

Aligning Front-of-Pack Labeling Research with Consumer Needs: A Cross-Country Analysis of Research Intensity and Policy Urgency

Valeria Gammella Quintero^{1, *}, Marco Francesco Mazzù², and Angelo Baccelloni³

¹ Luiss University, Department of Business & Management

² Luiss Business School

³ John Cabot University

Corresponding author: vgammellaquintero@luiss.it

Abstract

Front of Pack Nutritional Labeling (FOPL) is a key strategy to address rising global obesity and diet-related noncommunicable diseases. This study examines whether recent academic research aligns with the public health needs and policy development stages of different countries. Using a mixed approach we identified a disconnection: while nearly 30% of countries face high obesity rates and lack FOPL implementation, over 70% of research focuses on countries with established systems. This reveals a misalignment between research efforts and policy urgency. Our findings suggest the need for stronger coordination between researchers and policymakers to ensure that scientific evidence supports FOPL adoption where it is most needed.

Keywords: Front-of-Pack Nutritional Labels; Obesity; Overweight; Policy-making; Food; Bibliometric analysis.

1. Introduction

Global institutions are increasingly prioritizing the growing prevalence of obesity and overweight worldwide, as highlighted by the World Health Organization (WHO, 2025). Between 1990 and 2022, obesity rates among children and adolescents aged 5–19 rose from 2% to 8%, while adult obesity more than doubled, from 7% to 16%. Once considered an issue limited to high-income countries, obesity is now widespread in many middle-income nations, which report some of the highest prevalence rates. This global trend poses a major public health challenge, fueling the rise of noncommunicable diseases and placing mounting pressure on healthcare systems (WHO, 2024); a key factor contributing to this issue is malnutrition, which includes not only deficiencies but also excesses and imbalances in nutrient intake. In response, a range of stakeholders—from individuals to policymakers and industry players—have introduced various countermeasures. Among these, Front-of-Pack Nutritional Labeling (FOPL) has emerged as a prominent strategy to inform consumers about the nutritional quality of food products (Mazzù et al., 2023). FOPL systems vary by country: directive formats like Nutri-Score are voluntarily used in several European nations, Warning Labels are prevalent in South America, and non-directive models such as Italy’s NutrInform Battery offer alternative approaches.

While FOPLs are widely acknowledged as effective and necessary, their implementation differs significantly across countries in terms of “policy maturity” (van der Bende and Lissner, 2019; European Commission, 2020), resulting in a fragmented regulatory landscape.

Consequently, research efforts—both in focus and intensity—do not always align with the various stages of the policy lifecycle. Scholarly output tends to surge during moments of public debate or uncertainty, such as during the selection of an FOPL system or in later stages assessing its impact.

Despite a robust body of literature evaluating FOPL effectiveness, there remains a limited understanding of countries' underlying needs in relation to FOPL, especially when viewed through the lens of public health challenges and policy development stages. This paper therefore (i) explores the alignment between these needs and recent FOPL research (2018–2023), focusing on research intensity, quality, and geographic distribution, and (ii) highlights a disconnect, showing that research efforts are not always concentrated where they are most urgently needed.

2. Metodologia

This study adopts a mixed-method approach rooted in public policy analysis, integrating three key components: (i) a systematic review of the literature on Front-of-Pack Labels (FOPLs), (ii) an initial assessment of the policymaking landscape related to FOPLs across various countries, and (iii) a comparative analysis of country-level health indicators related to obesity. The policy cycle framework is employed to trace the evolution of FOPL initiatives through the different stages of the policymaking process. To support the conceptual framework and uncover cross-national patterns, relevant academic literature on FOPLs, policy development, and nutrition governance was thoroughly examined.

2.1 Systematic Literature Review and Research focus

The study began with a Systematic Literature Review conducted in accordance with PRISMA guidelines. In the initial phase, a search was carried out using the query (“= Front AND Pack AND Nutr*”) across the Scopus and Web of Science databases, restricted to peer-reviewed articles published between 2020 and 2024. This search yielded 1,316 records. Following the removal of duplicates and dataset cleaning, a relevance screening was performed based on journal quality, using the Scimago Journal Rank (SJR) as a reference. Only articles published in top-quartile (Q1) journals were retained, narrowing the pool to 1,161 papers. This subset was further refined to 238 articles by selecting only those with an SJR above the median value within each main thematic area.

In the third stage, a detailed manual screening was conducted to ensure the inclusion of high-quality studies with clear thematic relevance. Articles that did not explicitly address Front-of-Pack Labeling (FOPL) or deviated substantially from the core topic were excluded, resulting in a curated dataset of 150 articles. Finally, a full-text analysis was carried out, during which specific information from each article was systematically recorded in a dedicated review file. At this stage, additional exclusions were made due to content misalignment with the study's objectives—issues not evident during the abstract screening—yielding a final dataset of 105 articles, 91 of which were directly associated with individual countries.

2.2 Policy lifecycle stages

Policy life cycle frameworks offer a valuable lens for examining the progression of public policy development and implementation. Drawing on established literature (Robinson and Eller, 2010), this study identifies a series of stages beginning with the “absence” of policy discourse, followed by “agenda setting,” “problem identification,” and “policy formulation,” which encompasses both “drafting a proposal” and initiating the “legislative process.” The final stages involve “adoption” (either voluntary or mandatory) and “monitoring, adjustment, and evaluation” to assess and refine policy effectiveness.

In the context of Front-of-Pack Labeling (FOPL), the “problem identification” phase typically entails recognizing critical public health issues—such as rising obesity and overweight rates—and their links to poor dietary habits. The subsequent “agenda-setting” stage reflects increasing interest in FOPL as a policy response to nutrition-related diseases. The “policy formulation” stage is particularly pivotal, involving the assessment of alternative policy options. This includes drafting a proposal and proceeding through the legislative process, where the policy undergoes debate, approval, and legal ratification.

The “adoption” stage—whether voluntary or mandatory—depends heavily on political and institutional commitment. Once adopted, FOPL systems enter the “implementation” phase, which may encounter obstacles such as limited consumer engagement or “label fatigue” (Pfister and Pozas, 2023). This leads to the final phase of “monitoring, adjustment, and evaluation”, aimed at measuring the policy’s outcomes and improving its performance over time.

To determine each country’s position within the policy lifecycle, we analyzed data from 197 countries using the WHO GIFNA (2025) dataset. This encompasses all 193 United Nations member states, as well as additional entities including Vatican City, French Polynesia, Kosovo, and Palestine. Countries were categorized into nine macro-regions: (1) North America, (2) Central America and the Caribbean, (3) South America, (4) Europe – EU27, (5) Europe – non-EU27, (6) Africa, (7) Middle East, (8) Asia (excluding the Middle East), and (9) Oceania. Table 1 presents an overview of FOPL policymaking status across these regions.

For analytical clarity, countries were grouped into three overarching policy lifecycle phases: (i) “Pre-adoption”, (ii) “Voluntary adoption, monitoring, and adjustment” and (iii) “Mandatory adoption and monitoring”. The findings reveal that most countries (74.62%) remain in the early, pre-adoption stages, while only 6.60% have progressed to mandatory adoption.

Macro-Region	Countries in the macro-region	Countries in before voluntary adoption stages	Countries in voluntary adoption, monitoring and adj. stages	Countries in mandatory adoption and monitoring stages
	Number	Number	Number	Number
North America	3	2	0	1
Central America and the Caribbean	20	20	0	0
South America	12	3	1	8
Europe – EU 27	27	13	14	0
Europe, Non EU 27	19	13	6	0
Africa	54	54	0	0
Middle East	16	9	5	2
Asia (excl. Middle-East)	31	20	9	2
Oceania	15	13	2	0
Total	197	147	37	13
<i>Percentage on the total</i>	<i>100%</i>	<i>74.62%</i>	<i>18.78%</i>	<i>6.60%</i>

Table 1: Status of policy lifecycle by macro-region

2.3 Obesity-related health indicators

To evaluate the severity of obesity-related challenges across countries, we identified a set of key indicators. Specifically, the analysis included: (a) Body Mass Index (BMI), a widely used screening measure that estimates body fat based on height-to-weight ratio (with definitions from the Cleveland Clinic, 2025, and data primarily sourced from WorldData, 2025); (b) the prevalence of obesity and overweight within the total population, expressed as a percentage; (c) the incidence of noncommunicable diseases (NCDs), measured by the proportion of total deaths attributable to these conditions (data mainly retrieved from the World Bank, 2025); and (d) relevant covariates highlighted in the literature, including education level, income or purchasing power, age, and gender (Cooper et al., 2021; Egnell et al., 2018; Pettigrew et al., 2017), with data primarily obtained from WorldData (2025) and Numbeo (2025)

Of the complete dataset, 59 countries—representing approximately 30% of the total sample—had comprehensive data available across all selected indicators (see Table 2).

Macro-Region	Countries in the macro-region Number	Indicators available Average number (out of 16)
North America	3	16.0
Central America and the Caribbean	20	14.1
South America	12	15.4
Europe – EU 27	27	15.9
Europe, Non EU 27	19	13.0
Africa	54	12.6
Middle East	16	15.3
Asia (excl. Middle-East)	31	14.7
Oceania	15	13.1

Table 2: Number of countries and data availability by macro-region

3. Results

Using the dataset described above, we clustered countries based on two primary criteria: (i) the status of Front-of-Pack Label (FOPL) policy adoption—specifically, whether a FOPL system is currently implemented in the market—and (ii) key obesity-related health indicators, namely average Body Mass Index (BMI) and the proportion of deaths attributable to noncommunicable diseases (NCDs). BMI functions as an input indicator, reflecting potential health risks, while NCD-related mortality serves as an output indicator, capturing the consequences of such risks (e.g., Riquelme et al., 2021; García-Witulski, 2025).

From the original dataset, 184 countries were retained, with 13 excluded due to incomplete data. Countries were categorized according to standard adult BMI classifications (CDC, 2025): those with an average BMI above 30 were classified as “obese,” those between 25 and 29.9 as “overweight,” and those below 25 as having a “healthy weight”. Notably, no country in the dataset reported an average BMI below 18.5, which would indicate an underweight population.

For NCD-related mortality, the median value across countries was calculated and used as a threshold to divide the sample into two groups: those with a “higher incidence of NCD-related deaths” and those with a “lower incidence.” By combining these health classifications with the presence or absence of FOPL policies, we identified 12 distinct country clusters (see Table 3).

BMI Level	NCD incidence	Policy status		Total
		Early	In place	
BMI>30		9 (4.9%)	2 (1.1%)	11 (6.0%)
	Higher NCD	5 (2.7%)	1 (0.55%)	6 (3.3%)
	Lower NCD	4 (2.2%)	1 (0.55%)	5 (2.7%)
BMI: 25-29.9		84 (45.7%)	41 (22.3%)	125 (67.9%)
	Higher NCD	49 (26.6%)	29 (15.8%)	78 (42.4%)
	Lower NCD	35 (19.0%)	12 (6.5%)	47 (25.5%)
BMI <25		42 (22.8%)	6 (3.3%)	48 (26.1%)
	Higher NCD	3 (1.6%)	4 (2.2%)	7 (3.8%)
	Lower NCD	39 (21.2%)	2 (1.1%)	41 (22.3%)
Total		135 (73.4%)	49 (26.6%)	184 (100.0%)

Table 3: Country clustering by typology: incidence by segment

Clusters comprising countries where the average population falls into the “obese” or “overweight” categories—combined with a high incidence of NCD-related mortality—are of analytical interest. These groupings reflect nations facing acute public health challenges. Notably, 54 countries (29.3% of the sample) fall within this category while remaining in the early, pre-adoption phases of FOPL policy development. This represents a significant opportunity for targeted research and institutional action. While some of these countries have initiated limited legislative or drafting activities, they have not yet advanced to the voluntary or mandatory implementation stages. Others show minimal policy engagement, with little to no regulatory or legislative initiatives underway. These countries are typically lower-income or developing nations, where FOPL has not yet emerged as a governmental or institutional priority. A further 39 countries (21.2% of the sample) also fall into the “BMI > 30” or “BMI 25–29.9” range but report lower rates of NCD-related mortality. This discrepancy may be explained by several factors, including younger population demographics, delayed onset of NCDs, better access to basic healthcare, variation in leading causes of mortality, or potential underreporting and data quality limitations. Despite lower current mortality rates, these countries present a latent risk of future health deterioration and thus represent a strategic target for early-stage preventive policies such as FOPL implementation. In contrast, 16.3% of the sample consists of countries with similarly high BMI and overweight prevalence, but with active FOPL policy engagement. These nations have typically adopted voluntary labeling schemes, indicating broad industry participation, heightened consumer awareness, and institutional readiness to transition toward mandatory regulation. Such countries, often more economically developed, tend to implement multi-

phase FOPL strategies and demonstrate a clear commitment to nutrition policy as a core public health priority.

3.1 Advances in research and its link to supporting policy development

Each article selected through the literature review was examined to determine its geographical focus. A value of “one” was assigned to a country whenever it was explicitly addressed in the study—whether through experimental research, policy evaluation, or other analytical methods. This process yielded a total of 188 entries. Of these, 174 were associated with 50 specific countries, while the remaining 14 referred either to broader continental regions or lacked a defined national focus, instead contributing to the conceptual or theoretical development of FOPL. The findings reveal a marked concentration of research activity in specific geographic areas, suggesting an uneven global distribution of scholarly attention (see Table 4).

Macro-Region	Policy status		Total
	Early	In place	
North America	24	6	30
Central America and the Caribbean	-	-	-
South America	2	29	31
Europe – EU 27	9	52	62
Europe, Non EU 27	-	16	16
Africa	8	-	8
Middle East	-	-	-
Asia (excl. Middle-East)	3	17	20
Oceania		8	8
Total	46	128	174

Table 4: Research by macro-region and by policy status

Major countries focus of the research are displayed in Figure 1.

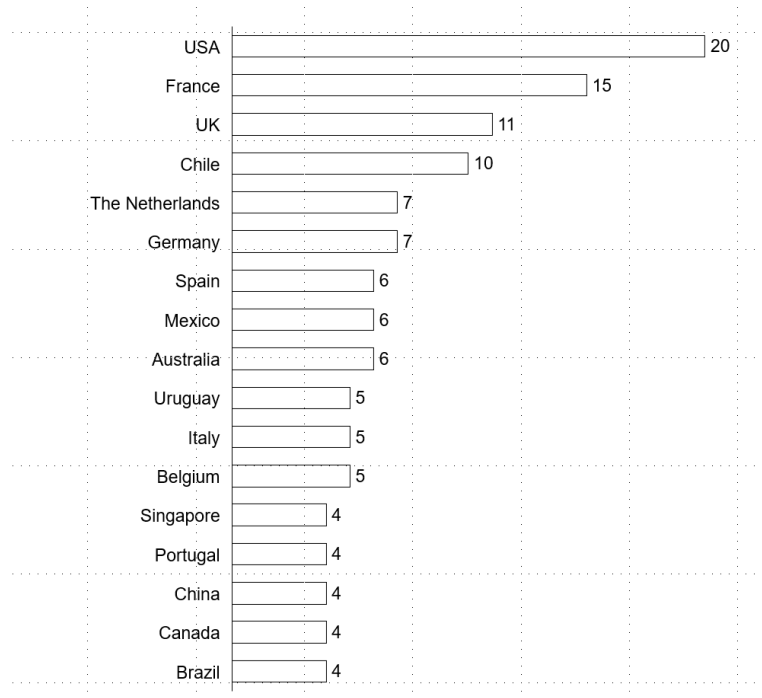


Figure 1: Country focus of advances in research

In this respect, authors affiliated with institutions of 12 different countries were active in top journals (Figure 2).

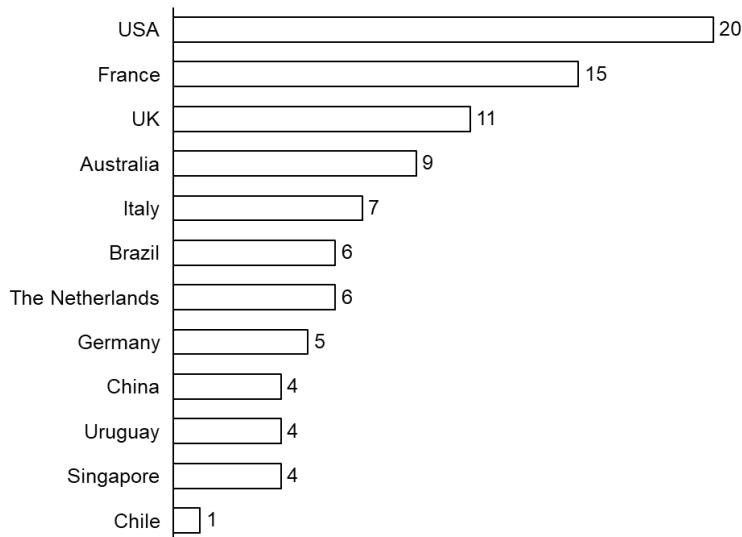


Figure 2. Authorship by country of affiliation of the main author

Authors affiliated with institutions in the United States and China—together responsible for 24 publications (26.0%)—were predominantly associated with studies examining countries

that remain in the early stages of FOPL policy development. A second, more substantial group includes 57 papers (62.0%) focusing on countries that were early adopters of voluntary FOPL systems, such as France, Italy, Germany, the Netherlands, Singapore, the United Kingdom, and Australia. A third cluster comprises 11 studies (12.0%) centered on countries where FOPL policies have already been implemented and where institutional efforts are now directed toward evaluating their real-world impact. This latter group primarily includes Chile, Uruguay, and Brazil.

Notably, a significant share of recent scholarly output in high-ranking journals (73.6%) has concentrated on countries with existing FOPL policies. These studies explore a broad range of issues, including assessments of policy effectiveness, comparative analyses of labeling schemes, and the development of new conceptual or applied frameworks (see Table 5).

BMI Level	NCD incidence	Paper by Policy status		Total
		Number, percentage		
		Early	In place	
BMI >30		0 (0.0%)	0 (0.0%)	0 (0.0%)
	Higher NCD	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Lower NCD	0 (0.0%)	0 (0.0%)	0 (0.0%)
BMI: 25-29.9		37 (21.3%)	106 (60.9%)	143 (82.2%)
	Higher NCD	33 (19.0%)	82 (47.1%)	115 (66.1%)
	Lower NCD	4 (2.3%)	24 (13.8%)	28 (16.1%)
BMI < 25		9 (5.2%)	22 (12.6%)	31 (17.8%)
	Higher NCD	2 (1.1 %)	20 (11.5%)	22 (12.6%)
	Lower NCD	7 (4.0%)	2 (1.1%)	9 (5.2%)
Total		46 (26.4%)	128 (73.6%)	174 (100.0%)

Table 5: Incidence of research by country clustering – Number of paper and distribution by cluster

In the United States, research on Front-of-Pack Labeling (FOPL) can be organized into several distinct micro-clusters. The first cluster explores the impact of various labeling formats—such as warning labels (Hughner and Dumitrescu, 2024), stop sign symbols (Rybak et al., 2024), and Traffic Light systems (Meng and Chan, 2022 —with a particular focus on their ability to influence healthier and more sustainable food choices. A second cluster is more policy-oriented, examining how FOPL initiatives are positioned as tools to promote healthier eating behaviors and curb the prevalence of noncommunicable diseases (NCDs). A third body of literature evaluates the behavioral outcomes of nutritional labeling interventions, including studies like those by Downs and Demmler (2020), which assess how such measures affect consumer decision-making and encourage shifts toward alternative or healthier food options. Lastly, several studies focus on the Nutrition Facts Panel, analyzing its effectiveness and influence within the broader framework of front-of-pack and back-of-pack labeling strategies.

In France, most studies focus on the application of the Nutri-Score system, reflecting a highly mature phase of research on this specific labeling scheme. This is evidenced by large-scale field experiments conducted in retail settings (Dubois et al., 2021) as well as investigations within broader communication and media contexts (Courbet et al., 2024; Hémar-Nicolas et al., 2024). Overall, the literature has progressed beyond initial evaluations of Nutri-Score’s potential benefits, moving toward more advanced analyses of its practical effectiveness and contextual relevance.

In the United Kingdom, research has largely concentrated on the practical application of Traffic Light labeling systems. Several studies have investigated their influence on consumer behavior with respect to specific nutrients (Mauri et al., 2021), either in isolation or when combined with additional visual cues such as green labels (Macdiarmid et al., 2021). Other studies have explored how complementary strategies—such as shelf placement and product allocation in retail environments—can enhance the effectiveness of Traffic Light labels in promoting healthier purchasing decisions (Grandi et al., 2021; Harastani et al., 2020).

In Chile, the research landscape on Front-of-Pack Labeling (FOPL) has reached a mature stage, with a predominant focus on the country's implementation of warning labels. Much of the literature adopts a distinctly economic perspective, analyzing the effects of FOPLs on outcomes such as prices, real wages, and employment (Paraje et al., 2021; Alé-Chilet et al., 2022; Pachali et al., 2023). Complementing this, a second stream of research adopts a broader policy-oriented lens (Araya et al., 2022). These studies examine the influence of various stakeholders—particularly food industry actors—in shaping or resisting FOPL policy development and implementation (Mialon et al., 2020), as well as the health impacts of FOPLs on vulnerable populations, including children and adolescents (Fretes et al., 2025).

In the Netherlands, research has underscored the positive role of Front-of-Pack Labels (FOPLs) in encouraging healthier eating behaviors. Notable labeling schemes studied include the national Dutch Choices logo (van der Bend et al., 2020) and the Traffic Light system. Additionally, recent work (Maesen et al., 2022) demonstrates a measurable impact of FOPL implementation on product sales.

In contrast, the body of FOPL research specific to Germany remains limited. One key study examined the influence of the Nutri-Score label on individuals' dietary planning (Hau and Lange, 2024), while most other research involving Germany appears within broader cross-country comparisons.

In Spain, the literature has primarily focused on the role of FOPLs in preventing health-related conditions, with Nutri-Score being the most frequently analyzed scheme. Studies have explored its relevance in the context of gluten-free product consumption (De las Heras-Delgado et al., 2021), the association between low nutritional scores and mortality risk (Gómez-Donoso et al., 2021), and its implications for renal function (Montero-Salazar et al., 2022). One particularly noteworthy contribution investigates how FOPLs moderate the relationship between brand attitude and purchase intention (Medina-Molina et al., 2021).

In Mexico, FOPL research carries strong policy relevance. Several studies explore divergent stakeholder perspectives on FOPL adoption (Durán et al., 2022), while others assess the effectiveness of labeling in reducing the consumption of ultra-processed foods (Cruz-Casarrubias et al., 2021) or position FOPLs as part of a broader set of tools to address obesity and noncommunicable diseases (Rivera et al., 2024).

In Australia, nearly all studies focus on the Health Star Rating (HSR), the country's voluntary FOPL system. Research approaches the HSR from both nutritional and applied perspectives. Nutritionally, studies investigate how components such as whole grains are factored into the HSR algorithm (Byron et al., 2024). From an applied standpoint, scholars have examined its integration into digital retail environments like online supermarkets (Maganja et al., 2023), as well as its broader implications for public health policy (Sainsbury et al., 2020).

In Uruguay, research centers on maximizing the effectiveness of warning labels. This includes examining the role of supportive communication campaigns (Ares et al., 2021) and the strategic placement of labels on specific product categories, such as white bread

(Antúnez et al., 2020) and sugar-reduced desserts marketed to children (Velázquez et al., 2023).

In Italy, studies predominantly benchmark the effectiveness of various FOPL schemes in terms of consumer comprehension, preference, and influence on dietary behavior (Hasni et al., 2024). Additional research explores how FOPLs interact with contextual factors, such as environmental cues (Mazzù et al., 2025) or product-specific considerations, as in the case of olive oil (Mazzù et al., 2024).

A significant portion of the literature has adopted a cross-country perspective. For instance, some studies evaluate technical developments such as the updated Nutri-Score algorithm (Merz et al., 2024), or the integration of environmental indicators using Traffic Light color schemes (Neumayr and Moosauer, 2021). Others compare the effectiveness of various labels based on consumers' objective understanding and interpretation (Egnell et al., 2020). Another cluster of cross-national research focuses on policy-related dimensions, aiming to assess the effectiveness of nutritional labeling implementation in specific regions (Barlow et al., 2021; Pettigrew et al., 2023). Within the Americas, several reviews have examined the impact of labeling policies across different national contexts (Crosbie et al., 2023), and have proposed conceptual frameworks to better understand the relationship between food environments and consumer food choices (Constantinides et al., 2021).

4. Discussion and conclusions

This study represents an initial attempt to examine the recent evolution of scientific research on Front-of-Pack Labeling (FOPL) and to compare it with the current state of policymaking across countries. The objective is to encourage critical reflection on whether research efforts are effectively aligned with the specific needs of different country clusters and the various stages of the policy lifecycle.

The research makes several key contributions. First, it offers preliminary insights into the alignment between scientific output and policymaking stages, highlighting how certain phases of policy development tend to attract greater attention from high-quality research, particularly in regions where the urgency of FOPL implementation is highest. Second, it underscores the disparities in research focus relative to consumer health priorities and policy maturity. While a significant portion of academic work concentrates on evaluating existing FOPL models or proposing context-specific innovations, these efforts are not always synchronized with countries' most pressing policy needs. Findings reveal an uneven distribution of research intensity and quality, as well as thematic fragmentation. This often stems from differences in national regulatory approaches and institutional research priorities. Comparative studies—spanning various phases of the policy lifecycle—constitute a major share of the literature and typically assess the effectiveness of FOPL schemes in influencing consumer behavior, public health outcomes, and industry practices. However, a persistent misalignment exists between the timing of research outputs, the public health conditions in specific countries, and the evolving demands of policy. While policymakers require timely, actionable insights to inform decisions, academic research may operate on different timelines and pursue broader theoretical goals, thereby limiting its immediate policy relevance. These observations point to the need for improved coordination between academic researchers and institutional stakeholders. Strengthening this collaboration could help ensure that scientific findings more effectively inform regulatory decisions and contribute to enhancing population health in context-specific ways.

The study is not without limitations. It focuses primarily on publicly available data on obesity-related health metrics and includes only peer-reviewed articles published in top-tier journals, as ranked by Scimago. Future research could broaden the scope to include additional data

sources, a wider range of publication types, and a longer time span, potentially revealing shifts in research priorities or the emergence of long-term trends. Furthermore, it would be valuable to investigate the extent to which institutional funding frameworks shape research agendas and geographic focus.

In summary, global institutions should place greater emphasis on encouraging—and, where appropriate, subsidizing—research in countries with the greatest need for intervention, particularly those with high rates of obesity and noncommunicable diseases. A more cross-disciplinary and targeted research approach would support the effective integration of FOPL into national legislation, ultimately contributing to improved health outcomes at the global level.

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