The Influence of Chile’s Food Labeling and Advertising Law and Other Factors on Dietary and Physical Activity Behavior of Elementary Students in a Peripheral Region: A Qualitative Study

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Abstract

**Background:** In 2016, Chile implemented the Food Labeling and Advertising Law to fight childhood obesity through front-of-package food labelling, marketing restrictions and school activities and programs. Nevertheless, little is known on its influence on key stakeholders in vulnerable peripheral regions of the country. This study aimed at identifying important influencing factors including the Food Labeling and Advertising Law on dietary habits and physical activity patterns of second graders in Chile, as perceived by school representatives and the children themselves.

**Methods:** Semi-structured interviews with four school directors and 17 groups of three second graders, informal interviews with 9 key teachers and 4 food services staff complemented with documented observations were carried out in four primary schools of the Chilean city of Punta Arenas, in the Magallanes Punta Arenas region. The different sources allowed for triangulation of results.

**Results:** FLAL seems to have a negligible influence on young children's diet and physical activity in the study region. Barriers are children's deeply rooted dietary habits, excessive screen-time, the parents’ lacking problem awareness, limited time for parenting practices and bad role modeling. Environmental barriers are overloaded schools due to insufficient coordination between governmental entities, lacking funds for sound teacher training and unsafe neighborhoods limiting children's play.

**Conclusions:** Policy interventions aimed at reducing childhood obesity need to include and empower schools, families and local communities as active partners and consider their framework conditions for greater influence on dietary habits and physical activity.

Introduction

In Chile, almost 29% of children between 4 and 14 years of age were reported to be overweight and 24% obese in 2019. (1) National data suggest a steep increase in obesity prevalence between the first and second grade (6-8 years), the lowest socio-economic groups being more strongly affected. (1, 2)

As in other regions of the world, the high overweight and obesity rates are a consequence of rapid nutritional transition and increasingly sedentary behavior in the Chilean population. (3) In 2007, expenditure in processed foods amounted to 57 % of total food expenditure. (4) On average, Chileans consume 30kg of ultra-processed food products and 170l of sugar-sweetened beverages (SSB) per year, which makes them the leading consumers of SSB worldwide. (5, 6) Children and adolescents consume too much sugar, fat and salt and do not achieve guideline recommendations for physical activity. (7, 8)

To prevent childhood overweight and obesity, the Chilean Government ratified the Food Labeling and Advertising Law (FLAL) (Law 20 606/2012), taking effect in January 2016. It covers four aspects:

1. Foods and drinks high in calories, sugars, sodium, and saturated fat must be marked with a front-of-package label (FoPL).
2. Products with FoPL are subject to restricted advertising and marketing. Targeting children younger than 14 years is prohibited.

3. Products high in the above-mentioned critical nutrients may not be sold in schools, be they packaged or not.

4. Schools must provide nutritional educational and promote physical activity. (9, 10)

First evaluations suggest a substantial reduction in sales of high sugar/sodium/saturated fat-products at school kiosks in the capital, and a significant reduction in SSB consumption in urban areas. (11, 12) One year after FLAL implementation, mothers in the Chilean capital stated that they perceived an important shift towards healthier dietary habits. (13) Nevertheless, little is known on the influence of the FLAL in peripheral regions like the Southern region of Magallanes, where prevalence of childhood obesity is among the highest in the country. (1) It is crucial to understand how key stakeholders like schools implement the Law and where they identify barriers to its successful implementation. Furthermore, little is known about young Chilean children's perception of the measures, despite them being potential key informants on their lifestyle choices and the factors that influence these (e.g. (14, 15)). To address this knowledge gap, the current study identified important influencing factors including the FLAL on dietary habits and physical activity patterns of second graders in the Chilean region of Magallanes, as perceived by school directors, staff and the children themselves. This knowledge may contribute to law amendments as well as the design of current and future policy measures in Chile and other countries.

**Methods**

**Study Design**

Primary schools in the city of Punta Arenas, Magallanes region, were visited for three days each. Semi-structured interviews with second graders and with school directors were carried out. As children feel more comfortable talking with peers, (16) the interviews with them took place in a group setting of three.

Interviews were complemented with documented observation of relevant aspects (e.g. snacks brought to school by the children; physical activity during the breaks) and informal interviews with important staff like sports teachers and food services employees. The different sources of information allowed for data triangulation. (17)

**Participants’ Recruitment and Data Collection**

The 14 primary schools in Punta Arenas belonging to the Health Promoting Educational Establishments were contacted through the Health Promotion Unit's local representative. These schools are committed to the promotion of a healthy lifestyle and participate in a corresponding governmental program. They are evaluated on a regular basis by the Ministry of Health. (18) Only establishments that authorized researcher presence during regular school activities were included.
In October 2018, CP visited each school for three days and interviews with directors and second graders were carried out. A minimum of six children were chosen randomly per school. The conversation lasted about 30 minutes and took place outside of the classroom. As recommended in the literature, (19, 20) the interviewer used appropriate language and talked to the children in a familiar manner, to stimulate participation. Informal interviews were held with actors crucial to the implementation of the FLAL (e.g. physical education teachers, cafeteria staff, kiosk manager) to get opinions of the people who work with the children on a daily basis. The questions were asked in relation to the topics from the interviews with the children and answers obtained thereof. The interview partners for the informal interviews were chosen randomly. The interviews lasted between 15 and 35 minutes. All semi-structured and all informal interviews were voice-recorded.

**Instruments**

The children’s interview guide was based on the model of Birch and Ventura (21). It was grouped into four topics, and complemented with community-specific factors:

1. Nutrition: Dietary habits, personal food preferences and basic knowledge on healthy nutrition and the FoPL.
2. Physical activity: Way of commuting to school, favorite activity during breaks, attitude towards physical education classes, participation in new school-based exercise programs, leisure time activities.
3. Parents: Caretaking (presence, cooking, family activities) and physical activity.

The interview guide for school directors mainly focused on the school environment. There were six leading questions regarding childhood obesity: changes observed in children's dietary and physical activity habits after FLAL implementation, unchanged habits, strengths and weaknesses regarding FLAL implementation in the respective school, parent support and proposed changes for a more effective healthy lifestyle promotion.

**Pre-Test**

The children's interview guide was pre-tested at the Latin American School in Bern, Switzerland, and adapted thereafter thoroughly. Both interview guides were checked for face validity by local representatives of the Chilean Health Promotion Unit in Punta Arenas and pre-tested again at the first school in Chile. As no changes had to be made thereafter, this data was included in the results.

**Data Analysis**

All audio recordings were transcribed ad verbatim. Notes and pictures of observations were stored in a separate file. The data was analyzed according to structural qualitative content analysis. (22) Coding
was done with ATLAS.ti software (Windows, version 8). The interviews were read and reread, memos were written, 37 codes were established in an inductive way, and then grouped into three code groups in an iterative way. For this publication, quotations were translated into English. To improve readability, the results were grouped into the four themes of school environment, family environment, children's awareness, and behavior.

**Ethical Approval**

The study was carried out in accordance with the Helsinki Declaration for biomedical research. The Magallanes region’s Health Ministry (Secretaría Regional de Salud de Magallanes y Antártica Chilena) gave its consent to this study (date of approval: 19.01.2018). Furthermore, permission to carry out the research on campus was given by the school directors. Parents of the interviewed children and interviewees gave their written consent to participating in the study. Children gave their verbal consent. As no health-related data was collected, the approval of the Bern Cantonal Ethics Committee was not necessary according to the Swiss national regulations (Federal Act of 30 September 2011 on Research involving Human Beings, Switzerland).

**Results**

The directors of four primary schools gave their consent to the research. Two of the schools are public, two are private with subsidies from the municipal government (Table 1). Three of them offer free school meals for children of disadvantaged families. All schools are attended mostly by middle class students, have high obesity rates and the government label for healthy lifestyle promotion.

Table 1: Characteristics of schools of the city of Punta Arenas recruited for the study

<table>
<thead>
<tr>
<th>Schools</th>
<th>Characteristics</th>
<th>Funding</th>
<th>Childhood Obesity Rate at School **</th>
<th>Socio-economic Status of Students***</th>
<th>Students’ Sex</th>
</tr>
</thead>
<tbody>
<tr>
<td>School 1</td>
<td>Public</td>
<td>≥35%</td>
<td>Middle/low</td>
<td></td>
<td>Mixed</td>
</tr>
<tr>
<td>School 2</td>
<td>Public</td>
<td>≥35%</td>
<td>Middle</td>
<td></td>
<td>Mixed</td>
</tr>
<tr>
<td>School 3</td>
<td>Private/subsidized</td>
<td>≥30%</td>
<td>Middle/low</td>
<td></td>
<td>Girls only</td>
</tr>
<tr>
<td>School 4</td>
<td>Private/subsidized</td>
<td>≥25%</td>
<td>Middle/(high)</td>
<td></td>
<td>Mixed</td>
</tr>
</tbody>
</table>

Sources: * (18); ** (23); *** (24).
A total of 21 interviews were carried out: 17 with groups of children from the different schools and one with the director of each school. Further, 13 informal interviews were held with teachers, cafeteria staff (school meals) and kiosk managers (Table 2).

Table 2: Interviews carried out in the four schools of the city of Punta Arenas

<table>
<thead>
<tr>
<th>Schools</th>
<th>Interviews</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Children (# of groups)</td>
<td>Directors</td>
</tr>
<tr>
<td>School 1</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>School 2</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>School 3</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>School 4</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>4</td>
</tr>
</tbody>
</table>

School Environment

The four schools had implemented several strategies to improve child nutrition: Information leaflets about healthy child nutrition had been distributed to parents, and playful pedagogical tools rewarded children for bringing a healthy snack. Observations revealed, however, that many children consumed energy-dense snacks like cookies and juices. Others brought the healthy snack only for getting the reward. In an informal interview an interviewee stated:

*Sometimes they bring the fruit for “Peraman” [“Pear man”, pedagogical tool] only and then throw it away (Assistant, School 4, informal interview)*

Three of the four school kiosks had closed after a drop in sales, as their offer had been reduced by the FLAL to healthy foods. The fourth kiosk continued to operate and offered salads as a snack. However, an informal interview revealed that foods banned by the FLAL from kiosks were still available at schools, as some students had started to secretly sell junk food.

*The older girls sometimes sell candy at school because there is no kiosk anymore. I don't criticize them, but I think they are very intelligent and entrepreneurial (Teacher, School 3, informal interview)*
The composition of school meals had changed due to the FLAL. Calories had been reduced by e.g. decreasing the fat content of flavored milk and the sugar content of cooked fruit, and increasing the offer of vegetables. Yet, the informal interviews with cafeteria staff revealed that many children left them on the trays due to the different taste, as they did with the vegetables. Moreover, sweets and unhealthy snacks continued to be consumed for celebrations. For the festivity of Teacher’s Day for instance, CP observed that mothers brought cakes, pastries, potato chips, juices and soft drinks for breakfast. They explained in an informal interview that, after the Law had taken effect, they had organized celebrations with healthy foods, but children had not eaten them.

The schools had also implemented strategies to increase the physical activity of their students e.g. by making breaks less sedentary. The fitness equipment on the playgrounds however was used mainly by children of the first four grades. No teacher-led organized activity could be observed during the breaks and children did not use the games painted on the floor.

*Especially from the fifth grade upwards, [...] the girls sit in the breaks [...] The use of the cell phone is a priority tool for them and this makes them indifferent to some of the activities we organize.* (School director, School 3)

Observations and informal interviews revealed that during physical education class, the children were sitting around or playing games of low physical activity. Children stated that the classes were boring because the activities were repetitive.

*I don’t find them entertaining at all, they are repeated all the time. [...] And when they tell us we’re going to do tests, we always play tag. We could play other games. In first grade we played at climbing ropes but now we don’t anymore* (Children group 4, School 2)

Obese children only performed low-impact activities. Teachers stated in the informal interviews that they lacked the necessary tools to support them and feared that they might present some health problem in class. Some parents exempted their obese children from physical education.

*Obese children do not participate in physical education, it is complicated because they get tired. As a teacher one does not know how much effort they can make without having a health problem.* (Physical education teacher, School 1, informal interview)

To fight childhood obesity, the schools offered a range of extracurricular physical activities, either as afterschool activity for children or on Saturday afternoons for the whole family. However, few attended, and often not those with weight problems.

*On Saturdays the physical education teacher has been organizing afternoon games with fun dance for the whole family, [...] those who go are few, [...] and those who go are people who do not have the problem of obesity and those who have it do not come.* (School director, School 3)
In general, teachers’ motivation for the topic was often limited, mainly due to three reasons: Firstly, many of them felt that parents were not concerned about childhood obesity, and that they gave all responsibility for its management to the school.

_I feel that parents don’t care until they see them [the children] sick, with a prediabetes or something like that._ (School director, School 4)

Secondly, many programs and activities regarding childhood obesity were being offered by various government institutions without coordination. Schools were often overrun with various similar activities, without follow-up or reporting of results and thus felt a lack of coordination, efficiency and even of continuity from the government.

_I think it would be good to have better coordination [...] Suddenly there is a program that comes from the CESFAM [Family Health Centers, first health contact point], one from the SEREMI [regional department of the Chilean Ministry of Health], another from the Municipality and it is like they all aiming to the same thing with activities that are a little different, but among them there is no coordination_ (School director, School 2)

**Home Environment**

Most of the parents worked and came home much later than their children, many of them single parents. After school children were left in the care of grandmothers, siblings or alone. Some had to take care of younger brothers or sisters. Many children therefore prepared their meals alone based on the available ingredients, food preferences and cooking ability.

_When I get home, I make my own noodles [...] I love them_ (Children group 3, School 3)

Even if the parents cooked, they usually prepared fast and convenience foods, as time to prepare more elaborate meals was lacking.

_[…] now there are many more mothers who work, there are single mothers who must work until 8 or 9 pm; then there is no time to make a space to cook. One understands that the poor lady must arrive tired_ (School director, School 2)

Many of the families had limited access to healthy foods and considered these expensive. Parents thus gave their children mainly cookies and juices as snacks, although children knew that these are not healthy.

_[…] I prefer to eat [snacks] without sugar but sometimes as my mom doesn’t have that much money and these [cookies with sugar] are sometimes cheap, and she buys me these_ (Children group 6, School 3)

Children usually went to school by car or school bus. Many children said they disliked walking, amongst other things because of the bad weather. Daily physical activity was therefore lacking. Children moreover felt that parents did not motivate or support them to participate in sport or physical activity after school.
No, my mom doesn't take me to soccer anymore because she always has important things to do (Children group 1, School 1)

On the other hand, children reported having access to electronic devices such as cell phones and television, regardless of their family's socioeconomic status. Almost all children owned a mobile phone, even in schools in the most vulnerable areas. The use of electronic devices was rarely controlled by parents or caregivers. Children did not have any supervision regarding electronic device use or bedtime.

Does anyone tell you to stop watching TV or cell phone? No, I turn it off when I get hungry (Children group 4, School 1)

No, I stay up all night watching videos (Children group 6, School 3)

Another problem proved to be parents' perception of their children's nutritional status. Often, they did not seem to recognize overweight or obesity in their offspring. Some of them felt offended if their child was considered overweight or obese. Others believed the excess weight to be temporary and assumed their child would reach normal weight in adolescence due to growing.

[...] they do not see the problem, and if they see that they are chubby they think "it is healthy and it will grow [...] they are significantly overweight, but as they have not presented any disease yet, it is not of concern (School director, School 4)

Even when parents were aware of their children's unhealthy nutritional status, many did not take them to the health center for monitoring. Children thus did not receive the necessary attention, potentially worsening their weight problem over the years.

Children's Awareness and Behavior

Children knew that foods with warning labels were unhealthy. They identified "junk foods", usually relating to fast foods such as French fries, as well as healthy foods such as fruits and vegetables.

I: What are these [black labels on cookie packaging]? K: They're high in calories, sugar. When they have that, they're junk [food]. (Children group 2, School 3)

Nevertheless, children described that it was hard to resist junk food. The same proved to be true regarding drinks: Although children knew that consuming water was healthy and essential for their growth, they chose what they liked best and were used to from home: Sugar-sweetened beverages.

What I like to drink most is soft drinks (Children group 3, School 3)

They don't drink much water. Here there is no culture of drinking water (School director, School 4)

Yet, children mentioned that they liked and consumed fruits. Their parents offered them fruit and reinforced that they were good for their health.
My dad tells me “what kind of food do you want to take”, and I choose an orange or sometimes a banana (Children group 4, School 2)

Most of the children ate only the vegetables lettuce, tomatoes and carrots. Many others were not even known by name, had never been tried before but were disliked anyway. When asked about the dishes they liked, children usually named those consumed at home like rice, meat, noodles, sausages and mashed potatoes. At school they tended to refuse to eat foods not familiar to them.

[I: What is the most common thing you eat at home?] K1+K2: Mashed potatoes with sausage. K1: Mashed potatoes is what I like best. K3: Hamburger, eggs, sausages. Today at my grandmother’s house there is mashed potatoes and sausages too. (Children group 4, School 2)

They don’t eat the vegetables, they eat only what they know and eat at home, rice, sausage potatoes (Cafeteria staff, School 1, informal interview)

Almost all children stated that access to unhealthy foods at home was easy. Although parents often hid and consumed them in secret, children knew about this and helped themselves without their caretakers noticing.

K1: They [parents] buy a big bag of snacks and say that the four of us are going to eat them, and always at night I go to bed and the three of them stay there eating them. I know where they are so I go to get some “ramitas” [a sort of snacks like chips] and eat them in my room. (Children group 2, School 3)

As mentioned before, many of the children spent time alone after school and decided how to use their free time. They chose to be online or sit in front of the television, with unlimited access to children’s programs, movies, games and videos.

K1: I’m not so much about going out and playing, I’m more about cell phones. K2: I’m more of a TV guy (Children group 4, School 1)

At the same time, children stated that they often got bored with these activities and felt trapped.

I’m only on my cell phone because I’m bored and don’t know what to do (Children group 1, School 3)

However, playgrounds and squares were not always in good condition and considered unsafe by parents and children due to the presence of marginalized people, aggressive stray dogs and heavy traffic on the surrounding streets. As a result, parents did not let their children go there alone and children themselves were scared to go.

They [parents] won’t let me go alone. [...] one day there was a mattress lying on the floor and there was a drunkard sleeping and I ran away with my sister (Children group 2, School 1)
There's a dog that foams at the mouth and he bit my friend one day and that's why they won't let me go outside [...] (Children group 6, School 3)

Security issues were also one of the reasons children did not participate in extracurricular activities after school.

The bad weather was another important reason why children did not engage in outdoor activities in their spare time. In some cases, caregivers wanted to prevent them from getting sick.

One time we went out for a run [in physical education class] and a boy’s mother complained that it was too cold. Yes, and now we're not going. Now we can't go outside anymore (Children group 2, School 1)

Discussion

To our knowledge this is the first study that explored how school representatives and children perceive the effects of the Chilean Food Labeling and Advertisement Law (FLAL) on schools, families and children. It further identifies important determinants of childhood obesity in the study region.

Our results indicate that according to the perception of the interviewees, the Law has little influence on the nutrition and activity behavior of primary school children and their families in Magallanes. Children know about healthy and unhealthy food, but this knowledge contrasts with their dietary habits and personal preferences. Although they know the significance of the new FoPL, they do not adapt their food choices. The parents’ lacking problem awareness regarding childhood obesity, unhealthy nutrition, lacking physical activity and excessive screen time counteract the public health objectives set with the FLAL implementation. Parents’ options appear to be severely limited by unfavorable working conditions, however. Schools on the other hand are overloaded with the different demands placed on them and with the lack of coordination between authorities. The findings of this study confirm that without changes in the family, the community and the working environment, it will be difficult to decrease childhood obesity in peripheral regions in Chile.

School environment

Several reviews report that school programs can be successful in preventing childhood obesity in high-income as well as in Latin American Countries, especially if they include interventions combining diet and physical activity. (25-28) For school interventions in Chile, evidence before the implementation of the FLAL is scarce and inconsistent. (29, 30) The current study found that schools in peripheral regions are making some efforts to improve their students’ dietary and physical activity habits. Teachers lack adequate pedagogical tools to teach about healthy lifestyles in an effective and sustainable way however. This is in line with Kain et al, (31) who describes that expert support may be crucial for a successful school-based intervention in Chile. Nutrition-specific training of classroom teachers was shown to enable them to play a key role in preventing overweight in their students. (32) Furthermore, for effective school programs, curricula need to be revised thoroughly. Special nutrition education programs
beyond existing health curricula delivered by teachers or specialists, nutrition education programs that were delivered across two or more traditional primary school subjects and experiential learning approaches (school gardens, cooking lessons, food preparation) proved to have the biggest impact on primary school children’s nutritional knowledge and behavior in a systematic review and meta-analysis. (33)

Schools involved in the present study had difficulties engaging parents. Insufficient parental involvement in healthy lifestyle interventions in Chile has also been described elsewhere. (31) Wang et al (28) showed that for high-income countries, the effectiveness of childhood obesity prevention programs was highest if they included home and community components. The importance of a community-based framework in school-based nutrition intervention programs was underlined further for efficient school-based interventions for Hispanic children in the US and Mexico. (26) Consequently, interventions in Chile and elsewhere should be reframed to involve schools, families and local communities for maximum impact.

The Chilean FLAL prohibits the sale of products high in critical nutrients in schools. In school kiosks in the capital, research showed a substantial reduction in the availability of foods high in calories, sugar and saturated fat after its implementation. (11) Our study suggests, however, that the Law may also have undesired side-effects, namely the closing of school kiosks, while unhealthy snacks continue to be consumed at schools, since the regulation of unhealthy foods does not apply to foods brought from home and bought elsewhere. In the capital, schools have started to restrict snacks brought from home according to the number of FoPL. (13) Nevertheless, approaches based on restrictions do not promote a true change in awareness and might lead to compensatory overconsumption of unhealthy foods outside of school.

Interestingly, in the present study the only kiosk that still operated was selling healthy foods successfully, showing that a healthy offer may influence students’ snack choice. Further research is necessary to identify promotors for such positive examples, however.

The current study found that school may be a place of contradictory messages. While children receive nutritional education, unhealthy food is consumed on special occasions and for celebrations. This is consistent with a study carried out in California, which reported that a significant amount of unhealthy foods and drinks are brought to schools for classroom rewards, celebrations and fundraising. (34) This practice might create a strong association between special events and unhealthy foods in children.

While different stakeholders developed FLAL, (9) this study calls attention to the lack of coordination between governmental institutions and stakeholder involvement in its implementation. More monitoring and evaluation in schools is required. The high demands placed on teachers by different programs and the negative impact of discontinued interventions has been previously reported in Chile’s Valparaíso Region. (31) In addition, this study shows how school staff have been demotivated by a lack of true school representative involvement in the design, implementation and evaluation of programs on the one hand, and competing governmental organizations on the other. Thus, the Law will not only require the well-designed system of monitoring and evaluation mentioned by Villalobos Dintrans et al (9). It must
also ensure implementing-stakeholder involvement at school-level. Finally, it must enable a coordination between governmental entities which outlasts changes in the ruling party to enable durable change.

Regarding school programs, it must be remembered that in Chile and elsewhere, the critical period for becoming overweight in childhood is before the age of 6 years. (2, 35) In fact, although this study did not assess BMI, most children in the participating primary schools were observed to be already overweight or obese. Therefore, preventive interventions might be more effective during the toddler and preschool years.

**Home Environment**

The home environment is a key factor in the promotion of a healthy lifestyle. (36) The results of this study revealed a complex interaction between the parents’ lack of problem awareness regarding childhood obesity, lack of time due to high workload and an unhealthy lifestyle within the family. Firstly, most parents were not aware of their children's unhealthy nutritional status. This phenomenon is not new and has been reported previously for people in Magallanes and for other populations such as Latinos and other ethnicities in the US and elsewhere (e.g. (36-39)). It is particularly common among low-income families. (40) Unconscious parents make it hard for governments to succeed with any approach.

Secondly, easy access to junk food at home was identified as a further determinant of childhood obesity in Magallanes. This is in line with the literature, which shows that home availability of healthy and unhealthy foods is positively associated with its intake. (41, 42) Snacking may contribute substantially to children's total energy intake (TEI). It represents 27% of TEI in Chile, a third of TEI in Australia and about a fourth in the US. (43, 44) Our results suggest a high intake of SBBs at home, in line with a study carried out 2016 in Santiago, Chile, which showed that home was the primary source of SBBs for preschool children and adolescents. (7) The results of the present study also reveal that parents are not a good role model for healthy eating. Yee et al. (42) illustrated in a meta-analysis that the effects of parental modeling on child food consumption behavior are homogenous and significant.

In Santiago de Chile, foods obtained from preschool children (<6 years) at home tended to have lower caloric densities than foods consumed at their day-care facility. (7) However, this study suggests that since the implementation of the FLAL, more importance has been given to the healthiness of school menus. Thus, caloric density may nowadays be higher in foods consumed at or obtained from home. This underlines the importance for policy makers to focus on the home environment.

Thirdly, the present study highlights how parents seem to ignore the impact of high levels of screen time on health or be unable to provide alternatives due to difficult working conditions. Heitzinger et al (37) showed a correlation between screen time and childhood overweight and obesity in Magallanes, while a systematic review confirmed associations between screen time and greater obesity, higher energy intake, poorer dietary quality and quality of life in children and adolescents. (45) Media consumption further correlates with children's exposure to commercials. (10, 46) Although the FLAL prohibits advertising products with FoPL to children younger than 14, it is a challenge to implement this restriction if children's media access and choice of programs are not controlled. Therefore, limiting screen time in
children and having a certain control over the content is a further crucial step in trying to resolve the childhood obesity problematic. In Chile and other countries with strong public health policy measures, this seems not to have been tackled so far. Parental awareness needs to be created, so they serve as role models: By reducing their own screen time, they have a positive influence on their children's screen-based behavior. (47) At the same time, parents need to have more favorable working conditions, so they have alternatives to leaving their children alone or with inappropriate childcare.

Parental modeling and encouragement have also been shown to influence the physical activity of children. (47-49) This is in good agreement with the present study, where parents and children show a predominantly sedentary lifestyle with little or no parental support for physical activity at school or during leisure time.

For the Latino population in the US, a review identified five main factors influencing childhood obesity: Parental influences (e.g. feeding practices, modeling), screen time, physical activity, food security and sleep duration. (36) The findings of the current study support this, as these factors also seem to play a crucial role in childhood obesity in the Chilean region of Magallanes. As a result, they should be considered in efforts of public health authorities. As the home environment exerts a strong influence on the children's lifestyle, changes will not be possible unless public health programs successfully involve parents and communities. Nevertheless, long working hours present an obstacle to any family or community-based program and need to be considered accordingly.

**Children's Awareness and Behavior**

Our results reveal that in Magallanes, the interventions induced by FLAL have not resulted in changed dietary habits or in a strong healthy lifestyle awareness in children themselves. Some of the reasons for this lack of outcome may be found in schools and the home environment and have been discussed in the above sections.

We found that children knew the black FoP warning labels, which allowed them to differentiate foods high in sugar, saturated fat and sodium. The approach chosen in Chile, which combines FoPL with nutrition education, has had an impact on children's nutrition knowledge. In other studies in Latin America, FoP labels without educational strategies did not influence healthfulness perception of children 6-9 years of age. (50) This underlines the importance of the combination of measures. However, in contrast to other studies (13, 51), our findings do not suggest that the labels significantly influence children's food choice. Desensitization might play a role, as children in the present study had been exposed to FoPLs for a longer time than the participants in other studies. Moreover, the warning labels seem to be especially important for foods formerly perceived to be “healthy” by children and their parents. (13, 50, 51) In line with this study, literature shows that for primary school children, knowledge does not necessarily translate into healthy behaviors. Aspects like social acceptability, eating context, texture, pleasure and versatility influence their food choices, (14) while other studies underline the importance of taste on preschooler and adolescent food selection. (52)
Our results reveal the narrow range of foods children in the study region are exposed to at home, possibly also due to high prices of fresh foods in this remote region. This may lead to the reported rejection of all unfamiliar or unpopular foods at school. There is a vast body of literature underlining how important the familiarity of foods is for child acceptance, and how it is shaped in the fetus, as an infant and a small child (e.g. (40, 53)). Children in our study region are being exposed to a low dietary diversity, especially regarding fruit and vegetables. They are being conditioned to prefer energy-dense and nutrient poor foods. Therefore, dietary interventions at schools may set on too late. Children need to be exposed to new or disliked foods repeatedly at an early age, by tasting them in a supportive environment. (40) One promising way would be to include experiential learning approaches (54) and hands-on experiences like cooking education. (55)

Regarding leisure time activities, the results of the present study suggest that children consciously opt for screen-based activities, partially because of scarce alternatives. Previous studies report a higher probability of children being active, when street connectivity was lower, safety from crime was better, walking/cycling facilities were available, and play areas were suitable (e.g. (46, 56)). All these factors are lacking in our study area, decreasing the physical activity in children. Thus, interventions tackling childhood obesity should also consider the built environment.

We are aware that our research has several limitations. The first is that only schools pertaining to the Health Promoting Educational Establishments participated in the study on a voluntary basis. Their accomplishments had been evaluated very well by the government. Thus, we might have a positive selection bias, not including schools in our sample which face the biggest difficulties in promoting a healthy lifestyle. The second limitation is that we did not interview the parents of the children, who could have added a “missing piece” regarding the home environment. Moreover, the time span between the implementation of FLAL and data collection may have been too short to identify a notable change in awareness and lifestyle habits. Moreover, the qualitative design of the study does not allow for the identification of causal relationships.

This study was carried out in Magallanes, a remote region of the country. Although the results cannot be generalized to other regions in Chile, they may indicate some of the special challenges peripheral regions in Chile face.

**Conclusions**

The current study shows that in a peripheral region, the influence of the Chilean Food Labeling and Advertising Law on school programs and children’s lifestyle is limited. Schools are subject to a challenging environment, where multiple demands are placed on them by governmental institutions without the necessary empowerment, expert support, and funding. Parenting behavior and parental modeling regarding a healthy lifestyle are lacking, and caretakers hardly involve in school activities. In conclusion, policies and laws on childhood obesity prevention have limited effect if they are implemented top-down and are not combined with education and resources for education. Furthermore, strategies
must actively engage parents and communities, and change some of the framework conditions like work schedules of caregivers to be successful.

**Abbreviations**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>CESFAM</td>
<td>Centros de Salud Familiar (Health Centers)</td>
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<tr>
<td>FLAL</td>
<td>Food Labeling and Advertising Law</td>
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<tr>
<td>FoPL</td>
<td>Front-of-package label</td>
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<tr>
<td>SEREMI</td>
<td>Secretarías Regionales Ministeriales de Salud (regional department of the Chilean Ministry of Health)</td>
</tr>
<tr>
<td>SSB</td>
<td>Sugar-sweetened beverages</td>
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<tr>
<td>TEI</td>
<td>Total energy intake</td>
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<tr>
<td>US</td>
<td>United States of America</td>
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</table>

**Declarations**

**Ethics approval and consent to participate**

The study was carried out in accordance with the Helsinki Declaration for biomedical research. The Magallanes region’s Health Ministry (Secretaría Regional de Salud de Magallanes y Antártica Chilena) gave its consent to this study (date of approval: 19.01.2018) and school directors gave permission to carry out the research on their campus. Parents of the interviewed children and interviewees themselves gave their written informed consent to participating in the study. Children gave their verbal informed consent. As no health-related data was collected, the approval of the Bern Cantonal Ethics Committee was not necessary according to the Swiss national regulations (Federal Act of 30 September 2011 on Research involving Human Beings, Switzerland).

**Consent for publication**

Not applicable.

**Availability of data and materials**

The datasets generated and analyzed during the current study are available in the Zenodo repository at the following link: https://zenodo.org/record/6567017

**Competing interests**

The authors declare that they have no competing interests.
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Authors’ contributions

CP and FP were involved in the conception and design of the study. CP collected and analyzed the data, with substantial revision by FP. FP prepared the manuscript in consultation with CP and supervised the project. Both authors read and approved the final manuscript.

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Authors’ information

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References

7. Rebolledo N, Reyes M, Corvalán C, Popkin BM, Smith Taillie L. Dietary Intake by Food Source and Eating Location in Low- and Middle-Income Chilean Preschool Children and Adolescents from


