.7% of all deaths, with 41.8% occurring prematurely (Brasil, 2021). In 2021, cardiovascular diseases represented 21% of all deaths in the country (Oliveira *et al.*, 2024). Additionally, more than 13 million people—approximately 6.9% of the national population—are currently living with diabetes in the country (Brasil, 2024). Overweight and obesity also affect a significant portion of the population, with 68% of Brazilians classified as overweight, of whom 31% are obese (World Obesity Federation, 2025). Given this scenario, there is an urgent need to implement effective policies that encourage healthier food choices and contribute to reducing the prevalence of NCDs in the Brazilian population.

Front-of-pack nutrition (FOP) labeling is one of the policies recommended by the World Health Organization (WHO) to encourage healthy eating habits (WHO, 2019). It has been adopted in several countries worldwide using different schemes (Batista *et al.*, 2023). Among the schemes implemented worldwide, warning labels stand out in the region of the Americas (Crosbie *et al.*, 2023). Warning labels aim to highlight products that are high in nutrients associated with NCDs (Ares *et al.*, 2023). The available evidence suggests that this scheme is effective at encouraging healthier purchase decisions (Adasme-Berrios *et al.*, 2022; Ares *et al.*, 2023; Contreras-Manzano *et al.*, 2022; Crosbie *et al.*, 2023a; Villaverde *et al.*, 2023). However, the evidence about the effectiveness of the policy after implementation is still scarce.

A study conducted in Uruguay, shortly after the implementation of front-of-pack labeling, showed that 67% of the participants had noticed the warnings on products they intended to purchase, and 58% stated that they had changed their purchasing decisions based on this information (Ares *et al.*, 2021). In Chile, a 23.7% reduction in sales of sugary drinks was observed after the implementation of the Chilean food law, which requires warning labels, marketing restrictions and a ban on the sale of products high in calories, sugar, saturated fats and sodium (Taillie *et al.*, 2020). A study conducted in Mexico, one year after the policy implementation, showed that 44.8% of adults reported that the warnings motivated them to buy fewer unhealthy foods, particularly sugary beverages (Contreras-Manzano *et al.*, 2024). While these studies provide valuable insights into the impact of front-of-package warning labels, research assessing consumer interaction with this type of FOP nutrition labelling is still scarce. In particular, no study so far has assessed consumer interaction with warnings with different graphical design, such as the high-in labels implemented in Brazil, in real shopping environments.

In Brazil, the National Health Surveillance Agency (ANVISA), through Collegiate Board Resolution 429/2020, regulated FOP nutrition labelling in the form of high-in labels. The labels consist of a white rectangle containing the image of a black magnifying glass, followed by the expression “High in”, on a black background (Supplementary Material Figure 1), indicating when the product is high in added sugars, saturated fats and/or sodium, according to the limits established by regulation (Supplementary Material Table 1). The regulation was implemented in a series of steps. The first deadline for compliance was October 2022 for products launched on the market after the approval of the regulation (October 2020). For food products available in the market by October 2022, the initial deadline for implementation was

October 2023, which was subsequently extended to April 2024. For small producers, the deadline for implementation was October 2024, whereas the deadline for compliance for beverages in returnable packaging is October 2025. No study so far has been published analyzing the effects of the high-in labels on consumer purchase decisions. (BRASIL, 2020a, 2020b)

Food choices tend to be repetitive, meaning that consumers regularly buy the same products in the same places. Studies have shown that decisions to buy food occur in short periods of time and without engaging in an in-depth search for information (Machín *et al.*, 2020, 2023). Understanding consumer behavior in real shopping environments can aid the development of more effective approaches to promoting healthier food choices, changing habitual purchasing patterns and encouraging more informed decisions. Although studies on the Brazilian high-in labeling system are scarce, existing research has predominantly focused on hypothetical scenarios (Alcantara *et al.*, 2025; França *et al.*, 2024; Prates *et al.*, 2022). These approaches, while valuable, may not fully capture actual consumer behavior in real-world shopping contexts. Understanding consumer behavior in real shopping environments is crucial for developing more effective strategies to promote healthier food choices, modify habitual purchasing patterns, and encourage more informed decisions.

In this context, this study aimed to explore the use of high-in labels following their implementation in Brazil, addressing the existing gap in the literature. The study focused on both consumer interaction with high-in labels at the point of purchase and retrospective self-reported effects on purchasing intentions, providing empirical evidence on how Brazilian consumers engage with this labeling system in a real-world shopping environment.

2. Material and methods

The present study was conducted in February and March 2024, after the second stage of the implementation. The study was approved by the Brazilian Research Ethics Committee (CAAE: 67186223.8.0000.5282, Plataforma Brasil).

2.1 Participants

The study was conducted in three supermarkets in two cities in the southeast region of Brazil, which corresponds to the region with the largest population in the country (IBGE, 2022): Rio Pomba (Minas Gerais State) and Rio de Janeiro (Rio de Janeiro State). The three supermarkets were medium-sized, one was located in Rio Pomba and the other two in Rio de Janeiro. The study was conducted over four consecutive weekdays in February and March 2024, with data collection occurring between 9:00 AM and 12:00 PM, and between 2:00 PM and 6:00 PM.

Shoppers who entered the supermarkets were intercepted by a researcher and invited to participate in the study. They were told that the aim of the study was to understand the shopping habits of Brazilian consumers and that they would need to wear eye-tracking equipment while shopping. They were also informed that they would be asked a series of questions after completing their shopping.

A total of 165 participants were involved in the study. As shown in Table 1, participants were diverse in terms of gender, age, education level and household income. However, most participants were female, in agreement with gender differences in the distribution of responsibilities in the household (Crane *et al.*, 2019; Nielsen, 2019). All participants reported having normal or corrected-to-normal vision and full color vision.

Table 1. Sociodemographic characteristics of the participants (n=165).

Characteristic	Number of participants	Percentage of participants
<i>Gender</i>		
Female	128	78
Male	37	22
<i>Age (years)</i>		
18-25	23	14
25-35	31	19
35-45	34	21
45-55	33	20
55-65	28	17
Over 65	16	10
<i>Education level</i>		
Did not finish elementary school	24	15
Finished elementary school	27	16
High school diploma	76	46
University degree	33	20
Postgraduate studies	5	3
<i>Food-related health conditions*</i>		
Yes	104	63
No	61	37
<i>City of residence</i>		
Rio de Janeiro	81	49
Rio Pomba	84	51
<i>Number of people in the household</i>		
1	25	15
2	48	29
3	36	22
4	37	22
5 or more	19	12
<i>Number of children and teenagers (up to age 18) in the home</i>		
0	76	46
1	36	22
2	12	7
3 or more	4	2
<i>Household income</i>		
Up to US\$ 255,20	86	52
US\$ 255,21- US\$ 700,83	66	40
US\$ 700,84- US\$ 1168,04	13	8
<i>Frequency of physical activity</i>		
Once or twice a week	44	27
3 or 4 times a week	7	4
4-7 times a week	24	15
None	90	55

2.2 Data collection

The study followed the procedures described by Machín *et al.* (2020) and Machín *et al.* (2023). The participants first read and signed an informed consent form. They were then asked to wear Pupil Pro brand eye-tracking glasses (Pupil Labs GmbH, Berlin, Germany). The equipment was connected to a cell phone, which the participants carried with them throughout their shopping process. Data were recorded using the Pupil Labs app (Pupil Labs GmbH, Berlin, Germany).

Mobile eye trackers provide valuable insights into visual attention by allowing the recording of eye movements in participants who move freely. However, variations in head and facial contours, makeup, and potential device shifts during movement can affect measurement accuracy (Niehorster *et al.*, 2020; Pentus *et al.*, 2020). To minimize these issues, participants were instructed to adjust the device before calibration to ensure a comfortable and secure fit, and realignment was performed if necessary. Data for which proper calibration could not be achieved or that contained errors during recording were excluded from the analysis. These procedures helped ensure the validity and reliability of the collected eye-tracking data.

The eye-tracker was manually calibrated using a target, according to the procedures provided by the manufacturer. Following calibration, participants were instructed to do their intended purchases as normal. Figure 1 shows an example of how the participants acted while shopping. They were instructed to contact a researcher once they had made all their purchases and before paying, so as not to record the economic transaction.



Figure 1 - Illustrative image depicting the implementation of the study.

After paying, participants were shown the high-in labels implemented in Brazil (Supplementary Figure 1) and asked a series of questions about their understanding of and exposure to the high-in labels. They were also asked about changes in their food purchase decisions after the nutritional high-in labels were added to food packaging (Supplementary Table 2). The questionnaire used was similar to that of Machín *et al.* (2023).

Finally, participants were asked a series of nine socioeconomic questions: gender (female/male); age (open question); education (did not finish elementary school/finished elementary school/high school diploma/university degree/graduate studies); the state where they resided (open question); number of people in the household (open question); number of children or teenagers under 18 years of age in the household (open question); health conditions

(diabetes or high blood sugar/hypertension (high blood pressure)/high cholesterol/heart disease/kidney disease/ overweight); frequency of physical activity (I do none/once or twice a week/3 or 4 times a week/4 to 7 times a week); and monthly family income (up to R\$2,824, R\$2,824-R\$7,060, R\$7,060-R\$14,120, R\$14,120-R\$28,240, over R\$28,240.00/would rather not say). All responses were recorded in full by the interviewers.

2.3 Data analysis

The eye movement and camera data collected with the eye-trackers were combined into a video file using Pupil Software (Pupil Labs GmbH, Berlin, Germany). Pupil Player v1.19 (Pupil Labs GmbH, Berlin, Alemanha) was used to analyze the video recordings. Fixations were identified based on eye movements using the scatter threshold recommended by the software. The following default parameters were used: a maximum distance between gaze locations of 3 degrees of visual angle and a minimum duration of 300 ms. Therefore, a fixation was recorded when participants maintained their gaze within a 3-degree visual angle for at least 300 milliseconds.

For each participant, every scene in the video in which food products were examined or purchased was identified by one of the authors. For each of the identified scenes, the following information was recorded: section, product category, and time spent examining the products. For sections that required employee assistance, the time spent within the section was recorded. Within each section of the supermarket, product comparisons were recorded and the type of information they read. When a product was picked up, the following information was recorded: product, whether the product was turned over, type of information read (if any), and whether the product was purchased. Descriptive statistics were used to analyze the data.

Given the dynamic nature of mobile eye tracking in a real-world shopping environment, it was not feasible to predefine fixed Areas of Interest (AOIs), as is common in laboratory-based studies. Instead, we adopted a post-hoc, manual coding approach for the identification of the information read by participants before making their purchase decisions. The video recordings of each participant's shopping session were reviewed to identify all visual fixations on stimuli that could potentially influence purchase intentions. This comprehensive coding process allowed us to capture a wide range of stimuli that might affect consumer behavior at the point of purchase. In our analysis, we distinguish between high-in labels and other informational labels present on the packaging (e.g., nutrition facts, ingredient lists).

The interview data were analyzed using descriptive statistics. For closed questions, the percentage of participants providing each response option was calculated. Responses to open-ended questions were analyzed using inductive coding (Krippendorff, 2018). Participants' responses to each question were independently coded into categories by three researchers with prior experience in content analysis. A series of meetings were then held to review the coding, discuss inconsistencies, and define the final categories by consensus. For each question, the percentage of participants providing responses within each category was then calculated. Quotes were selected to illustrate each of the categories and translated to English for publication.

3. Results

3.1. Eye-tracking data

Valid eye-tracking data were obtained from 144 participants, while for the remaining 21 participants recording issues occurred (e.g., non-valid eye-tracking data, incomplete recordings, or lack of good calibration). Considering the valid data, 98% (n = 141) purchased at least one food or beverage product, while three participants purchased other types of products (2%). In the following, only participants who purchased foods or beverages and had valid eye-tracking data were considered (n = 141).

Table 2 presents the sections of the supermarket visited by participants while making their food purchases. On average, the participants examined products in 4.2 (SD = 2.9) sections. The most visited were fruit and vegetables (n = 81, 57%), bakery products (n = 41, 29%), pantry products (e.g., beans, rice and pasta, n = 41, 29%), cookies and savoury snacks (e.g. chips) (n = 40, 28%) and dairy products (n = 28, 20%). Seventy-nine percent (n=112) of the participants visited sections with products eligible for the nutrition labeling regulation.

Table 2. Number and percentage of participants who visited different supermarket sections (n=141).

Section	Number of participants	Percentage of participants (%)
<i>Fruit and vegetables</i>		
Fruit and vegetables	81	57
<i>Bakery</i>		
Bakery	41	29
Ready-made cakes and loaves	25	18
<i>Pantry</i>		
Pantry products (Rice, beans and spaghetti)	41	29
Flour	26	18
Coffee	21	15
Cooking oil and olive oil	18	13
Sugar	10	7
Salt	5	4
Coconut milk and grated coconut	5	4
Instant noodles	4	3
Grains and cereals	3	2
Vinegar	2	1
<i>Snacks</i>		
Cookies and savoury snacks (e.g. chips)	40	28
Shoestring potatoes	10	7
<i>Meat products</i>		
Butcher's	35	25
Packaged and frozen meat	19	13
Meat and sausages	5	4
<i>Beverages</i>		
Non-alcoholic drinks	29	20
Chocolate powder	8	6
Alcoholic drinks	1	1
<i>Dairy</i>		
Dairy products	28	20
Milk and powdered milk	26	18
Cream and condensed milk	14	10

Grated cheese	2	1
<i>Sauces and preserves</i>		
Sauce	19	13
Canned and preserved food	16	11
<i>Refrigerated products</i>		
Frozen food	16	11
Margarine	4	3
Pastry dough	1	1
<i>Sweets and Desserts</i>		
Candies	18	13
Ice cream	1	1
Jelly	2	1
<i>Condiments and spices</i>		
Condiments and spices	12	9

Excluding categories that required interaction with an employee (e.g., bakery, butcher) or weighing products (e.g., fruits and vegetables), participants spent an average of 49 s (SD = 53 s) examining products before making their decision. Participants analyzed specific information before making their purchase decision for 162 of the 377 purchases involving packaged foods (43%). Only 31 participants (22%) turned a product over to read the information displayed on the back of the package.

The eye-tracking data showed that price was the most sought-after information ($n = 75$, 53%), followed by brand ($n = 58$, 41%), price offers ($n = 24$, 17%), and product features (e.g., flavor, product description) ($n = 22$, 16%). In addition, only six participants (4%) paid attention to the high-in labels. Figure 2 shows a screenshot of the eye-tracking recording of one of the participants, who focused on the high-in labels displayed on a chocolate package. All participants who fixated their gaze on high-in labels reported having seen them, and three purchased the product despite the presence of the high-in labels.



Figure 2. Screenshot of the eye-tracking recording of a participant who fixated on nutritional warnings while purchasing food

3.2. Understanding, exposure and self-reported use of high-in labels

After completing their purchases, participants ($n = 165$) were shown the high-in labels implemented in Brazil and asked if they had seen them before. Sixty percent ($n = 99$) indicated having seen, whereas 38% ($n = 63$) said they had never seen them, and 2% ($n = 3$) said that they were not sure whether they had seen them before or not. Participants who answered in the affirmatively identified food packages as the most relevant source of previous exposure to the high-in labels ($n = 98$, 59%). The most frequently mentioned products where participants remembered having seen were cookies ($n = 26$, 26%), sweetened beverages ($n = 9$, 9%), chocolates ($n=8$, 8%), sweets ($n=5$, 5%) and sauces ($n=5$, 5%). Five participants (5%) noted that the high-in labels were found on most products (“In most of the products in the supermarket”, “almost every product”, “practically all the products”). Only one participant ($n=1$, 1%) reported having seen the high-in labels at university.

All the participants were asked what they thought the high-in labels meant (Table 3). Forty-one percent ($n= 67$) said that high-in labels highlight products with high in nutrients, such as fat, added sugar and/or sodium, while 22% ($n= 37$) responded that the high-in labels meant that something was bad for their health. A further 13% ($n= 21$) said that they did not know what the high-in labels meant. Moreover, 12% ($n=19$) associated the signs with warnings or advice, 11% ($n= 18$) described them as nutritional information, and 8% ($n=13$) said that the high-in labels suggested avoiding or limiting consumption of these foods.

Table 3. Number and percentage of participants (n = 165) who referred to different categories when explaining the meaning of high-in labels. Examples of participant responses are included.

Categories	Examples	Number of participants (n=165)	Percentage (%)
High level of nutrients	<i>"Tell us if there's too much of something we can't consume"; "It has high sodium and sugar content"; "Informs the high content of these nutrients"; "That everything is high"; "That it has more sugar and salt than normal"</i>	67	41
Bad for your health	<i>"Health risk"; "Shows that it's bad for your health" "Products with these symbols are not good for your health"; "Warning us that something can be harmful if we consume too much of it"</i>	37	22
I do not know	<i>"I don't know"; "I haven't the foggiest idea"; "I don't understand a thing"</i>	21	13
Warnings	<i>"It's warning people", "Warning about what is in these products" "Warning about what they put in these products"</i>	19	12
Nutritional information	<i>"To inform the % of ingredients if it has a lot or a little"; "Nutrient content, more calories"; "Quantity of these things in food", "Informing about the quantity of these nutrients, before it was on the back, now it's on the front"; "Information on the content of products"</i>	18	11
Avoid or limit consumption	<i>"Better not consume products with these symbols"; "Consume products with these symbols on them in moderation" "We have to avoid this"; "Look after your health"; "Pay attention to what's written", "Be careful about what we're eating"; "Pay attention to the content of these ingredients"</i>	13	8
Attention	<i>"Advice about your health; "Providing health-related information"; "Related to food and health", "Means that it's good or bad for your health"</i>	12	7
Effect on health	<i>"For diabetics, they're high in sugar"; "Raise cholesterol levels"; "People with high blood pressure and diabetes can't consume this"; "It causes diabetes".</i>	8	5
References diseases	<i>They point out everything that is bad about these products"; "Unhealthy, high in sugar and fat"; "The products with these symbols are not healthy"</i>	7	5
Unhealthy products	<i>"That the product isn't bad"; "Say the product is good"</i>	2	4
Product is not bad		2	1

When asked whether they had seen the high-in labels during their shopping that day, only 31 participants (19%) responded affirmatively, while 81% reported not having seen them. Cookies were the most frequent product category (n = 14, 45%) mentioned for those who had seen the high-in labels, followed by chocolates (n = 6, 19%), sweetened beverages (n = 4, 13%), savory snacks (n = 4, 13%), canned and preserved foods (n = 4, 13%), sauce (n = 3, 10%), cream (n = 3, 10%), dairy products (n = 3, 10%), condensed milk (n = 2, 6%), margarine (n = 2, 6%), shoestring potatoes (n = 1, 3%), meat and sausages (n = 1, 3%), packaged bread (n = 1, 3%), and condiments and spices (n = 1, 3%).

Twenty-four participants (14%) indicated that they intended to purchase an item with high-in symbols, being cookies, the most frequently mentioned (n = 8, 33%) category, followed by sweetened beverages (n = 4, 17%), savory snacks (n = 4, 17%), chocolates (n = 3, 12%), and cream (n = 3, 12%). When asked about their actions regarding the products, the majority (n = 21, 88%) responded that they had purchased them anyway, while three participants (n = 3, 12%) opted for a similar product with fewer high-in symbols. When explaining the reason that led to their decision to purchase the product, perceived need and preference were the most frequently mentioned categories (Table 4). Those who reported replacing the product by one with fewer high-in symbols justified their decision on health.

Table 4 – Number and percentage of participants (n = 24) who referred to different reasons underlying their purchase decisions regarding products with high-in labels. Examples of participant responses are included.

Categories	Examples	Number of participants (n= 24)	Percentage (%)
Need the product	<i>"Because I need these products"; "Because I wanted this product"; "I work with confectionary, and I need to use these products"</i>	8	33
Food preferences	<i>"Because I really like sweets"; "Because my son likes them"; "Because I like them"; "My nephews and nieces like them and can't live without them"</i>	7	29
Little or moderate consumption	<i>"Because I only buy it very rarely, it's not a habit"; "I don't buy it very much" "I keep an eye on how much I eat"</i>	3	13
Bad for health	<i>"Because it's bad for your health and it was high in sodium", "Products with these symbols on them are bad for your health"</i>	3	13
Habitual nature of food choices	<i>"Because I use it in my daily life"; "I'm used to eating it every day"; "It's a habit of mine to buy these cookies to have with coffee"</i>	2	8
No products available without warnings	<i>"Every conserved product has the warning, there's no choice"</i>	1	4

Regarding retrospective changes in food purchase decisions after the implementation of high-in labels, 45 participants (27%) answered that they had been influenced. When asked about how their purchase decisions had changed (Table 5), the majority responded that they bought them in smaller quantities (n = 19, 42%) or they tried to substitute (n = 12, 27%) products with high-in labels. Meanwhile, other participants said did not buy products with high-in labels at all (n = 10, 22%). Some participants also mentioned that the high-in labels increased their awareness of food composition (n = 5, 11%) and facilitated their purchase decisions (n = 2, 4%).

Table 5. Number and percentage of participants (n = 45) who referred to different changes in their food purchase decisions since the introduction of high-in labels. Examples of participant responses are included.

Categories	Examples	Number of participants (n= 45)	Percentage (%)
Buy them in smaller quantities	<i>"I avoid buying products with these symbols"; "I would buy less"; "I avoid buying these products when I can"; "Consume in moderation"</i>	19	42
Substitute products	<i>"I look for products that do not contain them"; "If they have this symbol, I will not buy it or I will look for another product with less of these nutrients"; "Choose products without the symbol"; "I will look for an option that does not have an excess of these nutrients"</i>	12	27
Not buy products with warning labels	<i>"I've stopped buying products with this symbol"; "I'm going to stop buying this product"; "I wouldn't buy it"; "Depending on the food, I'm not going to eat it"</i>	10	22
Greater awareness of food composition	<i>"Because it stresses that the product has high sugar, sodium and fat content"; "It gives us a better idea of what we are eating"; "It provides more information, I always try to read it"</i>	5	11
Facilitated purchase decisions	<i>"It helped me to make a better choice"; "I can see things more clearly";</i>	2	4

When asked about the reasons why they had modified their purchase decisions, most of the participants (n = 37, 82%) claimed it was for the sake of their health or because they sought a healthier diet and quality of life (n = 5, 11%) (Table 6). Some participants indicated that the presence of high-in labels raise greater awareness about the quality of the foods they consume (n = 4, 9). Some participants (n = 4) who were unfamiliar with the high-in labels stated that if these appeared on food packaging, they would actively seek out products displaying the high-in labels, as they perceived these high-in labels as indicators of quality. Table 6 also presents the responses of participants who reported not changing their purchasing decisions after the implementation of the high-in labels (n = 54, 33%). The main reasons were lack of interest in reading labels (n = 14, 26%), already having healthy eating habits (n = 10, 19%) and the habitual nature of food choices (n = 6, 11%).

Table 6 – Number and percentage of participants who referred to different reasons for changing (n = 45) or not changing (n = 54) their shopping habits after the implementation of high-in labels. Examples of participant responses are included.

Categories	Examples	Number of participants	Percentage (%)
<i>Reasons that led them to change their shopping habits (n = 45)</i>			
For reasons of health	<i>“For reasons of health”; “It’s bad for your health”; “To be healthier”; “Because I have people with diabetes and high blood pressure in my family”; “Avoid health issues”</i>	37	82
Seeking a healthy diet and quality of life	<i>“Because I’m trying to be healthier”; “Better quality of life”; “To improve my life, avoid getting sick and feel better”</i>	5	11
Raise awareness	<i>““It’s important to know what I’m buying”; “Because it helps to provide information”; “It’s a way of knowing what we’re consuming”;</i>	4	9
<i>Reasons that led them not to change their shopping habits (n = 54)</i>			
Not interested in reading labels	<i>“I can’t be bothered looking at it”; “I don’t read this information on products”; “I’m looking for what’s practical, I don’t pay much attention”; “I don’t read any of this information on products, not even the expiration date”; “I don’t pay attention when buying something, I don’t pay attention to the label”.</i>	14	26
Already has healthy eating habits	<i>“I already have healthy habits”; “I’m a vegan and already have good habits”; “I keep an eye on what I eat and eat healthily”</i>	10	19
Habitual nature regarding food choices	<i>“I’m already used to the products I buy”; I’ll buy it even if it’s expensive”; “Because I already buy the same brands”; “I’m already used to eating the same things, the symbols alone wouldn’t be enough to change my habits”</i>	6	11
I do not know what it means	<i>“I don’t know what it means”; “I don’t understand”; “Because I don’t know what this means”; “Like many people, I’m going to ignore this due to lack of knowledge”</i>	5	9

I buy it anyway	<i>"I might even look at the symbol, but I'll buy the product anyway"; "It makes no difference to me"; "Because I eat the wrong things"</i>	5	9
Because I like the products	<i>"Because I like the products and that's why I buy them"; "Because I like them and so do my children"; "I buy the products I like" "Because I have kids at home and I have to buy them because the kids like them"</i>	5	9
I consume little or in moderation	<i>"Because I don't eat much of this kind of product"; "I hardly ever buy these products, and when I see them, I let myself have some"; "I don't eat it all the time"</i>	5	9
Conscious purchase	<i>"I will pay more attention to the products. Depending on the product, I will keep eating it. I'm already used to the products I consume"; "I was terrified, but I didn't stop buying them. I was scared"; "The symbols help me choose, but if I feel like eating them at the moment, I will buy them whether they have the symbol or not. Because they are comfort food. They are good for the soul. My desire to eat them wins out in the end"</i>	4	7
I already know the information in the warnings	<i>"I eat the product already knowing what's in it"; "I already knew why these symbols are printed on products"; "I already know that these products are harmful"</i>	4	7
I have no illnesses that stop me consuming the product	<i>"Because I don't have any illnesses that stop me from eating food with these symbols printed on them"; "Because I don't have any problems with salt and sugar"; "I have no health issues".</i>	3	6
They are good/mean quality	<i>"Because I like the symbol and think that products with these symbols on them are good"; "Because it means quality"</i>	2	4
Need the product/essential product	<i>"Due to the need to use the product"; "I need this food; I'm not going to stop eating it"</i>	2	4
Every product has the symbol on it	<i>"Because this symbol is on almost every product"; "Because every product contains these ingredients"</i>	2	4
I am on a diet	<i>"I don't eat this today because I am on a diet and eating well; but if I wasn't dieting, I would eat it anyway"</i>	1	1

4. Discussion

This study sought to explore the use of high-in labels after their entry into force in Brazil, using eye-tracking measures and self-reported data. It was possible to observe that only 60% of the participants had already seen the high-in labels before the study, with the majority identifying food packaging as the main source of contact with the high-in labels. These results suggest that a relevant proportion of Brazilian consumers may still be not fully aware of their presence. The percentage of participants reporting having seen the warnings considerably lower than that observed in other countries. In Uruguay, 86% of consumers reported noticing the warnings just 10 days after the introduction of the front-of-pack labeling policy, with this percentage increasing to 98% after 19 months (Ares *et al.*, 2021; Machín *et al.*, 2023). In Chile,

93% of consumers reported having seen the warnings one year after the implementation of the Chilean food law (Ministerio de Salud, 2017).

This discrepancy can be explained by differences in regulations between countries, particularly in terms of graphic design, label size, and the criteria used to classify nutrient content as high. In most Latin American countries, such as Chile, Uruguay, and Mexico, the adopted warning labels consist of black octagonal symbols containing the expressions “High in” or “Excess” (Crosbie *et al.*, 2023b). In Brazil, however, a different high-in model is used, featuring a white rectangle with a black magnifying glass and the text “High in” on a black background. Additionally, unlike other countries, the Brazilian system does not explicitly indicate the responsible authority or the source of the information, which may influence consumer trust and perceived credibility. Future research should explore whether adjustments in label design and nutrient profile criteria could enhance the effectiveness of warning labels in Brazil.

A considerable proportion of participants had not noticed the high-in labels before the study, highlighting the need for targeted strategies to enhance consumer awareness. Public awareness campaigns, as well as in-store interventions such as billboards, digital displays, or messages on shopping carts, could help draw attention to the labels and encourage their use in purchase decisions. For instance, Mørk *et al.* (2017) found that an in-store intervention promoting the keyhole labeling scheme successfully increased the sales of labeled products in Denmark. Similar approaches, adapted to the Brazilian context, could be explored to determine their effectiveness in increasing consumer engagement with high-in labels. Future research should evaluate the impact of these strategies on consumer behavior and assess their potential to enhance the effectiveness of high-in labels in guiding healthier food choices.

Among participants who had seen the labels a high level of understanding was registered. Most of the participants were able to indicate high-in symbols highlight products high in critical nutrients, that they highlight unhealthy products or products whose consumption should be limited. However, it is worth noting that 13% of the participants indicated that they did not understand what the high-in symbols meant. This reinforces the need for communication campaigns to increase awareness (Ares *et al.*, 2021)

At the point of purchase, 15% of the participants reported having noticed high-in labels on a product and only 6% of the participants actually fixated their gaze on the high-in labels before making their purchase decisions. These findings are consistent with a study conducted in Uruguay, which, 19 months after the full implementation of the warnings, which reported only 7% of the participants fixated their gaze on the warnings (Machín *et al.*, 2023). The infrequent use of warnings at the point of purchase is aligned with the habitual nature of food purchase decisions (Hoyer, 1984; Machín *et al.*, 2020). Consumers have been reported to repeat their decisions over time and to rarely search for detailed information when making their habitual purchases (Carrasco *et al.*, 2005; Gardner *et al.*, 2011; Machín *et al.*, 2020). This suggests that it is unlikely that consumers actively seek out nutritional symbols during their purchasing process. However, it is possible that soon after these symbols were implemented, consumers may have adjusted their purchase decisions, forming new eating purchasing habits. Over time, these new consumption patterns may continue to be repeated, lastingly influencing their choices, even if the active search for nutritional information decreases (Machín *et al.*, 2020, 2023). Nevertheless, further research is needed to assess the extent to which these changes occur in the long term.

In this sense, 28% of the participants indicated that they had made changes in their purchase decisions after the implementation of the high-in labels. The majority reported that they avoided purchasing products with high-in labels, buying them in smaller quantities, or replacing them with healthier alternatives, mainly due to health concerns. The percentage of participants reporting changing their purchase decisions after the implementation of the

warning is lower than those reported in Chile and Uruguay. However, direct comparisons should be interpreted with caution due to differences in study designs and contexts. In Chile, 44% of the consumers reported taking the warnings into account when making purchasing decisions (Ministerio de Salud, 2017). Meanwhile, between 56 and 58% of the consumers reported changing their purchase decision after the implementation of warning labels in Uruguay. (Ares *et al.*, 2021; Machín *et al.*, 2023). These findings suggest that high-in labels may be effective in influencing the purchase decisions of the population. However, our results showed that a small proportion of consumers ($n = 4$, 2%) indicated that they sought products with high-in labels, associating them with a quality product, which reveals a misinterpretation of the labels. This result has not been reported in studies conducted in countries that have implemented octagonal warnings. Octagonal warnings may be more efficient at conveying the idea that products are not healthy due to previous associations with traffic signs (Cabrera *et al.*, 2017).

A relevant proportion of the participants (33%) said that they had not changed their purchase habits. Among those who did not change their behavior, the most common justifications included a lack of interest in reading labels, the habitual nature of food choices, or the fact that they already had habits they considered healthy. These results are aligned with other studies, which show that resistance to behavioral change is often related to established eating patterns and the perception that current choices are adequate (Huddleston *et al.*, 2018; Machín *et al.*, 2023). These results highlight the potential value of developing more effective communication and education strategies that stimulate greater awareness of the role of nutritional warnings and encourage consumers to reconsider their eating habits, even those who already consider themselves healthy. In addition, high-in labels should be part of a comprehensive package of policies aimed at creating healthier food environments (Ares *et al.*, 2018; Jones *et al.*, 2019; Pettigrew *et al.*, 2024). The available evidence suggests that the implementation of marketing regulations and fiscal policies can largely contribute to promote healthier food choices among Brazilian consumers (WHO, 2023, 2024a).

4.1. Strengths and limitations

Our findings contribute to the existing literature by providing empirical evidence on consumer interactions with Brazil's front-of-package (FOP) nutrition labels in both real-world shopping environments and retrospective assessments. The results offer preliminary evidence of the potential of high-in labels to promote healthier food choices after policy implementation, complementing findings from studies conducted in hypothetical scenarios (Alcantara *et al.*, 2025; França *et al.*, 2024; Prates *et al.*, 2022). A key strength of the study was the combination of mobile eye-tracking data with self-reports, offering a more comprehensive perspective on Brazilian consumer behavior. Results indicate that active searches for high-in labels were infrequent, emphasizing the need for further research on their impact. Before-and-after studies examining changes in consumer purchase decisions or product sales could help bridge this gap.

This study has several limitations that should be acknowledged. First, it was conducted with a small convenience sample of participants from two Brazilian cities. While the sample included individuals with diverse socio-demographic characteristics, it cannot be considered representative of the Brazilian population. As a result, the findings may not fully capture regional variations in consumer behavior, particularly in areas with different levels of access to information, education, and dietary habits. Additionally, the reliance on self-reported measures and eye-tracking data provides insights into consumer attention and perception but does not allow for a direct assessment of the policy's effectiveness in changing actual food purchase behaviors over time. Self-reported data may also be subject to recall and social desirability biases, potentially influencing responses about label use and decision-making.

Future research should aim to address these limitations by employing larger, more diverse, and nationally representative samples to enhance the generalizability of findings. Longitudinal studies and quasi-experimental designs assessing actual purchasing patterns before and after policy implementation would also be valuable in determining the real-world impact of front-of-package labels on consumer food choices.

5. Conclusion

The results of the present study provide insights into consumer experiences with front-of-pack high-in labels after their implementation in Brazil. Among participants who had seen the warnings before the study, approximately half reported changing their purchase decisions, indicating the potential of this policy to promote healthier food choices. However, the fact that 40% of participants had not noticed the labels and that consumer attention at the point of purchase was limited highlights the need for strategies to enhance awareness and encourage label use. In this regard, targeted communication campaigns and in-store interventions could play a crucial role. Such initiatives could emphasize the role of high-in labels in facilitating more informed food choices, raise awareness of the negative health effects associated with consuming labeled products, and promote the benefits of opting for healthier alternatives. Integrating these efforts with broader public health initiatives could further strengthen the impact of front-of-package labeling in guiding consumer decisions and improving dietary habits in Brazil.

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SUPPLEMENTARY MATERIAL



Figure 1. High-in labels shown to the participants.

Table 1. Criteria established by National Health Surveillance Agency's (Anvisa) RDC 429 for the use of the magnifying glass

Nutrients	Solid or semi-solid foods	Liquid food
Added sugars	≥ 15 g of added sugars per 100 g of food	≥ 7.5 g of added sugars per 100 ml of food.
Saturated fat	≥ 6 g of saturated fat per 100 g of food	≥ 3 g of saturated fat per 100 ml of food.
Sodium	≥ 600 mg of sodium per 100 g of food	≥ 300 mg of sodium per 100 ml of food.

Table 2 - Questions used to assess understanding, exposure and self-reported use of high-in labels.

Questions
Have you seen these symbols (referring to the high-in labels shown in Supplementary Figure 1) before? (yes/no/not sure)
<i>If yes...</i>
Where have you seen these symbols? (open question)
What do you think the symbols mean? (open question)
Have you seen these symbols on any food or beverage in the supermarket today? (yes/no/not sure)
<i>If yes...</i>
On which products? (open question)
Did you intend to buy any of these foods or beverage that had the symbol? (yes/no)
<i>If yes...</i>
Which ones? (open question)
What did you do with the product? (I bought it anyway/I bought a similar product without the symbol/I bought a similar product with fewer symbols/I did not buy the product)
Why? (open question)
Have you changed your purchase decisions after the symbols began to appear on the food? (yes/no)
<i>If yes...</i>
How? (open question)
Why? (open question)
<i>If not...</i>
Why? (open question)

APÊNDICE III*

*Material suplementar capítulo III

SUPPLEMENTARY MATERIAL



Figure 1. High-in labels seal implemented in Brazil under Collegiate Board Resolution (RDC) 429/2020.

Table 1. Description of the eight pairs of choice sets included in the choice task for each product category

Pair	Brand	Alternative 1		Brand	Alternative 2	
		High-in label	Textual sensory marketing claim		High-in label	Textual sensory marketing claim
1	Familiar	Absent	Present	Unfamiliar	Present	Absent
2	Familiar	Present	Present	Familiar	Present	Absent
3	Familiar	Present	Absent	Unfamiliar	Absent	Absent
4	Familiar	Absent	Absent	Familiar	Absent	Present
5	Unfamiliar	Present	Absent	Unfamiliar	Present	Present
6	Unfamiliar	Present	Present	Familiar	Absent	Absent
7	Unfamiliar	Absent	Present	Familiar	Present	Present
8	Unfamiliar	Absent	Absent	Unfamiliar	Absent	Present

Table 2. Perceived healthiness and acceptance of the two product categories evaluated in the study

Category	Perceived healthfulness*	Acceptance*
Ice cream and	3.91 ^b	7.49 ^a
Cream cheese	4.45 ^a	6.86 ^b
<i>p-value</i>	<0.001	<0.001

*Perceived healthfulness was evaluated on a structured 7-point scale (1 = not healthy, 7 = completely healthy). Acceptance was assessed using a 9-point hedonic scale (1 = extremely dislike, 5 = neither like nor dislike, 9 = extremely like).

Means with different lowercase letters in the same column indicate significant differences according to the student's *t*-test ($p \leq 0.05$).