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Sociodemographic differences in nutrition labels effect on Chilean and Mexican youth

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ABSTRACT

Objective. To examine sociodemographic differences in the awareness, understanding, use and effect of nutrition labels among Mexican and Chilean youth.

Methods. Online surveys among youth (10-17 years) were obtained in 2019 (n=2631). Participants reported their awareness, understanding, and use of their country-specific nutrition facts tables (NFT) and front-of-pack labels (FOPL) (Chile: warning labels [WLs]; Mexico: guideline daily amounts [GDA]). Additionally, participants reported their perceived healthfulness of a sweetened fruit drink after viewing one of six versions of it with different FOPL (no-label control, Health Star Rating, WLs, GDAs, Traffic Light, or Nutri-Score) during an experimental task.

Results. Higher self-reported nutrition knowledge was associated with higher NFT and FOPL awareness, understanding, and use, except for WL use. WLs were the most effective FOPL in decreasing the perceived healthfulness of the sweetened fruit drink compared to a no-label condition and other FOP labels. In Chile, the effect of GDA differed by income adequacy, while in Mexico Nutri-Score differed by age.

Conclusions. Results suggest that nutrition label awareness, use, understanding, and impact differ across demographics, favoring higher income and nutrition knowledge. Despite this, WLs are likely to have a positive impact on nutrition-related knowledge and behaviors among Mexican and Chilean youth, independently of their socio-demographic groups.

Keywords Food labeling; adolescent; child; sugar-sweetened beverages; Chile, Mexico.

Poor dietary habits and obesity among youth are pressing public health matters in many countries, including Chile and Mexico (1). Ultra-processed foods, including sugar-sweetened beverages (SSB), are determinants in the obesity epidemic (2). Mexico and Chile are among the highest consumers of SSB in Latin America (2), with these beverages representing a primary source of added sugar among youth (3,4).

Nutrition labeling provides information about the nutritional content of food products. Most countries mandate some form of nutrition facts tables (NFTs), which show the nutrient content per 100 g or serving. In order to interpret this information, consumers must understand it and subsequently use it (5). However, NFTs displayed with varying serving sizes or several columns of numeric information (i.e., nutrient content, percent daily value) make harder for consumers to compare between brands or identify if a product is relatively high in a nutrient, limiting their ability to make informed choices (5,6). An international study including Mexican and Chilean youth showed that NFTs are widely noticed, but not easily understood or used, with higher usage among Chilean youth (7). Such differences might be related to differing sociodemographic characteristics.

International organizations recommend front-of-pack labels (FOPL) providing summarized and clear nutrition information on the front of packaged foods and beverages to support

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informed and healthier food choices (8). This policy measure has spread in the Americas, including mandatory FOPL policies in Chile and in Mexico (9). FOPL overcome the limitations of NFTs since they are more noticeable and often provide information on healthiness, calories, and key nutrients of a product, such as sugars, sodium, saturated and trans fats (8), which are risk factors for mortality in the Americas (8). FOPL have been shown to influence consumers' decision to purchase less healthy food products, including sugar-sweetened beverages.(10) A variety of FOPL have been implemented worldwide (11). Some monochromatic FOPL include the industry-led Guideline Daily Amounts (GDA), which was mandatory in Mexico from 2014 to 2020, and displayed the proportion of an adult's guideline daily amount of key nutrients. Summary systems, like the Health Star Rating (HSR), provide an overall healthfulness rating from 0.5 to 5 stars. Similarly, the Nutri-Score (NS) is a five-colored letter rating from A to E to indicate the most and least healthful products. The Multiple Traffic Light (MTL) system uses traffic light colors to fill the cells in a GDA system, according to the nutrient's content level. Finally, warning labels (WLs) show warning symbols (often octagonal) on food packages if energy and key nutrients exceed established thresholds (8). In the Americas region, an increasing number of countries have either discussed, introduced or adopted WLs (9). In Chile and Mexico, mandatory WLs were implemented in 2016 and 2020, respectively (12,13).

For a food label to influence dietary choices, consumers must be aware of and understand the information. Processing label information may differ based on FOPL types, and consumer's characteristics (14). However, despite sociodemographic differences, the WL system has been shown to better aid people in identifying healthier products.(15) Additionally, familiarity with the labels (e.g., repeated exposure to labels due to implementation or public debates) may improve its effectiveness (10).

Youths' habits and preferences may shape food preferences and choices in adult life (16), as well as household purchases (10). FOPL represents the primary source of nutrition information for youth whether at retail outlets or at home. Country-comparisons among youth indicate that in 2019 and 2020 noticing, self-reported understanding and use of FOPL was higher for the WL in Chile compared to the GDA in Mexico, and also compared to different FOPL in other countries (7). However, few studies have assessed the effectiveness of FOPL among youth, while considering differences across key sociodemographic characteristics or previous exposure to labels (17). This study aims 1) to investigate the association between key sociodemographic characteristics and the awareness, use, and understanding of NFT and FOPL among youth in Chile and Mexico; and 2) to evaluate the effect of various FOPL on the perceived healthfulness of a sugar-sweetened beverage and to explore potential differences in their effect by sociodemographic characteristics using a randomized experiment. We hypothesized that the effect of the GDA would be larger among Mexican youth and that the effect of WLs would be larger among Chilean youth, compared to the other FOP labels.

METHODS

Study design and recruitment

Data were obtained from the Chilean and Mexican arms of the 2019 International Food Policy Study (IFPS) Youth Survey, an annual repeat cross-sectional survey conducted in six countries (18). Data were collected via self-completed web-based surveys conducted in November-December 2019 with youth aged 10 to 17 years, three years after the implementation of WLs in Chile and five years after the implementation of GDA in Mexico, but a year before the implementation of the Mexican WL (12,13).

Respondents were recruited through parents/guardians enrolled in the Nielsen Consumer Insights Global Panel and their partners' panels. Those who confirmed they had a child aged 10 to 17 living in their household were asked for permission for one of their children to complete the survey. In addition to the parental permission, all potential respondents provided assent. Surveys were conducted in Spanish.

The child's parent/guardian received remuneration in accordance with their panel's usual incentive structure (e.g., points-based, or monetary rewards, chances to win prizes). Questionnaire items were drawn or adapted from national surveys in Mexico and Chile or selected based on previous research.

A total of 2914 youth from both countries completed the survey, of which 2631 (Chile n=1139; Mexico n=1492) had complete data complying with quality standards. The study was reviewed by and received ethics clearance through the University of Waterloo Research Ethics Committee (ORE# 41477) and the National Institute of Public Health in Mexico.

Awareness, use, and understanding of nutrition labels

Respondents viewed an image (Figure 1) of either a NFT or a FOPL from their respective country (GDA for Mexico and WLs for Chile) while responding to questions. Awareness was assessed by asking "Have you seen this type of food label on packages or in stores?" with responses categorized as 'Not aware' (Never, Rarely, Sometimes) or 'Aware' (Often, All the time).

Use was assessed by asking "Do you use this type of food label when deciding what to eat?" with responses categorized as 'Not used' (Never, Rarely, Sometimes), or 'Often used' (Often, All the time).

Self-reported understanding was assessed by asking "Do you find this information…" with response options categorized as 'Hard to understand' (Very hard to understand, hard to understand, in the middle), or 'Easy to understand' (Easy to understand, very easy to understand).

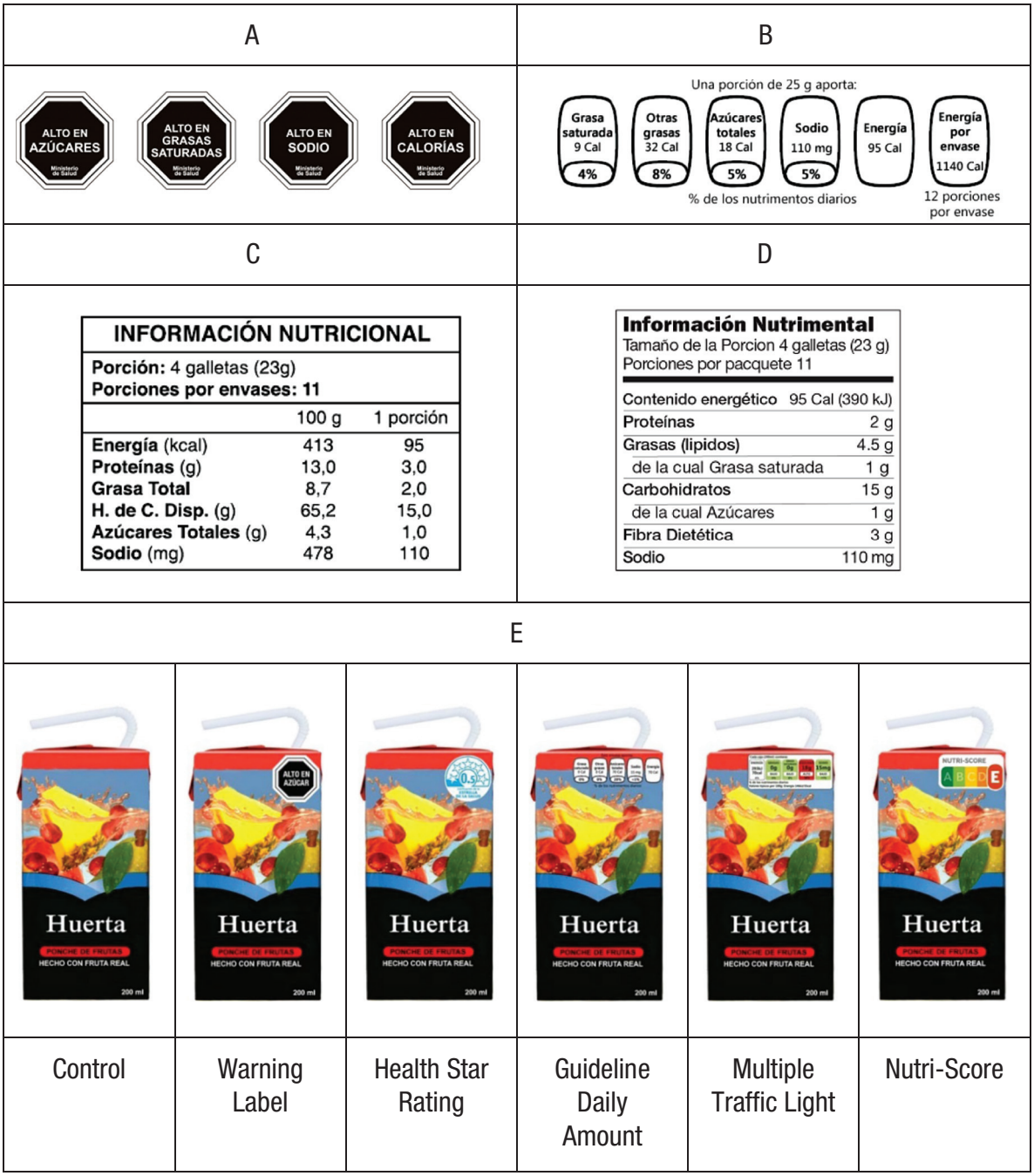
Effect of different FOPL on the perceived healthfulness of a sugar-sweetened beverage

Participants were randomly assigned to view one of six on-screen images of a sweetened fruit drink with different labeling: no label (control), HSR, WL, GDA, MTL, or NS. (Figure 1). The sweetened fruit drink was modeled after a popular drink package to appear authentic but was digitally altered to display a fictitious brand name. Participants were asked "In your opinion, is this product…" with five response options: (1) Very unhealthy, (2) Unhealthy, (3) In the middle, (4) Healthy and (5) Very healthy.

Covariates

Sociodemographic measures included sex, age, and indigeneity assessed through cultural identification questions

FIGURE 1. Nutrition labels shown to youth in Mexico and Chile, the International Food Policy Study 2019



specific to each country (Mexico: "According to your culture, are you considered indigenous?" and Chile: "Do you consider yourself a member of a community of indigenous peoples?"). We also assessed self-reported nutrition knowledge using a 0 to 10 scale (each participant was asked "How much do you know about healthy eating and nutrition?"), and perceived income adequacy (assessed by: "Does your family have enough money to pay for things your family needs?" followed by four response options: 1) Not enough money, 2) Barely enough money, 3) Enough money, and 4) More than enough money) (Table 1).

Statistical analysis

Unweighted and weighted descriptive findings were reported stratified by country. Post-stratification sample weights were constructed using a raking algorithm with population estimates from the census in each country based on age group, sex, region, and indigeneity (18). Differences in NFT and FOPL awareness, use, and understanding across demographic characteristics in Mexico and Chile were tested using logistic regression models controlling for covariates, country, and post-stratification sample weights.

TABLE 1. Sociodemographic characteristics of Mexican and Chilean youth. International Food Policy Study 2019

	Unweighted			Weighted		
	Chile (n=1139) n (%)	Mexico (n=1492) n (%)	P value[a]	Chile (n=1097) n (%)	Mexico (n=1445) n (%)	P value[a]
Sex			0.078			0.742
Male	602 (52.9)	840 (56.3)		585 (51.0)	750 (50.3)	
Female	537 (47.1)	652 (43.7)		562 (49.0)	740 (49.7)	
Age group			0.809			0.382
10-13 years	594 (52.2)	771 (51.7)		542 (47.3)	733 (49.2)	
14-17 years	545 (47.8)	721 (48.3)		605 (52.7)	757 (50.8)	
Indigeneity			0.153			0.001
Not indigenous	1004 (88.2)	1287 (86.3)		974 (84.9)	1162 (78.0)	
Indigenous	135 (11.8)	205 (13.7)		173 (15.1)	328 (22.0)	
Nutrition knowledge (Mean ± SD)	6.3 ± 2.2	6.9 ± 1.9	0.000	6.3 ± 2.2	6.9 ± 2.0	0.000
Perceived Income Adequacy			0.007			0.027
Not enough money	63 (5.5)	48 (3.2)		67 (5.9)	51 (3.4)	
Barely enough money	274 (24.2)	361 (24.2)		281 (24.5)	365 (24.5)	
Enough money	752 (66.0)	991 (66.4)		753 (65.7)	994 (66.7)	
More than enough money	50 (4.4)	92 (6.2)		46 (4.0)	80 (5.4)	
Nutrition Facts Table						
Aware	877 (77.0)	1018 (68.2)	0.000	893 (77.9)	1007 (67.5)	0.000
Often used	361 (31.7)	466 (31.2)	0.801	368 (32.1)	488 (32.8)	0.749
Easy to understand	245 (21.5)	308 (20.6)	0.589	256 (22.4)	301 (20.2)	0.245
Front-of-pack Label[b]						
Aware	1079 (94.7)	977 (65.5)	0.000	1089 (94.9)	972 (65.2)	0.000
Often used	861 (75.6)	462 (31.0)	0.000	868 (75.7)	484 (32.5)	0.000
Easy to understand	354 (31.1)	252 (16.9)	0.000	357 (31.1)	239 (16.0)	0.000

[a] Chi^2 was used to test for significant differences in categorical variables between countries with weighted data. Simple linear regression models were used for continuous variables.
[b] Front-of-pack label awareness, understanding and use corresponds to GDA in Mexico and WLs in Chile.

For the task measuring the perceived healthfulness of a sweetened fruit drink, we examined the success of randomization of covariates by comparing socio-demographic profiles between experimental groups using Chi-square tests. Linear regression models evaluated the effect of label condition on the perceived healthfulness (1 to 5) of the sweetened fruit drink. Interaction analyses revealed significant differences between FOPL systems between countries, therefore, stratified models were presented. We alternated each labeling system as the reference category in regression analysis to assess pair-wise differences. Then, we tested for possible interactions between label condition and sociodemographic characteristics; only statistically significant effects are presented. Analyses were adjusted for covariates to control for differences between countries.(19) Estimates of the effect of label condition on perceived healthfulness were not weighted to maintain randomization balance across conditions.

All analyses were conducted using Stata 16 and the significance level was set at $p<0.05$.

RESULTS

Participants had similar age and sex distribution between countries. Most did not consider themselves indigenous (78%-85%) and reported having enough or more than enough money to pay for family needs (70%-72%). NFT awareness and FOPL awareness, understanding, and use were higher among Chilean youth compared to their Mexican counterparts (see Table 1).

Sociodemographic differences in NFT and FOPL awareness, use and understanding

In both countries, higher self-reported nutrition knowledge was consistently associated with higher levels of self-reported NFT and FOPL use and understanding, and NFT awareness (Table 2). Older age and higher income adequacy were also associated with higher NFT understanding in both countries. In Chile, higher income adequacy was also associated with higher FOPL understanding, and self-identifying as being indigenous was associated with lower FOPL understanding. In Mexico, higher income adequacy was also associated with higher FOPL awareness and FOPL and NFT use. In addition, in Mexico, having higher nutrition knowledge was associated with higher FOPL awareness, and older age was also associated with higher FOPL understanding.

Effect of different FOPL labels on the perceived healthfulness of a sweetened fruit drink

No significant differences were observed in sociodemographic characteristics between experimental conditions (data not shown). The effects of most FOPL were similar in both countries (Table 3). Adjusted models showed that in both countries WLs were associated with lower perceived healthfulness of the sweetened fruit drink compared to the control group (β ranges: -0.67 to -0.76) as well as compared to the other FOPL

TABLE 2. Sociodemographic differences in awareness, understanding and use of nutrition labels among Mexican and Chilean youth. International Food Policy Study 2019

	Chile												México											
	Nutrition Facts Table[a]						WL Front of Pack Label[b]						Nutrition Facts Table[a]						GDA Front of Pack Label[b]					
	Awareness		Understanding		Use		Awareness		Understanding		Use		Awareness		Understanding		Use		Awareness		Understanding		Use	
	OR	CI 95%	OR	CI 95%	OR	CI 95%	OR	CI 95%	OR	CI 95%	OR	CI 95%	OR	CI 95%	OR	CI 95%	OR	CI 95%	OR	CI 95%	OR	CI 95%	OR	CI 95%
Sex																								
Male		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.
Female	1.17	0.87,1.59	1.03	0.78,1.37	1.1	0.81,1.50	0.95	0.54,1.69	0.96	0.71,1.31	1.09	0.83,1.44	1.2	0.89,1.51	0.9	0.70,1.21	0.9	0.65,1.24	0.9	0.72,1.22	1	0.73,1.27	0.8	0.56,1.11
Age																								
10-13 years		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.
14-17 years	1.28	0.95,1.71	**1.55**	**1.18,2.04**	1.35	0.99,1.85	1.44	0.81,2.53	**1.68**	**1.25,2.27**	1.23	0.94,1.61	1.2	0.88,1.49	**1.7**	**1.32,2.30**	1.4	0.99,1.89	1.3	0.98,1.66	**1.8**	**1.39,2.42**	1.3	0.91,1.81
Indigeneity																								
Non-indigenous		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.
Indigenous	1.26	0.79,2.01	1.27	0.84,1.92	1.09	0.68,1.75	0.61	0.29,1.29	**0.64**	**0.42,0.98**	1.09	0.72,1.64	0.9	0.62,1.36	1.3	0.90,1.98	1.1	0.73,1.79	1.1	0.71,1.57	1.3	0.86,1.92	1.1	0.67,1.72
Nutrition knowledge	**1.18**	**1.10,1.26**	**1.24**	**1.15,1.33**	**1.35**	**1.24,1.48**	1.08	0.95,1.23	**1.17**	**1.09,1.25**	**1.28**	**1.20,1.38**	**1.1**	**1.05,1.20**	**1.4**	**1.28,1.55**	**1.6**	**1.43,1.84**	**1.2**	**1.13,1.30**	**1.4**	**1.27,1.53**	**1.6**	**1.41,1.83**
Perceived Income Adequacy																								
Not enough money		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.
Barely enough money	1.18	0.62.2.23	1.35	0.67,2.70	1.48	0.64,3.39	1.37	0.44,4.30	1.25	0.66,2.33	0.66	0.33,1.32	1.5	0.71,2.98	0.9	0.35,2.20	1.5	0.54,4.07	1.2	0.59,2.60	0.7	0.30,1.69	2.9	0.75,10.82
Enough money	1.17	0.65,2.12	1.36	0.70,2.62	1.88	0.86,4.14	1.49	0.53,4.23	1.82	0.95,3.11	0.84	0.44,1.60	1.5	0.75,3.01	1.1	0.46,2.76	2.3	0.88,5.93	1.4	0.70,2.91	0.9	0.39,2.11	3.4	0.94,12.44
More than enough money	1.21	0.49,2.98	**3.1**	**1.28,7.50**	1.86	0.68,5.09	2.12	0.38,11.9	**5.59**	**1.61,19.44**	0.76	0.32,1.85	2.4	0.98,6.00	**1.4**	**0.47,4.06**	**3.4**	**1.04,10.88**	**4.1**	**1.55,10.83**	0.9	0.32,2.63	**4.8**	**1.10,20.79**

[a] We evaluated the country-specific NFT implemented in each country.
[b] Label awareness, understanding and use corresponds to GDA in Mexico and WLs in Chile.
Models controlled for sex, age group, indigeneity, nutrition knowledge, and perceived income adequacy.
Ref., reference category.
Bold font indicates statistically significant ($p<0.05$) differences with the reference group.

TABLE 3. Linear regression models and pairwise comparisons of perceived healthfulness of a sweetened fruit drink among Mexican and Chilean youth. International Food Policy Study 2019

	Chile		Mexico	
	β	95% CI	β	95% CI
Front-of-package label condition				
Control group		Ref.		Ref.
HSR vs Control (ref)	-0.17	-0.36,0.02	0.04	-0.14,0.22
WL vs Control (ref)	**-0.76**	**-0.95,-0.58**	**-0.67**	**-0.85,-0.49**
GDA vs Control (ref)	-0.12	-0.32,0.07	-0.07	-0.25,0.11
MTL vs Control (ref)	**-0.48**	**-0.67,-0.29**	**-0.19**	**-0.37,-0.01**
NS vs Control (ref)	-0.16	-0.35,0.02	0.09	-0.08,0.27
Pairwise comparisons				
WL vs HSR (ref)	**-0.6**	**-0.79,-0.40**	**-0.71**	**-0.89,-0.52**
GDA vs HSR (ref)	0.04	-0.16,0.25	-0.11	-0.29.0.72
MTL vs HSR (ref)	**-0.31**	**-0.50,-0.11**	**-0.22**	**-0.41,-0.04**
NS vs HSR (ref)	0	-0.19,0.20	0.06	-0.12,0.24
GDA vs WL (ref)	**0.64**	**0.45,0.83**	**0.6**	**0.42,0.78**
MTL vs WL (ref)	**0.29**	**0.10,0.48**	**0.48**	**0.30,0.66**
NS vs WL (ref)	**0.6**	**0.41,0.79**	**0.76**	**0.58,0.94**
MTL vs GDA (ref)	**-0.35**	**-0.55,-0.16**	**-0.11**	-0.29,0.07
NS vs GDA (ref)	-0.04	-0.24,0.16	0.17	-0.01,0.34
NS vs MTL (ref)	**0.31**	**0.12,0.50**	**0.28**	**0.10,0.46**

Linear regression models introduced ratings of perceived healthfulness (from 1 or very unhealthy to 5 or very healthy) as a continuous variable and controlled for age, sex, indigeneity, nutrition knowledge, and income adequacy. Bold font indicates statistically significant ($p<0.05$) differences with the reference group.
HSR, Health Star Rating; WL, Warning Label; GDA, Guideline Daily Amount; MTL, Multiple Traffic Light; NS, Nutri-Score; Ref., reference category.

labels (β ranges: -0.29 to -0.76). In both countries, the MTL also led to a lower perceived healthfulness of the sweetened fruit drink compared to the control group (Chile: β= -0.48, 95% IC: -0.67, -0.29 Mexico: β= -0.19, 95% CI: -0.37, -0.01), but to a lesser magnitude than WLs. The MTL also was associated with lower perceived healthfulness compared to the HSR and NS labels in both countries, as well as the GDA in Chile, but not in Mexico (β ranges: -0.19 to -0.48). Furthermore, interaction analyses revealed no significant differences in the perceived healthfulness of the drink among most FOPL systems between countries, including the effect of GDA and WL in Mexico and Chile, respectively ($p>0.05$). However, the effects of MTL (β: 0.30, 95% CI: 0.04,0.56) and NS (β:0.27, 95% CI 0.01,0.53) in Mexico compared to the control condition differed to that observed in Chile. Therefore, stratified models were presented.

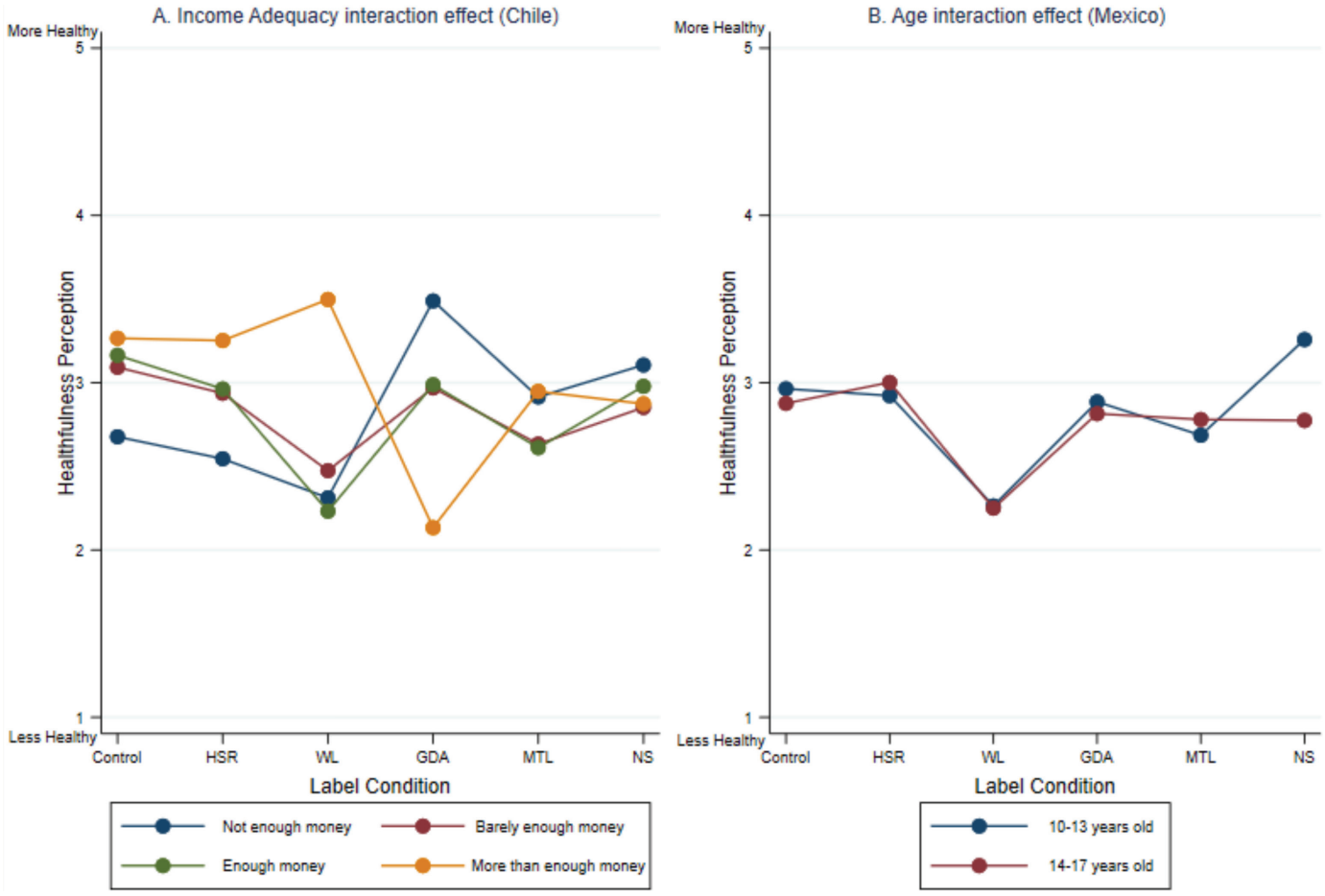
Label effects differed across some sociodemographic characteristics. In Chile, GDA were more effective in decreasing the perceived healthfulness of the sweetened fruit drink among those with higher income adequacy compared to those with lower income adequacy (Figure 2A). In Mexico, the NS led to higher perceived healthfulness among children aged 10 to 13 years compared to those aged 14 to 17 years (Figure 2B). No other differences in label effects across key demographic characteristics were observed within countries.

DISCUSSION

This study provides evidence on the factors associated to nutrition label awareness, understanding and use in Mexico and Chile. Our findings confirmed that WLs were the most effective FOPL in reducing the perceived healthfulness of the sweetened fruit drink among youth, with similar effects across both countries. Results also expand current knowledge by showing that FOPL effects among youth may differ across demographic characteristics, including perceived income adequacy and age.

Our study suggested that older age, higher nutrition knowledge, and higher perceived income adequacy are associated with higher awareness, understanding and use of NFTs and FOPL. Older participants reported a better understanding of both NFTs and FOPL. Previous studies in adults have suggested that interest in nutrition information increases with age due to a growing health awareness or higher education (20–22). This higher level of education may provide youth with enhanced tools for understanding nutrition labels, beyond the implemented system, which may help explain our findings. Regarding income, few studies with children or youth are available for comparison, however, a study in Texas, United States of America found that youth from the lowest socioeconomic tertile had higher odds of using nutritional labels when compared to the upper tertiles (23). These results suggest that nutrition labels' effect may differ across socioeconomic levels, regardless of the implemented system. Notably, among Mexican youth within the lowest economic status, FOPL such as the Warning Labels have demonstrated better results in promoting healthier food choices (24) underscoring the need for local evidence to guide FOPL implementation. Additionally, findings indicate that in Chile self-identifying as indigenous was associated with lower FOPL understanding. As in other Latin American regions, indigenous populations in Chile face disproportionate social and economic inequalities, which have contributed to widening education and health inequalities and may explain the lower FOPL understanding among this population (25,26). However, this population group has been neglected in most research areas, underscoring the need for more investigation on the effects of nutrition labels among indigenous populations to confirm these results.

FIGURE 2. Predicted perceived healthfulness of a sweetened fruit drink among Mexican and Chilean youth by label condition. International Food Policy Study 2019



Panel A shows the effect of the Guideline Daily Amount label differed across income adequacy categories in Chile. Panel B shows the effect of the Nutri Score differed across age categories in Mexico.
HSR, Health Star Rating; WL, Warning Label; GDA, Guideline Daily Amount; MTL, Multiple Traffic Light; NS, Nutri Score

Familiarity with FOPL may increase their effect on decision-making (10,27). Given that youth in this study were exposed to the country's FOPL, WLs and GDA would be expected to have a larger effect in Chile and Mexico, respectively. However, the effect of these FOPL on perceived healthiness did not differ across countries, suggesting that among this sample, familiarity with the label did not impact its effectiveness. This might be due to message fatigue within the Chilean population due to prolonged exposure to the labels (28). Additionally, familiarity may not play an important role for FOPL that are either very difficult (GDA) or very easy to understand (WLs) due to a ceiling effect. In another study utilizing the same data, 75% of Chilean youth considered WLs easy to understand, whereas only 32% of Mexican youth considered the GDA easy to understand (7). Future research may examine this hypothesis. It is also theoretically possible that Mexican youth could have been familiar with WLs by the time of the study because the new regulation in Mexico to replace the GDA was publicly reviewed and debated by the time of our study (August 2019 to January 2020), with presence in the news and media (12). However, it is unlikely that Mexican youth were highly exposed to WLs during this process since youth are not typically involved in these debates in Mexico.

In line with other analyses of these data (27), WLs led to the lowest healthfulness perception for a sweetened fruit drink in both countries. It has been argued that WLs are more effective in communicating health risks because they directly inform consumers of the excessive content of critical nutrients, and they are also disruptive and prevent consumers from fully appreciating the attractiveness of food packages (24,29). Interestingly, the MTL was also associated with a lower rating of perceived healthfulness (compared to the no-label condition) in both countries, but not when compared to GDA in Mexico. Although previous research in Ecuador has shown that the MTL is effective in guiding healthier choices (30), other research suggests that this FOPL may not be as effective in discouraging the consumption of products with high contents of nutrients of concern, and that the combination of colors may cause confusion among consumers (13,24).

The current study explored whether the effect of labels differed across demographic characteristics. In Chile, GDA led to a lower perceived healthfulness among those with higher income adequacy. Although evidence on the effect of nutrition labels among youth with different income backgrounds has been inconsistent (15), these results suggest that GDA may widen the gap between young consumers with high and low nutrition literacy

levels (31). In Mexico, NS led to higher perceived healthfulness ratings among younger children compared to older ones. Similar healthier ratings were reported among Brazilian children in terms of age differences when either GDA, MTL or WLs were displayed on food products (32). These results suggest that older children might be more well-situated to understand not only NS, but all FOPL systems. Although our first analysis showed a positive association between FOPL understanding and higher age, nutrition knowledge and income, when objectively measured (i.e., using the experimental task to measure perceived healthfulness), WLs had consistent effects across demographic characteristics in both countries, which suggests this may be an appropriate FOPL system to target all population segments. Nonetheless, concerted efforts to improve FOPL understanding among specific population groups should be implemented, to maximize the beneficial impact of nutritional labels and promote more equitable impacts across population groups.

This study provides novel information on the sociodemographics associated with the awareness, understanding, and use of nutrition labels among a large sample of youth living in two countries where FOPL have been implemented, and provides evidence on the effect of five different labeling systems on the perceived healthfulness of a sugar-sweetened beverage.

However, this study is subject to limitations. First, respondents were recruited using nonprobability-based sampling; therefore, the findings do not provide nationally representative estimates. Given that our survey was conducted online, it requires internet access from participants, introducing the possibility of recruiting a specific segment of the population. However, it's worth noting that as of 2019, approximately 70% of Mexicans had internet access, shedding light on the potential reach of our survey within this context (33). Second, the experiment was not conducted in real purchasing situations, where participants have a wide variety of products to choose from and are often exposed to distraction. Also, we only tested a sugar-sweetened beverage, and the effectiveness of FOPL could differ by product categories (34). Third, the ability to identify an unhealthy product does not necessarily translate into making healthier choices on a regular basis since other behavioral and normative beliefs might influence purchases (14,35). Fourth, given the recruitment method, where parents provided prior consent, there exists a potential risk of parental influence in youths' responses. To address this concern, youth were explicitly informed that they could decline answering any question. Moreover, it was emphasized that their identities would be kept confidential, ensuring that their responses would not impact their parents' rewards for survey completion. Finally, it is important to acknowledge the self-reported nature of the measures assessing awareness, understanding, and use of nutritional labels. While recognizing this limitation, it is noteworthy that previous research in adults has suggested that self-reported understanding tends to align with higher levels of functional understanding (31).

In conclusion, the findings of this study provide evidence on the factors associated with nutrition label awareness, understanding, and use in Mexico and Chile. Results suggest that among youth, nutrition label awareness, use, understanding, and impact differ across demographics, with more favorable outcomes observed among older age, higher income and nutrition knowledge. These differences were particularly important for the NFT and some FOPL, including the GDA and the NS. Findings also support Mexico's and Chile's decisions to implement WLs as the mandatory FOPL, as the label seems to be more effective in drawing attention, being understood, and used, and ultimately influencing healthfulness perceptions, regardless of the degree of familiarity with these labels. Despite reported differences in its perceived understanding, these labels produced similar responses across different population sub-groups, indicating WLs are unlikely to exacerbate disparities.

Our study provides valuable insights that advocate for the widespread adoption of WLs in Latin America. The evidence underscores the necessity of directing interventions towards specific population segments characterized by lower levels of awareness, understanding and use of nutritional labels. Recognizing these disparities is crucial to ensure that most vulnerable groups benefit equally from this policy. Furthermore, our research emphasizes the importance of local evidence for guiding policymaking and implementation worldwide.

Authors contributions. KLQ, analyzed the data, drafted and edited the manuscript; CN, AC, SB, and CC contributed to the conceptualization, review and editing of the manuscript; AJ, CMW, and LV conceived the original study and experiments and data collection; DH conceptualized, lead the investigation, project administration and funding acquisition of the IFPS.

Conflicts of interest. 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.

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Diferencias sociodemográficas en el efecto de las etiquetas nutricionales en las adolescentes de Chile y México

RESUMEN

Objetivo. Examinar las diferencias sociodemográficas por lo que respecta al conocimiento, la comprensión, el uso y el efecto de las etiquetas nutricionales en adolescentes de México y Chile.

Métodos. En el 2019 se efectuó una encuesta en línea en adolescentes (10 a 17 años) (n=2631). Los participantes indicaron su conocimiento, comprensión y uso de los cuadros de información nutricional y los etiquetados frontales específicos de los empaques de su país (en el caso de Chile, las etiquetas de advertencia, y en el de México, las guías diarias de alimentación (GDA). Asimismo, se llevó a cabo un experimento en el que los participantes indicaron su percepción de lo saludable que era una bebida de fruta azucarada después de ver una de sus seis versiones con diferentes etiquetas frontales en los envases (control sin etiqueta, calificación de producto saludable mediante estrellas *Health Star*, etiquetas de advertencia, GDA, colores del semáforo, o sistema *Nutri-Score*).

Resultados. El autorreporte de un mayor conocimiento sobre nutrición por parte de los participantes se asoció a un mayor conocimiento, comprensión y uso de los cuadros de información nutricional y los sistemas de etiquetado frontal, excepto en el caso del uso de las etiquetas de advertencia. Las etiquetas de advertencia fueron el sistema de etiquetado frontal más eficaz para reducir la percepción saludable del producto con respecto a la bebida de fruta azucarada, en comparación con la ausencia de etiqueta y el resto de los etiquetados frontales. En Chile, el efecto de las GDA variaba en función de la adecuación del ingreso, mientras que en México el efecto del *Nutri-Score* difería según la edad.

Conclusiones. Los resultados sugieren que el conocimiento, el uso, la comprensión y el efecto de las etiquetas nutricionales difieren entre los distintos grupos demográficos, de tal manera que son más favorables en las personas con mayores ingresos y conocimientos de nutrición. A pesar de esto, es probable que las etiquetas de advertencia tengan un impacto positivo sobre los conocimientos y los comportamientos relacionados con la nutrición en los adolescentes de México y Chile, con independencia de los grupos sociodemográficos de los que forman parte.

Palabras clave Etiquetado de alimentos; adolescente; niño; bebidas azucaradas; Chile; México.

Diferenças sociodemográficas no efeito da rotulagem nutricional em adolescentes chilenos e mexicanos

RESUMO

Objetivo. Analisar diferenças sociodemográficas em termos de conhecimento, compreensão, uso e efeito da rotulagem nutricional entre adolescentes mexicanos e chilenos.

Métodos. Foram realizadas pesquisas on-line entre adolescentes de 10 a 17 anos ao longo de 2019 (n=2631). Os participantes relataram que conheciam, compreendiam e usavam as tabelas de informação nutricional e a rotulagem frontal de embalagens específicas de seus respectivos países (Chile: rotulagem de advertência; México: valores diários de referência). Além disso, os participantes relataram sua percepção sobre a saudabilidade de um suco de fruta adoçado depois de ver uma de seis versões diferentes de rotulagem frontal (controle sem rótulo, Health Star Rating, rótulos de advertência, valores diários de referência, semáforo nutricional ou Nutri-Score) durante uma tarefa experimental.

Resultados. Um maior conhecimento autodeclarado sobre nutrição foi associado a maior conhecimento, compreensão e uso de tabelas de informação nutricional e rotulagem frontal, com exceção do uso de rótulos de advertência. Os rótulos de advertência foram o tipo de rotulagem frontal mais efetivo para reduzir a percepção de saudabilidade do suco de fruta adoçado em comparação com o controle sem rótulo e outros tipos de rotulagem frontal. No Chile, o efeito dos valores diários de referência variou de acordo com a renda, enquanto no México o Nutri-Score variou de acordo com a idade.

Conclusões. Os resultados sugerem que o conhecimento, a compreensão, o uso e o impacto da rotulagem nutricional variam de acordo com fatores demográficos, favorecendo uma renda mais alta e conhecimento sobre nutrição. Apesar disso, é provável que os rótulos de advertência tenham um impacto positivo sobre o conhecimento e os comportamentos relativos à nutrição entre adolescentes mexicanos e chilenos, independentemente do grupo sociodemográfico a que pertencem.

Palavras-chave Rotulagem de alimentos; adolescente; criança; bebidas adoçadas com açúcar; Chile; México.