Public support for food policies in Mexican adults: Findings from the International Food Policy Study, 2017–2021

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ABSTRACT

Deaths attributable to unhealthful eating underscore the need to improve dietary patterns through upstream, policy-led solutions. The approval and successful implementation of food policies is partly determined by their public acceptance. Little is known about public support for food policies in Mexico. We aimed to investigate the level of public support for 30 food policies, grouped into 5 domains, and their associated characteristics among Mexican adults. Data are from the 2017–2021 International Food Policy Study (IFPS), a cross-sectional web-based survey of adults. Differences in public support across years were estimated using linear regression models. The association between demographic characteristics and policy support was analyzed using multivariate logistic regression models. The highest mean support was for the subsidies and benefits domain, followed by the labelling and reformulation domain. The level of support varied across years and policy domains. Support was higher in 2019 compared to 2017 and 2018, and subsequently lower in 2020 and 2021 compared to previous years. Older age was associated with greater support across all domains (OR ranged from 0.002 to 0.004, $p < 0.01$). Female participants and those selfidentifying as indigenous showed greater support for certain policy domains, whereas higher income adequacy was associated with lower support for other policy domains.

In Mexico, support for food policies varies across subpopulations. Our findings may serve as a guide to the development and promotion of food policies in Mexico, as well as to improve their feasibility and success.

1. Introduction

In 2017, 11 million deaths globally were attributable to dietary factors, (Afshin et al., 2019). In Mexico, non-communicable diseases (NCDs) are responsible for 80% of deaths (Organización Panamericana de la Salud, 2019; Institute for Health andm Metrics Evaluation (IHME), 2019) with unhealthy diets being among the major lifestyle risk factors (Ng et al., 2020; World Health Organization, 2010) contributing to 11.3% of total deaths (Institute for Health and Metrics Evaluation (IHME), 2019), underscoring the need to improve dietary patterns. The direct and indirect costs of NCDs impact the healthcare system. For instance, 8.9% of the Mexican government's health expenditures are attributed to overweight and its associated diseases (OECD, 2019). Out-of-pocket health expenditure also increases with overweight and can threaten particularly less wealthy households (Jakovljevic et al., 2020; Jakovljevic et al., 2019).

The World Health Organization (WHO) recommends a number of policy solutions to improve food environments and promote healthy diets (World Health Organization, 2020). However, the approval and successful implementation of food policies is partly determined by their public acceptance (Juerkenbeck and Spiller, 2020; Barquera et al., 2013). Greater public support for food policies is often associated with

more will from decision makers to approve and implement them (Kongats et al., 2019). Understanding the public support for food policies among a population, as well as its associated factors, may help guide government investments in the promotion and development of food policies (Diepeveen et al., 2013). To date, most of the evidence regarding public support for food policies stems from high income countries, including North America, Australia, New Zealand, and some regions in Europe (Kongats et al., 2019; Diepeveen et al., 2013; Robles and Kuo, 2017; Fleming-Milici et al., 2018; Petrescu et al., 2016; Hagmann et al., 2018; Watson et al., 2017; Kwon et al., 2019). However, recently Latin America has adopted a leading role in the implementation of food policies, such as the soda tax and front-of-pack labeling. Identifying the most supported food policies in countries like Mexico will provide policy makers from countries which share similar economic, political and environmental determinants with a variety of solutions to improve healthier diets and may provide valuable insights on how aligning interventions with the population's opinions could be useful to improve the effectiveness of food policies (Diepeveen et al., 2013).

In the last several years, Mexico has implemented public actions to improve the food environment, population eating and food purchase behavior (Barquera et al., 2013; Rivera et al., 2008; de Salud et al., 2010; Secretaría de Economía, n.d.). During this period, civil society organizations played an important role in the promotion, approval and implementation of such policies through a series of social mobilizations and lobbying (Barquera et al., 2013; Secretaría de Economía, 2019; González, 2017; Carriedo et al., 2018). Some of the most relevant mobilization activities in Mexico in recent years include social campaigns informing the public about the harmful effects of sugar-sweetened beverages and ultra-processed foods, and discouraging their consumption (Alianza por la Salud Alimentaria, n.d.; Alianza por la Salud Alimentaria, 2020; El Poder del Consumidor et al., 2018), lobbying for the implementation of a clear and understandable nutrition front-of-package label (El Poder del Consumidor, 2019; El Poder del Consumidor, 2020), mobilizations to regulate the participation of minors in non-healthy foods advertisements (Alianza por la Salud Alimentaria, 2018a), and initiatives aimed at connecting local producers with consumers (Alianza por la Salud Alimentaria, 2018b).

Available research from high-income countries indicates that public support for food policies is related to personal and cultural characteristics, and that it may change over time (Diepeveen et al., 2013). For instance, studies have found that greater public support is associated with increased health knowledge (Diepeveen et al., 2013; Watson et al., 2017), female gender (Diepeveen et al., 2013; Kwon et al., 2019), and higher socioeconomic level (Diepeveen et al., 2013; Robles and Kuo, 2017); however, these associations often differ by policy domain (Diepeveen et al., 2013; Fleming-Milici et al., 2018; Petrescu et al., 2016; Hagmann et al., 2018). For example, policies involving education programs or labeling policies generally have higher levels of support, whereas those restricting the availability of specific foods or imposing financial disincentives have much lower support (Diepeveen et al., 2013).

Despite the recent implementation of food policies aiming to improve the food environment and dietary patterns in Mexico, as well as the active involvement of the civil society in this process (Barquera et al., 2013; Secretaría de Economía, 2019; González, 2017; Carriedo et al., 2018; El Poder del Consumidor, 2020; Barquera and White, 2018), public support for food policies in Mexico has not been widely investigated. To the authors' knowledge, only one study has examined policy support in Mexico (Kwon et al., 2019), and no previous studies have explored how policy support may change over time. Therefore, the present study aimed to investigate the level of public support for a range of food policies, and characteristics associated with support among Mexican adults and how this may have shifted over recent years.

2. Methods

2.1. Study design

Data involved a subset of measures from the Mexico arm of the 2017, 2018, 2019, 2020 and 2021 waves of the International Food Policy Study (IFPS), an annual repeat cross-sectional survey of adults from 5 countries (Hammond et al., 2019; Hammond et al., 2021a; Hammond et al., 2021b; Hammond et al., 2022a; Hammond et al., 2022b). Data were collected via self-completed web-based surveys conducted in November–December each year. The study was reviewed by and received ethics clearance through a University of Waterloo Research Ethics Board (REB# 30829) as well as the Research, Ethics in Research and Biosafety Commissions of the National Institute of Public Health of Mexico (INSP).

Overall, 31,614 participants were surveyed in Mexico between 2017 and 2021. In total, 30.2% of respondents were excluded from the analytic sample for the following reasons: unstated region (i.eg., quit the survey before completing the region, or selected don't know or refuse to answer); invalid response to a data quality check question (i.eg., "What is the current month?"), below a minimum survey completion time and/or invalid response to at least three of 21 open-ended responses from the broader IFPS survey. Further details regarding exclusion are available in the survey's technical reports (Hammond et al., 2019; Hammond et al., 2021a; Hammond et al., 2021b; Hammond et al., 2022a; Hammond et al., 2022b). Additionally, participants who answered "don't know" or "refuse to answer" (2.2%) in any of the measures of interest were also excluded from analyses. For participants with repeated measures across years 2018 and 2019, only data corresponding to their first year of participation was retained to ensure that observations were independent of each other (0.6%). There were no repeated measures in 2020 and 2021, therefore no additional participants were excluded from that period. Overall, a sample of 21,871 participants was analyzed (Fig. 1).

2.2. Participants

Participants were primarily recruited through Nielsen's Consumer Insights Global Panel and its partner panels, with an oversample of respondents with lower educational attainment recruited through Qualtrics and their partner panels in 2021. The oversample was recruited to obtain a sample that more closely resembled the education distribution in the general population as recruitment in previous waves through Nielsen alone yielded a sample with higher educational attainment than observed in the general population. Email invitations with unique survey access links were sent to a random sample of panelists, stratified by age and sex proportional to the general population in the country. Individuals aged 18 to 64 were eligible to participate in 2017; individuals aged 18 to 100 years were eligible between 2018 and 2021; panelists known to be ineligible were not invited. Participants provided consent prior to completing the survey and received remuneration in accordance with their panel's usual incentive structure (e.g., points-based, or monetary rewards and/or chances to win prizes).

2.3. Public support for food policies

Support was evaluated for a range of food policies (21 in 2017; 20 in 2018; 16 in 2019 and 2020; and 13 in 2021) within five thematic domains, including food labelling and reformulation; taxes; food sales regulation; unhealthy food and beverage marketing; and subsidies and benefits (see Supplementary Table 1 for specific policies). Respondents were asked: "Would you support or oppose to a government policy that would require…" followed by a series of public policies, displayed in random order. Response options were: "Support", "Neutral" and "Oppose". The policies evaluated each year varied according to their temporal relevance, meaning that some policies were in place or under discussion in some years and not others. This resulted in some policies
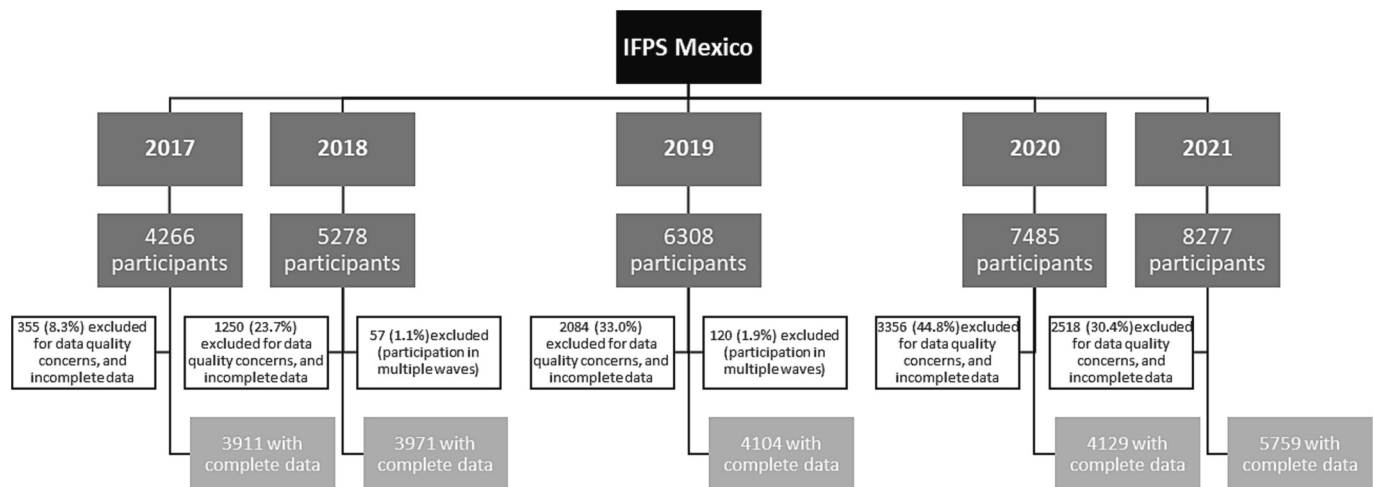
Fig. 1. Sampling of Mexican participants in the International Food Policy Study, 2017–2021.
Respondents were excluded for the following dada quality concerns (quit before providing region, below minimum survey completion time, failed the data quality question, and/or invalid response to at least three of 21 open-ended responses; those who responded "Don't know" or "refuse to answer" or were otherwise missing data on the measures of interest were also excluded.

being assessed across multiple waves, while others were only assessed in select waves. Due to survey time constraints, in 2018–2021, each respondent was only asked about a subset of 8 randomly assigned policies. Randomization of food policies was not blocked to evaluate at least one policy per domain; 65.0% of participants were asked about at least one policy within each of the five thematic domains, and 92.1% were asked about at least one policy within two or more thematic domains.

To estimate the level of public support for each thematic domain, a numeric value was assigned to each response option (−1 Oppose, 0 Neutral, 1 Support). The average public support for policies within each thematic domain was calculated for each wave, considering only the policies asked that year. Additionally, a dichotomous variable of public support was estimated for each specific policy. Participant's responses were classified as supporting (i.e., responding "Support") or not supporting (i.e., responding "Neutral" or "Opposed") each one of the specific policies queried.

2.4. Covariates

Sociodemographic characteristics included age (in years), sex at birth (female or male), ethnicity (indigenous, non-indigenous), self-reported nutrition knowledge, educational level, country region derived from the reported state of residence (North, Center, Mexico City or South), and perceived income adequacy (i.e., it was difficult to make ends meet). Annual questionnaires and sample selection methods are described elsewhere (Hammond et al., 2019; Hammond et al., 2021a; Hammond et al., 2021b; Hammond et al., 2022a; Hammond et al., 2022b).

2.5. Statistical analysis

Analyses were weighted with post-stratification sample weights constructed using a raking algorithm with population estimates from the census based on age group, sex, region, and ethnicity. Descriptive statistics examined differences between demographic characteristics across years. The weighted percentage of participants who supported each individual policy and the weighted mean support for each thematic domain were estimated in the total sample and across survey years. Differences in the mean support between thematic domains were tested using independent *t*-tests.

Linear regression models investigated differences in the mean support for thematic food policy domains over the years, with public

support as the dependent variable and study year and thematic domain as independent variables. Models accounted for the clustering effect within individuals. To investigate if differences between study years differed across thematic domains, interaction effects were introduced to regression models (i.e., domain x study year). All models controlled for covariates.

Multivariate linear regression models investigated associations between the mean public support for each thematic domain (scale from −1 to 1) and covariates. Significance was set at $p < 0.01$ for regression models and test comparisons. Analyses were conducted using Stata 16.

3. Results

The sample characteristics by year are described in Table 1. Across the entire sample, <15% reported being knowledgeable in nutrition, and over 40% indicated low perceived income adequacy. There were differences in the mean age, indigeneity, perceived income adequacy, education, and nutrition knowledge across years ($p < 0.01$). Larger differences in education level were found in 2021 compared to previous years due to efforts to recruit a lower education sample to better reflect national distribution of the population.

3.1. Overall public support for individual food policies and policies within thematic domains

The mean support for individual food policies ranged from above 80% of participants supporting school policies (e.g., free breakfast or lunch programs or nutrition standards) and subsidies (e.g., to reduce the price of fresh fruits and vegetables or free drinking water in public spaces), to around 50% supporting zoning restrictions (e.g., number of convenience stores or fast food restaurants near schools) and policies related to unhealthy food and beverage marketing (e.g., banning the use of toys as part of fast-food restaurant meals). For these latter policies, opposition was relatively low, and most participants reported being neutral about the food policies within this domain (Supplementary Table 1).

When investigating the overall support by thematic domain (Table 2), the highest mean support was observed for policies within the subsidies and benefits and labelling and reformulation domains, while the lowest mean support was observed for policies within the taxes and unhealthy food and beverage marketing domains. Differences in the mean overall support for policy domains were observed between most

Table 1

Unweighted and weighted sociodemographic characteristics of Mexican adults in the International Food Policy Study sample by year.

	Unweighted							Weighted						
	Overall	2017	2018	2019	2020	2021	p	Overall	2017	2018	2019	2020	2021	p
n (%)	21,871 (100)	3911 (17.9)	3971 (18.2)	4104 (18.8)	4129 (18.9)	5756 (26.3)		21,871 (100)	3924 (17.9)	3981 (18.2)	4101 (18.8)	4137 (18.9)	5728 (26.2)	
Mean age ± SD	37.08 ± 12.8	33.87 ± 11.4	36.13 ± 12.4	37.27 ± 12.3	38.33 ± 13.0	38.88 ± 13.5	**0.000**	39.61 ± 14.2	37.25 ± 12.5	39.32 ± 13.9	39.26 ± 13.9	40.74 ± 14.4	40.84 ± 15.2	**0.000**
Sex *n* (%)														
Male	11,118 (50.8)	1954 (50.0)	2102 (52.9)	2081 (50.7)	2094 (50.7)	2887 (50.2)	0.054	10,486 (47.9)	1885 (48.0)	1902 (47.8)	1936 (47.3)	1988 (48.1)	2773 (48.4)	0.931
Female	10,753 (45.2)	1957 (50.0)	1869 (47.1)	2023 (49.3)	2035 (49.3)	2869 (48.8)		11,385 (52.1)	2039 (52.0)	2079 (52.2)	2162 (52.7)	2149 (51.9)	2956 (51.6)	
Ethnicity														
Non-indigenous	18,116 (82.8)	3410 (87.2)	3347 (84.3)	3403 (82.9)	3434 (83.2)	4522 (78.6)	**0.000**	17,728 (81.1)	3417 (87.1)	3131 (78.6)	3221 (78.5)	3371 (80.8)	4619 (80.6)	**0.000**
Indigenous	3755 (17.2)	501 (12.8)	624 (15.7)	701 (17.1)	695 (16.8)	1234 (21.4)		4141 (18.9)	507 (12.9)	850 (21.4)	881 (21.5)	795 (19.2)	1110 (19.4)	
Income adequacy *n* (%)[a]														
Difficult	9286 (42.5)	1550 (39.6)	1633 (41.1)	1690 (41.2)	2007 (48.6)	2406 (41.8)	**0.000**	9972 (45.6)	1636 (41.7)	1758 (44.2)	1743 (42.5)	2108 (51)	2727 (47.6)	**0.000**
Neither easy nor difficult	8631 (39.5)	1540 (39.4)	1571 (39.6)	1632 (39.8)	1518 (36.8)	2370 (41.2)		8485 (38.8)	1503 (38.3)	1537 (38.6)	1635 (39.9)	1464 (35.4)	2346 (41.0)	
Easy	3954 (18.1)	821 (21.0)	767 (19.3)	782 (19.0)	604 (14.6)	980 (17.0)		3414 (15.6)	785 (20.0)	686 (17.2)	723 (17.6)	565 (13.7)	655 (11.4)	
Education *n* (%)														
Low	5642 (25.8)	710 (18.2)	760 (19.1)	882 (21.5)	910 (22.0)	2380 (41.4)	**0.000**	7580 (34.7)	665 (16.9)	779 (19.6)	924 (22.5)	935 (22.6)	4277 (74.7)	**0.000**
Medium	2681 (12.3)	483 (12.3)	455 (11.5)	507 (12.4)	556 (13.5)	680 (11.8)		2714 (12.4)	494 (12.6)	524 (13.2)	533 (13.0)	565 (13.7)	598 (10.4)	
High	13,548 (61.9)	2718 (69.5)	2756 (69.4)	2715 (66.1)	2663 (54.5)	2696 (46.8)		11,577 (52.9)	2765 (70.5)	2678 (67.3)	2644 (64.5)	2636 (63.7)	853 (14.9)	
Region *n* (%)														
North	4825 (22.1)	916 (23.4)	928 (23.4)	870 (21.2)	912 (22.1)	1199 (20.8)	**0.000**	5221 (23.9)	927 (23.6)	941 (23.6)	966 (23.6)	997 (24.1)	1389 (24.3)	1.000
South	4565 (20.9)	798 (20.4)	831 (20.9)	873 (21.3)	840 (20.3)	1223 (21.3)		6335 (29.0)	1139 (29.0)	1164 (29.2)	1198 (29.2)	1181 (28.6)	1653 (28.9)	
Center	7534 (34.4)	1271 (32.5)	1347 (33.9)	1417 (34.5)	1394 (33.8)	2105 (36.6)		8512 (38.9)	1536 (39.1)	1552 (39.0)	1594 (38.9)	1619 (39.1)	2211 (38.6)	
Mexico City	4947 (22.6)	926 (23.7)	865 (21.8)	944 (23.0)	983 (23.8)	1229 (21.3)		1803 (8.2)	323 (8.2)	324 (8.1)	342 (8.4)	339 (8.2)	475 (8.3)	
Nutrition knowledge *n* (%)														
Not knowledgeable	7417 (33.9)	1239 (31.7)	1315 (33.1)	1261 (30.7)	1377 (33.4)	2227 (38.7)	**0.000**	7682 (35.1)	1204 (30.7)	1328 (33.4)	1239 (30.2)	1342 (32.4)	2570 (44.9)	**0.000**
Somewhat knowledgeable	11,460 (52.4)	2122 (54.3)	2103 (53.0)	2229 (54.3)	2227 (53.9)	2779 (48.3)		11,374 (52.0)	2134 (54.4)	2103 (52.8)	2256 (55.0)	2261 (54.7)	2620 (45.7)	
Knowledgeable	2992 (13.7)	550 (14.1)	553 (13.9)	614 (15.0)	525 (12.7)	750 (13.0)		2815 (12.9)	586 (14.9)	550 (13.8)	606 (14.8)	534 (12.9)	539 (9.4)	

SD = Standard deviation, *n* = weighted sample size.

Bold *p* value means statistically significant differences per year (*p* < 0.01).

[a]Income adequacy: how difficult or easy is it for you to make ends meet?

Ethnicity assessed by "According to your culture, are you considered indigenous?" (Yes, no).

Nutrition knowledge assessed as "How would you rate your nutrition knowledge?" followed by 5 response options 1) Not knowledgeable (not at all knowledgeable, a little knowledgeable), 2) Somewhat knowledgeable, and 3) Knowledgeable (very knowledgeable, extremely knowledgeable).

Educational level based on the last grade that participants completed in school: 1) low (none, preschool, primary, secondary, high school, or baccalaureate, normal basic) 2) medium (technical or commercial studies with completed primary, technical, or commercial studies with completed secondary, technical or commercial studies with completed high school) and 3) high (bachelor's degree, bachelor/professional, master's degree or doctorate).

Perceived income adequacy assessed as "Thinking about your total monthly income, how difficult or easy is it for you to make ends meet?"; responses were collapsed into 3 groups: 1) Difficult (very difficult, difficult), 2) Neither easy nor difficult, or 3) Easy (easy, very easy).

Table 2
Weighted mean support* for food policy domains and differences by year in Mexican adults of the International Food Policy Study, 2017–2021.

Thematic domain	Overall Mean ± SD	Overall Std. Err	Overall 99% CI	2017 Mean ± SD	2017 Std. Err	2017 99% CI	2018 Mean ± SD	2018 Std. Err	2018 99% CI	2019 Mean ± SD	2019 Std. Err	2019 99% CI	2020 Mean ± SD	2020 Std. Err	2020 99% CI	2021 Mean ± SD	2021 Std. Err	2021 99% CI
Labelling and reformulation	0.71 ± 0.46 [c]	0.46	0.70,0.73	0.69 ± 0.40	0.01	0.67,0.71	0.71 ± 0.42	0.01	0.69,0.73	0.79 ± 0.40 [ab]	0.01	0.77,0.81	0.70 ± 0.47 [c]	0.01	0.68,0.73	0.66 ± 0.65 [bc]	0.01	0.62,0.70
Taxes	0.46 ± 0.63+	0.63	0.45,0.48	0.43 ± 0.59+	0.01	0.40,0.46	0.46 ± 0.64+	0.01	0.43,0.50	0.53 ± 0.60+ab	0.01	0.50,0.56	0.45 ± 0.63+ c	0.01	0.42,0.49	0.43 ± 0.71+ c	0.01	0.40,0.47
Food sales regulation	0.52 ± 0.55	0.55	0.51,0.54	0.53 ± 0.42	0.01	0.51,0.55	0.52 ± 0.55	0.01	0.49,0.55	0.60 ± 0.52 [ab]	0.01	0.58,0.63	0.53 ± 0.55 [c]	0.01	0.50,0.56	0.38 ± 0.79 [abcd]	0.02	0.34,0.43
Unhealthy food and beverage marketing	0.45 ± 0.57+	0.57	0.44,0.47	0.41 ± 0.48+	0.01	0.38,0.43	0.45 ± 0.57+	0.01	0.42,0.48	0.53 ± 0.54+ab	0.01	0.50,0.56	0.45 ± 0.59+ c	0.01	0.42,0.48	0.44 ± 0.71+ c	0.01	0.40,0.48
Subsidies and benefits	0.82 ± 0.41	0.41	0.81,0.83	0.76 ± 0.43	0.01	0.74,0.78	0.82 ± 0.39 [a]	0.01	0.80,0.85	0.86 ± 0.35 [ab]	0.01	0.85,0.88	0.82 ± 0.40 [ac]	0.01	0.80,0.84	0.82 ± 0.52 [ac]	0.01	0.79,0.84

St. Err.: Standard Error, CI: Confidence Interval.

*Support to each domain represents the mean social support to policies within each thematic domain, from −1 (lowest support) to 1 (highest support).

Matching superscript symbols indicate no statistical differences between thematic domains within the same column.

[a] indicates different compared to 2017, [b] indicates different compared to 2018, [c] indicates different compared to 2019, [d] indicates different compared to 2020, according to linear regression models adjusted for the study year and thematic domains as independent variables, and the interaction term between these two variables. Models accounted for the clustering effect within individuals.

Values closer to 1 indicate greater public support and values closer to −1 indicate less public support. Thus, values closer to 0 indicate the participant neither supports nor opposes the policies.

domains ($p < 0.01$), except between the taxes and unhealthy food and beverage marketing domains (Table 2).

3.2. Public support for food policies across survey years

For all survey years (Table 2), the mean support was consistently higher for policies related to providing subsidies and benefits, followed by policies related to food labelling and food reformulation. Policies related to taxes and the marketing of unhealthy foods and beverages obtained the lowest level of public support between 2017 and 2020, however, in 2021, food sales regulation (i.e., setting nutrition standards for school cafeterias, zoning to restrict unhealthy restaurants and convenience stores near schools) had the least support.

Adjusted differences in the changes of support for each thematic domain by year are shown in Supplementary Table 2. Patterns of change in support across thematic domains were somewhat consistent across survey years, with higher support in 2019 compared to 2017 and 2018, and subsequent lower support in 2020 and 2021 compared to previous years (Fig. 2). However, support for policies within the food sales regulation domain showed relatively larger decreases between 2017 and 2018 and between 2020 and 2021 compared to the rest of the policy domains (p values <0.01) (Supplementary Table 2). Similarly, compared to policies within the labelling and reformulation domain, policies within the domain of subsidies and benefits showed relatively larger increases between 2017 and 2018 and between 2019 and 2020, but smaller increases between 2018 and 2019.

3.3. Factors associated with public support for food policies

Several sociodemographic characteristics were associated with support for food policies (Table 3). Older age was consistently associated with higher support for food policies within all five thematic domains. Compared to the "Not knowledgeable" category, having greater self-reported nutrition knowledge was associated with greater support for food policies in most domains, except for subsidies and benefits. Being a female was associated with greater support for policies within labelling and reformulation and subsidies and benefits domains. Compared to non-indigenous participants, self-identifying as an indigenous person was associated with greater support for policies within the taxes, food sales regulation and food and beverage marketing domains. Similarly, compared to those who found it difficult to make ends meet, those who found it neither easy or difficult to make ends meet had lower support for food policies related to food sales regulation; while those who found it easy to make ends meet had lower support for subsidies and benefits.

Education and region were also associated with policy support in certain domains. Compared to having a low level of education, having a high level of education was associated with higher support for policies related to food labelling and reformulation (β = 0.036, 95% CI 0.01, 0.06). Living in the South region of Mexico was associated with greater support for taxes and food sales regulation policies, compared to living in the Centre region; meanwhile compared to Mexico City, living in the South was associated with higher support within the food labelling and reformulation domain.

4. Discussion

The results of this study show that policies related to subsidies and benefits as well as food labelling and reformulation had the greatest support in Mexico over the study period, while the least support was observed for policies addressing unhealthy food and beverage marketing and taxes. Support for food policies appeared to increase from 2017 to 2019, followed by subsequent decreases in the following years, within most thematic domains. Several demographic characteristics were associated with support for food policy domains.

Our results are consistent with studies in North America, Oceania, and some regions of Europe suggesting that food labelling policies (e.g.,
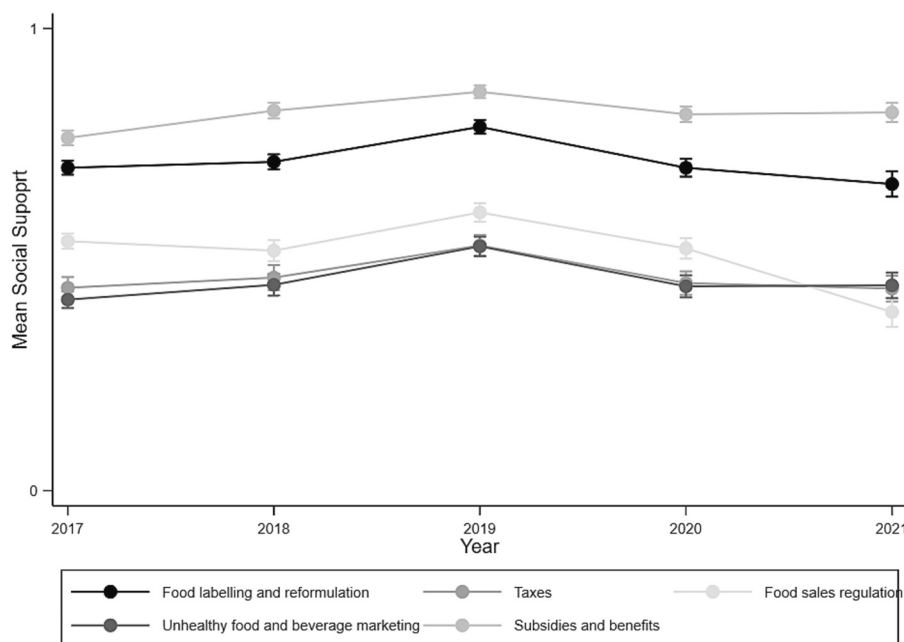
Fig. 2. Changes in Mexican adults' public support for food policies by thematic domain between 2017 and 2021.
Estimates were derived from a linear regression model with public support as the dependent variable and the interaction effect 'policy domain X study year', adjusted for age, sex, ethnicity, perceived income adequacy, education, region, and self-reported nutrition knowledge, the clustering effect within individuals and post-stratification sample weights.

front-of-pack labeling or menu labeling) or subsidies to reduce the price of fruits and vegetables generally have a greater level of public support (Juerkenbeck and Spiller, 2020; Diepeveen et al., 2013; Kwon et al., 2019; Reisch et al., 2017). This is also in line with studies showing higher public support for less intrusive policies (i.e., policies that do not interfere directly with individual, population or business choices) (Nuffield Council on Bioethics, 2007), such as food labelling or subsidies (Kongats et al., 2019; Diepeveen et al., 2013). In Mexico, the use of mandatory front-of-pack labeling was implemented in 2014, and subsequent lobbying and promotion efforts were made in 2018 and onwards to improve this regulation by introducing 'High in' warning labels (El Poder del Consumidor, 2019; El Poder del Consumidor, 2020). These collective efforts may have contributed to the high level of support for labeling policies in the country, which may have facilitated their approval in 2020 (Secretaría de Economía, n.d.; White and Barquera, 2020).

In our study, policies aimed at regulating the marketing of unhealthy foods and policies related to taxes were among the least supported. This differs from evidence from other countries suggesting that policies aimed at regulating the marketing of unhealthy foods are among the most supported (Juerkenbeck and Spiller, 2020; Kim et al., 2019; Sainsbury et al., 2018), Within this domain, the least support was observed for policies aimed at regulating toys, gifts, and discounts distributed by unhealthy food companies and restaurants, or restricting sponsorship of sporting events and teams by food companies. This may be related to social or cultural differences between countries. Multi-country comparisons from other IFPS research have shown that exposure to unhealthy food marketing is higher in Mexico (Nieto et al., 2022). Further, sponsorship of sporting events by the unhealthy food industry is a very common practice in Mexico (Gómez et al., 2011). It is possible that these latter policies might have been perceived as restrictive by participants, and consequently received lower support. However, our results also indicated that these policies had very little opposition, highlighting the political palatability of these options. Finally, support for policies related to taxes was also among the lowest. In line with evidence indicating that public support for taxation could be increased if revenue was used for health purposes, (Sainsbury et al., 2018) our

results showed that within this domain, the support was higher for taxes on sugary drinks if the money was spent on subsidizing healthy foods.

Our results indicate that the level of public support for all five thematic domains increased between 2017 and 2019, with subsequent decreases in 2020 and 2021. Previous research has suggested that public support for food policies may increase over time for policies already implemented, as people become more aware of their positive impact (Diepeveen et al., 2013). However, similar trends were observed across all food policy domains, regardless of whether they were previously implemented. This suggests that other overarching factors may have also played a role in the trends of public support for food policies. In 2020, the onset of the COVID-19 pandemic disrupted the lives of people, with devastating impact on the health system, the global economy, and overall political satisfaction (Bol et al., 2021). Further, the pandemic had profound effects in low- and middle-income countries, including Mexico. Research suggests that major global crises can serve as turning points or entrench the existing status quo, depending on the performance of established institutions and the public's perception of their performance (Ruiz-Rufino and Alonso, 2017; Campbell, 2012; Aidt and Leon, 2016). Indeed during 2020 and 2021, the approval of the presidential administration in Mexico declined (Márquez, 2023). The decline in public support for food policies in this period may reflect the significant disruptions and changes to people's lives, including their priorities and concerns about food and health. It is also possible that the series of mobilization activities by organized civil society (i.e., to promote the "Excess" warning labels) before 2020 influenced the level of public support for food policies. However, after warning labels were implemented in Mexico in 2020, mobilizations to promote its implementation ceased, potentially contributing to the decreasing trend seen in public support since 2020. To the authors' knowledge, no study has investigated how these sorts of mobilization activities may influence public support for food policies, however evidence suggests that grassroots organizations and civil society groups have enhanced the success of nutrition policies in Latin America (Carriedo et al., 2021).

We found that several individual factors were related to policy support. In line with our results, studies indicate that older people may have greater support because they are more aware of the health

Table 3
Characteristics associated with public support by thematic domain among Mexican adults in the International Food Policy Study, 2017–2021.

	Labelling and reformulation			Taxes			Food sales regulation			Unhealthy food and beverage marketing			Subsidies and benefits		
	β	St. Err.	99% CI	β	St. Err.	99% CI	β	St. Err.	99% CI	β	St. Err.	99% CI	β	St. Err.	99% CI
Survey wave															
2017	Ref.			Ref.			Ref.			Ref.			Ref.		
2018	0.017	0.011	−0.01,0.05	0.020	0.018	−0.03,0.07	−0.022	0.014	−0.06,0.01	0.027	0.015	−0.01,0.07	**0.063**	**0.012**	**0.03,0.09**
2019	**0.094**	**0.011**	**0.07,0.12**	**0.088**	**0.017**	**0.05,0.13**	**0.060**	**0.013**	**0.03,0.09**	**0.111**	**0.014**	**0.07,0.15**	**0.104**	**0.011**	**0.08,0.13**
2020	0.004	0.012	−0.03,0.04	0.010	0.017	−0.03,0.05	−0.017	0.014	−0.05,0.02	0.023	0.015	−0.02,0.06	**0.053**	**0.012**	**0.02,0.08**
2021	−0.022	0.015	−0.06,0.02	−0.003	0.019	−0.05,0.04	**−0.153**	**0.018**	**−0.20,-0.11**	0.022	0.017	−0.02,0.07	**0.052**	**0.013**	**0.02,0.09**
Age	**0.003**	**0.000**	**0.00,0.00**	**0.004**	**0.000**	**0.00,0.00**	**0.003**	**0.000**	**0.00,0.00**	**0.004**	**0.000**	**0.00,0.01**	**0.002**	**0.000**	**0.00,0.00**
Sex															
Male	Ref.			Ref.			Ref.			Ref.			Ref.		
Female	**0.023**	**0.008**	**0.00,0.04**	0.012	0.012	−0.02,0.04	0.013	0.010	−0.01,0.04	0.013	0.010	−0.01,0.04	**0.044**	**0.008**	**0.03,0.06**
Ethnicity															
Non-indigenous	Ref.			Ref.			Ref.			Ref.			Ref.		
Indigenous	−0.018	0.012	−0.05,0.01	**0.055**	**0.016**	**0.01,0.09**	**0.064**	**0.013**	**0.03,0.10**	**0.064**	**0.014**	**0.03,0.10**	−0.022	0.011	−0.05,0.01
Income adequacy[a]															
Difficult	Ref.			Ref.			Ref.			Ref.			Ref.		
Neither easy nor difficult	−0.021	0.009	−0.04,0.00	−0.001	0.013	−0.03,0.03	**−0.034**	**0.011**	**−0.06,0.00**	−0.027	0.012	−0.06,0.00	−0.013	0.008	−0.03,0.01
Easy	−0.016	0.012	−0.05,0.01	0.025	0.017	−0.02,0.07	0.003	0.014	−0.03,0.04	0.000	0.015	−0.04,0.04	**−0.043**	**0.011**	**−0.07,-0.01**
Education															
Low	Ref.			Ref.			Ref.			Ref.			Ref.		
Medium	−0.004	0.015	−0.04,0.04	−0.011	0.020	−0.06,0.04	−0.029	0.019	−0.08,0.02	−0.024	0.018	−0.07,0.02	−0.019	0.014	−0.05,0.02
High	**0.036**	**0.011**	**0.01,0.06**	0.001	0.014	−0.04,0.04	0.010	0.012	−0.02,0.04	−0.002	0.013	−0.03,0.03	0.003	0.010	−0.02,0.03
Region															
South	Ref.			Ref.			Ref.			Ref.			Ref.		
North	−0.025	0.012	−0.05,0.00	−0.037	0.016	−0.08,0.01	−0.020	0.014	−0.06,0.02	−0.015	0.015	−0.05,0.02	−0.019	0.011	−0.05,0.01
Centre	−0.025	0.010	−0.05,0.00	**−0.044**	**0.015**	**−0.08,-0.01**	**−0.044**	**0.013**	**−0.08,-0.01**	−0.033	0.013	−0.07,0.00	−0.010	0.010	−0.03,0.01
Mexico City	**−0.034**	**0.012**	**−0.06,0.00**	−0.024	0.017	−0.07,0.02	−0.037	0.015	−0.08,0.00	−0.011	0.015	−0.05,0.03	−0.017	0.010	−0.04,0.01
Nutrition knowledge															
Not knowledgeable	Ref.			Ref.			Ref.			Ref.			Ref.		
Somewhat knowledgeable	**0.064**	**0.010**	**0.04,0.09**	**0.059**	**0.013**	**0.02,0.09**	**0.030**	**0.011**	**0.00,0.06**	0.026	0.012	0.00,0.06	0.007	0.009	−0.01,0.03
Knowledgeable	**0.051**	**0.014**	**0.01,0.09**	**0.107**	**0.019**	**0.06,0.16**	**0.057**	**0.018**	**0.01,0.10**	**0.086**	**0.018**	**0.04,0.13**	0.001	0.012	−0.03,0.03

St. Err.: Standard Error.

Bold text indicates statistically significant association. $p < 0.01$ values were considered statistically significant.

[a]Income adequacy: how difficult or easy is it for you make ends meet?

For each thematic domain a linear regression model was fitted adjusted by year, age, sex, ethnicity, education, income adequacy, region, and nutrition knowledge.

Ethnicity assessed by "According to your culture, are you considered indigenous?" (Yes, no).

Nutrition knowledge assessed as "How would you rate your nutrition knowledge?" followed by 5 response options 1) Not knowledgeable (not at all knowledgeable, a little knowledgeable), 2) Somewhat knowledgeable, and 3) Knowledgeable (very knowledgeable, extremely knowledgeable).

Educational level based on the last grade that participants completed in school: 1) low (none, preschool, primary, secondary, high school, or baccalaureate, normal basic) 2) medium (technical or commercial studies with completed primary, technical, or commercial studies with completed secondary, technical or commercial studies with completed high school) and 3) high (bachelor's degree, bachelor/professional, master's degree or doctorate).

Perceived income adequacy assessed as "Thinking about your total monthly income, how difficult or easy is it for you to make ends meet?"; responses were collapsed into 3 groups: 1) Difficult (very difficult, difficult), 2) Neither easy nor difficult, or 3) Easy (easy, very easy).

implications that stem from unhealthy environments and therefore may have greater trust in government strategies (Diepeveen et al., 2013; Hagmann et al., 2018). In line with our results, some studies have found that having greater knowledge about health or knowing the effects of the food environment on health is associated with greater support for food policies (Petrescu et al., 2016; Watson et al., 2017). The observed association of greater public support among female respondents is consistent with previous research (Diepeveen et al., 2013; Fleming-Milici et al., 2018; Watson et al., 2017) and may be explained by a lower prevalence of unhealthy behaviors (Diepeveen et al., 2013) and greater health awareness (Hagmann et al., 2018) among female adults. Our results also suggest that self-identifying as an indigenous person is related to greater public support for some policies, as previously reported in Mexico for policies related to food and beverage marketing and sales regulation (Kwon et al., 2019). However, our findings contrast with previous reports from the US and the UK (Petrescu et al., 2016). Differences may be explained by the limited racial diversity in Mexico in comparison to these countries. Perceived income adequacy was associated with lower public support for food policies. Previous research has found mixed results in this area: while some studies have found an association between income or socio-economic level and public support for food policies (Diepeveen et al., 2013; Fleming-Milici et al., 2018), others have not (Petrescu et al., 2016; Hagmann et al., 2018). However, it should be noted that we did not objectively measure income, but perceived income adequacy, which is more likely to reflect relative wealth or social positioning compared to others in Mexico.

4.1. Strengths and limitations

The current study represents one of the first studies to assess public support for a range of food policies in Mexico over time. Nonetheless, the study has some limitations. First, recruitment used non-probability sampling; therefore, the findings do not necessarily provide nationally representative estimates. Self-reported nutrition knowledge may not necessarily reflect actual knowledge levels (Kruger and Dunning, 1999). During 2020, the onset of the COVID-19 pandemic alongside with the lockdown measures taking place in Mexico may have impacted the response dynamics of the survey, resulting in a sample self-reporting lower income adequacy level than previous years. Additionally, since the study included cross-sectional data from five years, associations between the public support for food policies and demographics are susceptible to reverse causality.

4.2. Policy implications

Overall, the results suggest widespread support for public health policies to improve food environments in Mexico and that support for these policies was relatively constant, but with some fluctuations over the past years. This study's findings provide insight into population segments where stronger efforts may be needed to increase public support for certain policies, as well as opportunities for designing and implementing food policies. Specifically, greater support for a policy suggests a certain degree of readiness by the population for the implementation of the policy (Hagmann et al., 2018). In this respect, policies related to labeling, reformulation of foods, and subsidies may be considered as more politically feasible policy options to promote healthy food environments and to contribute to reducing the prevalence of non-communicable diseases. On the other hand, food policies with the lowest support (i.e., "food and beverage marketing" and "taxes") could be targeted by strategies directed to increase public support among specific groups (i.e., those with higher income adequacy), for example, by informing and creating awareness of the effectiveness of regulations to food and beverage marketing (Juerkenbeck and Spiller, 2020; Kongats et al., 2019; Bos et al., 2015), directing policies at manufacturers or commercial businesses rather than at individuals directly (Diepeveen et al., 2013; Bos et al., 2015), or by publicly stating that tax revenues will

be used for health purposes (Sainsbury et al., 2018). It is possible that in Mexico, the series of mobilizations by civil organizations prior 2019 led to an increase in public support for food policies, however, once the policies are implemented it may be helpful to communicate their goals, and benefits, to promote public involvement.

Despite the sample included in this study comes from Mexico, our findings have potential transnational applications, especially in countries that face similar challenges related to the need for better dietary patterns. For instance, understanding the individual characteristics influencing support may offer insights to policy makers to be consider by policy makers and incentive them to tailor these policies in order to resonate with specific segments of the population. Besides, since public support may change over the years, other countries may learn from the patterns observed in Mexico and anticipate potential shifts in public support over time.

5. Conclusion

The results of this study suggest that the level of public support for food policies aimed at improving the food environment is generally high in Mexico. Although the support was relatively constant, with some degree of fluctuations over the years, variations according to thematic domain and certain social and demographic characteristics were observed. These findings could help decision-makers in Mexico and countries with similar sociodemographic characteristics identify opportunities for designing and implementing food policies and targeting promotion efforts to specific population segments.

CRediT authorship contribution statement

Kathia Larissa Quevedo: Conceptualization, Investigation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing, Visualization. **Alejandra Jáuregui:** Conceptualization, Methodology, Supervision, Writing – review & editing, Visualization, Project administration. **Claudia Nieto:** Validation, Supervision, Writing – review & editing. **Eduardo Ortiz-Panozo:** Methodology, Software, Writing – review & editing, Visualization. **Alejandra Contreras-Manzano:** Investigation, Supervision, Writing – review & editing. **Simón Barquera:** Investigation, Writing – review & editing, Project administration. **Lana Vanderlee:** Investigation, Writing – review & editing, Funding acquisition. **Christine M. White:** Investigation, Data curation, Writing – review & editing, Project administration. **David Hammond:** Investigation, Resources, Data curation, Writing – review & editing, Project administration, Funding acquisition.

Declaration of Competing Interest

David Hammond has provided paid expert testimony on behalf of public health authorities in response to legal claims from the food and beverage industry. All remaining authors declare no conflicts of interest.

Data availability

Data will be made available on request.

views of the Canadian Institutes for Health Research, the National Institutes of Health, or other sources of funding. DH has provided paid expert testimony on behalf of public health authorities in response to legal claims from the food and beverage industry. All remaining authors declare no conflicts of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ypmed.2023.107710.

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