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Understanding the role of the front-of-package "traffic-light" label model in the prevention of obesity and chronic diseases through the project: Mobilizing a critical mass of "250 Thousand Families" as a public policy resource for addressing non-communicable diseases in Ecuador.

Viability of the labeling system

Report prepared for the World Health Organization

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1. Introduction

The traffic light nutrition label (TLNL) is one of the systems that receive great attention from the public health community. This color-coded labeling scheme has been implemented in some countries, with variations on the targeted nutrients and on the numerical information displayed. Governments of other countries are in the process of implementing such interpretative nutrition labeling scheme. However, stakeholders are seeking more evidence on the effectiveness of this strategy to promote healthy eating habits. This is necessary as the implementation and viability of the TLNL has met with strong opposition from the food and beverage industry, and certain government bodies. Although fueled mainly, and without veil, by economic interests, this resistance movement also calls upon public health arguments. For example, it claims negative repercussions on the consumption of nutritious food, namely dairy products. The resistance movement draws its strength in part from the scarcity of scientific evidence on the impact of the TLNL on people's eating habits. It is therefore crucial to conduct independent studies on the issue, in order to inform stakeholders on what direction to take as regards food nutrition labeling.

This report provides an overview of the TLNL's implementation in Ecuador and the current threats it faces. The relationships of the TLNL with eating habits are then examined and discussed from the existing scientific literature and from an original study carried out in 2017 with populations of three regions of the Ecuadorian highlands. Recommendations for scaling-up the label to a larger and more diverse population are expressed where relevant throughout the report.

2. The Ecuadorian traffic light nutrition label: State implementation, resistance and consumer adoption

The TLNL is a public policy that emanates from an interdepartmental government plan to promote the quality of life of Ecuadorians (the "Plan Nacional para el Buen Vivir"). Adopted in August 2014, it required manufacturers to integrate the TLNL onto the packaging of processed products marketed in Ecuador, allowing them one year to comply. The regulation exempts certain packaged foods from displaying the label, considering that they are not, or not significantly, processed. These include, for example, products such as natural milk, natural fruit juices, meats, grains, vegetables and fruits. Ecuador is the first Latin American country to implement this type of label, and the first in the world to do it as a mandatory measure. It is inspired by the Multiple Traffic Lights (MTL) nutrition label, set up on a voluntary basis in the United Kingdom, in the sense that it uses the three colors of traffic lights, that it exposes the content in fat, sugar and salt, and that it is based on the same criteria for the color code. On the other hand, the UK version, more globally widespread, must be displayed on the front of the package, informs about the content in saturated fats, and displays more numerical nutritional information.

As was the case elsewhere in the world with FOP nutrition labels (Jaichuen, Phulkerd, Certthkrikul, Sacks, & Tangcharoensathien, 2018; Mandle, Tugendhaft, Michalow, & Hofman, 2015), the TLNL in Ecuador has from the outset faced numerous pressures to modify or abolish some of its features and conditions of implementation, such as its location on the packaging and the prohibition of advertising intended for children for sodium (Diaz et al., 2017; Freire, Waters, Rivas-Mariño, Nguyen, & Rivas, 2016). Pressures, however, are not only internal to the country, given the important place that food occupies in international trade (International Trade Center, n.d.). Ecuadorian regulations on food labeling have, for example, given rise to various forms of opposition from the WTO, and the American and Mexican governments (Diaz et al., 2017). In Ecuador, the food and beverage industry, when not lobbying for the abolition of the TLNL, is strongly pressing the addition of a lot of additional information to it, with the alleged purpose of avoiding providing misleading information. Fear of repercussions on

the national economy or on specific market sectors, such as dairy products, is what mainly feeds resistance movements (Diaz et al., 2017; Freire et al., 2016). The food and beverage industry put part of the responsibility on the label for the drop in sales in their sector at the turn of its implementation. It was reported that in fact the value of sales had not been affected and that the reported drop in sales volume had been the subject of warning signs, dating from before the label was implemented (Diaz et al., 2017). In addition, such an effect has not been observed for other foods which bear a similar label (Peñaherrera et al., 2018).

Consumer adoption in Ecuador

Our study with three populations of the Ecuadorian Andes showed how the TLNL was generally well known there, three years after the beginning of its implementation. Residents of Quito were the most well informed, whereas people living in Ibarra were the least. In fact, the TLNL reached 91% of the population of Quito, 78% of that of Riobamba, and 70% of that of Ibarra (figure 1).

Figure 1. Proportions of the populations of Ibarra, Quito and Riobamba who know the TLNL as a whole; who use the TLNL.
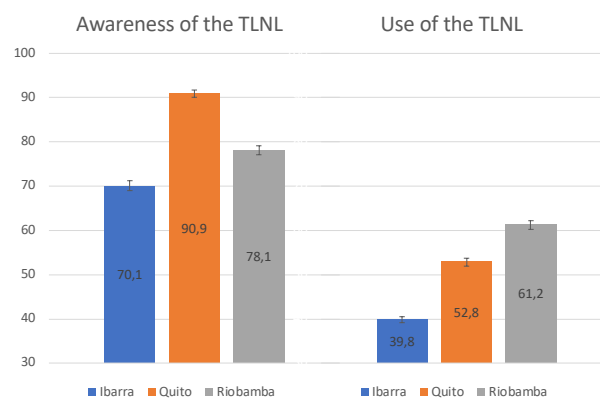
Weighted relative frequencies and standard deviations
N=1447 (Ibarra), N=1204 (Quito), N=1392 (Riobamba)

Likewise, higher proportions of people reported on its nutrient and color components in Quito, followed by Riobamba and Ibarra (figures 2 and 3). The few previous studies on

the matter in Ecuador also highlighted the high levels of recognition of the label (Freire et al., 2016; Freire et al., 2018; Teran, Hernandez, Freire, Leon, & Teran, 2019). In addition, these studies show that the nutrients displayed on the TLNL are highly recognized, and that the colors help in the assessment of the nutritional quality of the products. The red label is the one that receives the most attention based on a focus group study across Ecuador (Freire et al., 2016), something that was also revealed in our study with urban populations of the Ecuadorian highlands (figure 3). Online experimental studies also pointed to the greatest impact of red labels in reducing consumer preference for foods of poor nutritional value (Balcombe, Fraser, & Falco, 2010; Maubach, Hoek, & Mather, 2014; Scarborough et al., 2015).

Figure 2. Proportions of the urban populations of Ibarra, Quito and Riobamba who know the nutrients on the TLNL.
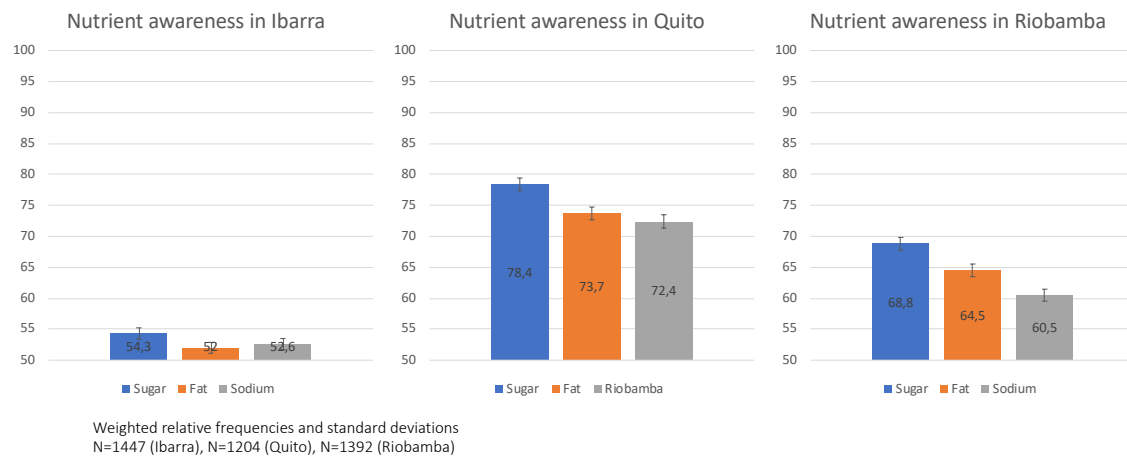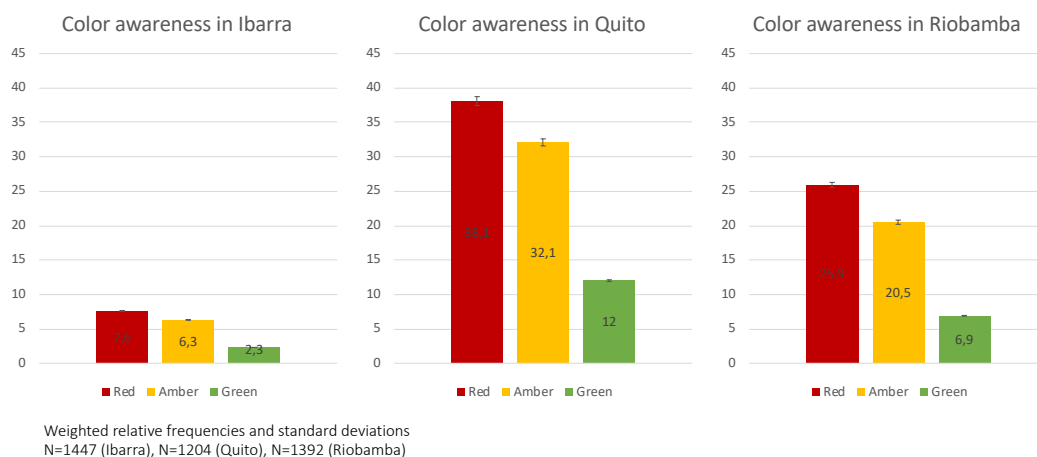

Weighted relative frequencies and standard deviations
N=1447 (Ibarra), N=1204 (Quito), N=1392 (Riobamba)

Figure 3. Proportions of the urban populations of Ibarra, Quito and Riobamba who know the colors on the TLNL and their meaning.

Color awareness in Ibarra — Red 7,4; Amber 6,3; Green 2,3
Color awareness in Quito — Red 38,2; Amber 32,1; Green 12
Color awareness in Riobamba — Red 25,8; Amber 20,5; Green 6,9

Weighted relative frequencies and standard deviations
N=1447 (Ibarra), N=1204 (Quito), N=1392 (Riobamba)

The level of awareness of the TLNL is most likely related to the level of access to packaged foods displaying the label. Our analyses have exhibited the positive relationship existing between being aware of the TLNL and living in a household with modern food shopping habits, which referred to shopping at venues such as super- and minimarkets, corner stores and street vendors. Also, people who were aware of and well informed on the TLNL were more likely to have a higher education level and greater financial means (table 1). These outcomes may reflect the stage of market integration of packaged foods in this region of Ecuador. At an early stage, which is the case in Riobamba, Ibarra and, although more advanced, in Quito, the industrially processed foods reach mainly urban populations, the wealthiest and the most educated people (Hawkes, 2008). Freire et al. (2016) also highlighted the higher level of knowledge about TLNL among residents of large cities than in medium and small cities.

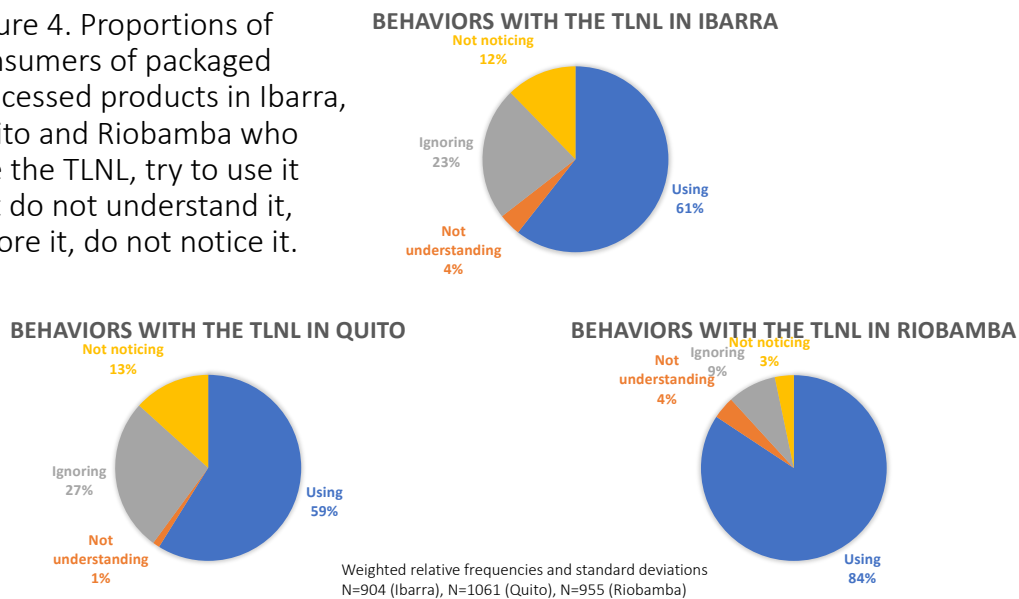| Table 1. Extent of associations between being aware of the TLNL and geographic, demographic, socioeconomic, behavioral and health status variables					
	Wald chi-2	P value	Odds ratio	95% CI (for OR)	
Having a post-secondary school degree	**148.4589**	**<.0001**	**10.284**	**7.069**	**14.961**
Having a secondary school degree	**116.2441**	**<.0001**	**3.132**	**2.545**	**3.855**
Being 60 years old or over	**92.4727**	**<.0001**	**0.324**	**0.257**	**0.408**
Living in Quito	**47.3072**	**<.0001**	**2.542**	**1.948**	**3.315**
Living with 187.50-375$/month	**40.9979**	**<.0001**	**1.959**	**1.595**	**2.407**
Living with >375$/month	**28.6514**	**<.0001**	**2.233**	**1.664**	**2.996**
Living in a household with modern food shopping habits	**22.7682**	**<.0001**	**1.675**	**1.355**	**2.069**
Being physically active	**16.7882**	**<.0001**	**0.675**	**0.559**	**0.815**
Being between 18 and 39 years old	**9.8421**	**0.0017**	**1.459**	**1.152**	**1.847**
Living in Riobamba	4.5271	0.0334	1.259	1.018	1.557
Being a woman	4.0776	0.0435	1.238	1.006	1.524
Having received a diagnosis of NCD	2.4275	0.1192	1.187	0.957	1.471
Being at increased risk of NCD, according to BMI and waist circumference	1.3792	0.2402	0.871	0.691	1.097
Being a smoker	0.0951	0.7578	0.951	0.689	1.311
All variables were mutually adjusted in a multivariable logistic regression N=3741, DF=14, Intercept χ2(1) = 256.6269, p < .0001 Green font = positive association; Red font = negative association; Black font = no association					

The use of the TLNL seems to be subject to similar dynamics. Our analyses comparing TLNL users to non-users (see figure 4, for the prevalence of various behaviors with the TLNL among consumers of packaged processed foods) showed how it was also positively associated with a higher socioeconomic status and with living in a household with modern food shopping habits (table 2). People among these groups are more likely to have increased access to packaged foods, information about the TLNL, and exposure to the publicity around these foods, contributing to developing the knowledge about the labeling system and the habit of using it. In terms of gender and age group, differences were observed in terms of awareness and use of the TLNL. Women were more likely to be aware of the TLNL, but gender was not associated with people's behavior with the TLNL, as was observed in a previous cross-sectional survey in Quito (Teran et al., 2019). This is interesting since it is generally agreed that men are less health conscious than women, and would therefore be less inclined to use the label to make better food choices (Balcombe et al., 2010; Freire et al., 2016; Mandle et al., 2015; Orozco, Ochoa, Muquinche, Padro, & Melby, 2017). It may be that the traffic light format appeals to men, thereby reducing gender disparities in the use of information about the nutritional value of foods. Age also explained disparities in behaviors toward the TLNL. People between 18 and 39 years old were more likely to be aware of the TLNL, whereas people

who were 60 years of age or older were more likely to use it (table 2). This is expected as studies have pointed out that nutrition labels are used more by people when they have health concerns, which become more common with age (Freire et al., 2016; Graham, Lucas-Thompson, Mueller, Jaeb, & Harnack, 2017; Mandle et al., 2015; van Herpen & Trijp, 2011).

Figure 4. Proportions of consumers of packaged processed products in Ibarra, Quito and Riobamba who use the TLNL, try to use it but do not understand it, ignore it, do not notice it.

BEHAVIORS WITH THE TLNL IN IBARRA

Not noticing 12%
Ignoring 23%
Not understanding 4%
Using 61%

BEHAVIORS WITH THE TLNL IN QUITO

Not noticing 13%
Ignoring 27%
Not understanding 1%
Using 59%

BEHAVIORS WITH THE TLNL IN RIOBAMBA

Not noticing 3%
Ignoring 9%
Not understanding 4%
Using 84%

Weighted relative frequencies and standard deviations
N=904 (Ibarra), N=1061 (Quito), N=955 (Riobamba)

One of the concerns raised over the TLNL in Ecuador is the fact that relying excessively on this measure to promote healthy eating in the population may contribute to social health inequalities. In fact, vulnerable populations are less likely to know and use the label. This was observed for the poor and less educated in our study (tables 1 and 2) and for women who identify as Indigenous in a previous study in Riobamba (Orozco et al., 2017). As regard the label itself, requiring that it is displayed in front of the package (Freire et al., 2016; Graham et al., 2017) and not overloaded with information (Diaz et al., 2017; Mandle et al., 2015; Watson et al., 2014) would help reach vulnerable populations. However, it is essential to simultaneously act at the root of social inequalities in health, that is to fight against social exclusion and poverty with strong

national policies, legislations and regulations, and regional programs led by community actors.

Table 2. Extent of associations between using the TLNL and geographic, demographic, socioeconomic, behavioral and health status variables					
	Wald chi-2	P value	Odds ratio	95% CI (for OR)	
Living in Riobamba	81.6821	<.0001	2.882	2.291	3.625
Being a smoker	29.4664	<.0001	0.506	0.396	0.647
Having a post-secondary school degree	28.3655	<.0001	2.101	1.599	2.760
Being 60 years old or over	13.8621	0.0002	1.773	1.311	2.396
Being between 40 and 59 years old	11.7777	0.0006	1.405	1.157	1.706
Living in Quito	8.9481	0.0028	0.724	0.586	0.895
Being physically active	7.9476	0.0048	1.285	1.080	1.530
Living with 187.50-375$/month	7.5346	0.0061	1.344	1.088	1.659
Living with >375$/month	7.1843	0.0074	1.406	1.096	1.804
Having a secondary school degree	5.8514	0.0156	1.332	1.056	1.680
Living in a household with modern food shopping habits	5.2229	0.0223	1.316	1.040	1.666
Being a woman	1.2689	0.2600	1.113	0.924	1.340
Having received a diagnosis of NCD	0.0126	0.9107	0.988	0.803	1.216
Being at increased risk of NCD, according to BMI and waist circumference	0.0171	0.8960	0.987	0.813	1.199
Being well informed aboud the TLNL	0.6456	0.4217	1.098	0.874	1.380
All variables were mutually adjusted in a multivariable logistic regression N=2751, DF=15, Intercept χ2(1) = 81.7305, p < .0001 Green font = positive association; Red font = negative association; Black font = no association					

3. The traffic light nutrition label and eating habits

The FOP labels, since they strongly attract the attention of consumers, exert strong pressure on the food and beverage industry to improve the nutritional content of processed packaged foods, which has been recognized in Ecuador with the TLNL (Freire et al., 2016; Peñaherrera et al., 2018). It was observed that one year after its implementation, the sweetened beverages sold in Ecuador had overall a reduced sugar content, but no significant change in the colors of the TLNL (Peñaherrera et al., 2018). On the one hand, this wave of product reformulation helps limit excessive intakes of fat, sugar and salt in the population. On the other hand, this process does not significantly influence eating habits; people keep the habit of depending on industrially processed products. In addition, this diversification of business opportunities strengthens the market for processed products and contributes to its establishment in low- and middle-income countries (Mandle et al., 2015). These could otherwise benefit from combining

the advantages of the modernization of the food system with the conservation of food knowledge and skills among consumers.

On the side of direct influence on consumers, experimental studies have shown that the presence on food products of a nutritional label using traffic lights favored the correct categorization of the products presented according to their nutritional value (Hodgkins et al., 2015; Maubach et al., 2014). The label has also been shown to change consumer opinion about food; products of lower nutritional value being more often perceived negatively in the presence of a traffic light label (Cecchini & Warin, 2016; Machin et al., 2017). Food choices made with or without the nutrition label have also been observed in experimental studies. These demonstrate the tendency to choose foods of higher nutritional quality in the presence of a traffic light nutrition label (Freire et al., 2018; Machín, Aschemann-Witzel, Curutchet, Giménez, & Ares, 2018; Teran et al., 2019; van Herpen & Trijp, 2011).

Some studies in Ecuador however concluded in the low likelihood of its actual use during food purchasing. One was based on the perspective of consumers who participated in focus groups across Ecuador (Freire et al., 2016). The other was a cross-sectional survey with women in the province of Chimborazo (Orozco et al., 2017). Among the factors indicated to explain the findings, there was the greatest influence of brand and price in food decisions in urban areas, and low formal education and alternative eating patterns in rural areas.

Other studies found no influence of a traffic light nutrition label on consumer food choices (Cecchini & Warin, 2016; Graham et al., 2017; Hawley et al., 2013; Machin et al., 2017; Peñaherrera et al., 2018). There are in fact very few studies on the matter, especially in low- and middle-income countries. Many of them are task experiments, conducted before the introduction of the labeling scheme on the market. In addition, they generally involve a limited selection of foods, on which a choice is forced. These

studies are measuring the impact, at one point in time, of the presence of the label on various behavioral elements (attention to nutritional content, preference for healthier options) and nutritional outcome (food and nutrient quality of selection). In contrast, the strength of our study in Ecuador was that it enabled putting in relation people's eating habits with their behavior with the label, as we assess the two independently. Controlling for geographic, demographic, socioeconomic, behavioral and health status influences, we found that the use of the TLNL was associated with the absence in the diet of processed meats and sweetened beverages (table 3). There was in fact a reduced growth in volume and monetary value of sales in non-alcoholic beverages in Ecuador from 2010 to 2015, overlapping with the implementation of the TLNL (Diaz et al., 2017). Moreover, it was interesting to note that the participants in the focus groups conducted in 2015 across Ecuador especially associated the TLNL with sweetened beverages, as well as snacks (Freire et al., 2016).

Table 3. Extent of associations between using the TLNL and consumption habits of various food groups.					
	Wald chi-2	P value	Odds ratio	95% CI (for OR)	
Fresh vegetables daily N=2750, Intercept χ2(1) = 1.4614 , p=0.2267	42.5152	<.0001	1.866	1.547	2.250
Fish and seafoods at least weekly N=2749, Intercept χ2(1) = 90.4815, p<.0001	38.8526	<.0001	1.769	1.479	2.117
Fresh fruits daily N=2747, Intercept χ2(1) = 0.0452, p=0.8317	29.7314	<.0001	1.633	1.369	1.947
Avocados at least weekly N=2750, Intercept χ2(1) = 112.3031, p<.0001	18.4244	<.0001	1.527	1.258	1.852
Commercial sweet beverages N=2749, Intercept χ2(1) = 23.4783, p<.0001	17.7249	<.0001	0.662	0.546	0.802
Processed meat N=2751, Intercept χ2(1) = 56.7723, p<.0001	9.5582	0.0020	0.733	0.602	0.893
Fastfood N=2749, Intercept χ2(1) = 3.5090, p=0.0.0610	6.4055	0.0114	0.787	0.654	0.947
Homemade juice daily N=2746, Intercept χ2(1) = 13.0472, p=0.0003	5.7913	0.0161	1.245	1.041	1.488
Refined-grain products daily N=2750, Intercept χ2(1) = 0.5904, p=0.4423	4.2620	0.0390	0.798	0.644	0.989
Salty snacks N=2740, Intercept χ2(1) = 9.6933, p=0.0018	2.4928	0.1144	0.865	0.723	1.035
Unsweetened dairy products N=2747, Intercept χ2(1) = 5.0273, p=0.0250	2.0252	0.1547	0.874	0.725	1.052
Sweets and desserts N=2748, Intercept χ2(1) = 14.6704, p=0.0001	1.4673	0.2258	0.894	0.745	1.072
Legumes at least every other day N=2749, Intercept χ2(1) = 114.4450, p<.0001	0.7979	0.3717	0.917	0.758	1.109
Sweetened dairy products N=2750, Intercept χ2(1) = 29.2342, p<.0001	0.4710	0.4925	0.935	0.773	1.132
Whole-grain products at least every other day N=2747, Intercept χ2(1) = 84.7988, p<.0001	0.0380	0.8455	0.980	0.803	1.197
Tubers at least every other day N=2750, Intercept χ2(1) = 1.3386, p=0.2473	0.0171	0.8960	0.989	0.836	1.170
Multivariable-adjusted logistic regression analyses, DF=16 (city of residence, gender, age, level of education, level of personal finance, physical activity habits, smoking habits, household's food shopping habits, level of knowledge about the TLNL, health status) Green font = positive association; Red font = negative association; Black font = no association					

Some critics have raised the concern that the use of a nutrition label like the TLNL might not promote the consumption of unpackaged, unprocessed foods, i.e. they only contribute to the substitution of one packaged food for another that appears healthier (Cecchini & Warin, 2016). That was indeed one of the behaviors in response to the TLNL revealed by focus groups discussions with Ecuadorians consumers (Freire et al., 2018). Our investigation in Ecuador highlighted the relationship existing between consumer behavior with the TLNL and foods that are not industrially processed, and that thereby don't bear the label. People who reported using the TLNL were more likely than others to eat daily fruits and vegetables, as well as avocados, fish and seafoods at least weekly, even when controlling for geographic, demographic, socioeconomic, behavioral and health status influences (table 3). Another preoccupation raised is the negative influence that the label would have on the consumption of certain foods with a naturally high sugar, fat or salt content. In fact, this is particularly a concern with high-fat dairy products (Diaz et al., 2017). However, our study with populations of the Ecuadorian highlands found no association between the use of the TLNL and consumption of dairy products, among other foods such as tubers, whole grain products and legumes (table 3).

Nevertheless, it remains that the TLNL is only one component of a product packaging, packaging which is itself one of the many factors on which food choices are made (Freire et al., 2016; Mayen, Marques-Vidal, Paccaud, Bovet, & Stringhini, 2014). Further regulations over the marketing of processed foods should be considered, for example by prohibiting their advertising to children, imposing a special tax on them, and applying the TLNL on baby food (Diaz et al., 2017; Freire et al., 2016). Moreover, social marketing campaigns are needed to promote the use of the TLNL as part of healthy and sustainable eating patterns adapted to the local context (Diaz et al., 2017).

4. Conclusion

The TLNL has been adopted by a large part of Ecuadorians. People living in urban centers, the wealthiest and the most educated were particularly reached by this public policy. This is expected as these groups are the main consumers of packaged foods, in the initial stage of market integration of these products. Awareness and education campaigns should target socially excluded and vulnerable groups, such as the poor, the less educated, those who live in remote areas and Indigenous people. Stakeholders must however consider that the TLNL might not suit completely the needs of these groups, who have other health and life preoccupations than the current national main public health concerns. Campaigns aimed at these groups should also promote alternative healthy lifestyles, while emphasizing the usefulness of the TLNL as a preventive measure against overnutrition in a modernizing food environment, which, unfortunately, often increases the burden of undernourished people.

Although there is still little evidence of the impact of the TLNL on eating habits, its use is associated to healthy eating habits, independently of people's level of education, socioeconomic status and food environment. Contrary to fears of negative economic repercussions, in particular concerning certain sectors of the food and beverage industry, the use of the TLNL was not linked to consumption habits of foods such as dairy products, tubers, whole-grain products and legumes. Furthermore, Ecuadorians across the country have reported that the TLNL increased their ability to assess the nutritional quality of foods. In the light of these results, supported by positive international experiences with traffic light nutrition labels revealed in the scientific literature reviewed, the TLNL should be considered by governments who want to implement an interpretative and simplified food labeling system, in particular if they can make it compulsory, on the front of the packaging, and accompanied by appropriate social marketing campaigns and a set of measures tackling poverty and social exclusion.

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