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Title

Healthy Snacks in School: How Do Regulations Work? A Mixed-Design Study

Abstract

BACKGROUND: School is an important setting to promote healthy eating habits for children. We compared the effects of 4 conditions on the nutritional quality of snacks brought to school. We also investigated teachers' opinions regarding the process, barriers, and facilitators in regulation implementation.

METHODS: We compared the nutritional quality of morning snacks based on 1958 photographs from schools divided into 4 conditions: regulation based on a list of permitted foods and beverages; regulation banning sweets, chips, and sugary drinks; information without regulation; or no intervention. Based on 5 focus groups (n = 18 participants), we investigated factors influencing regulation implementation.

RESULTS: In schools with a list of permitted foods and beverages, 76% of the children had a healthy snack, compared to 52% to 54% in the 3 other conditions ($p < .01$). They also brought less sweet foods compared to those in the other conditions (41% vs. 68% to 71%, $p < .01$). In focus groups, most teachers supported regulation but also expressed ambivalence about their legitimacy.

CONCLUSIONS: In this study, a regulation based on a list of permitted foods and beverages showed the best results. All actors should be involved in a progressive implementation process to increase acceptance of such regulation.

Keywords

School, snacks, regulation, healthy eating, evaluation, mixed-design

Developing healthy eating habits in children is a public health priority aimed at reducing the incidences of chronic disease.[1] However, a large gap is visible between food intake recommendations and actual intakes in children and adolescents. A European study reported that adolescents eat only 50% to 60% of the recommended amount of fruit, vegetables, milk, and dairy products, but their consumption of meat, meat products, fats, and sweets exceeds the recommendations.[2]

Schools play a critical role in promoting healthy habits because a large majority of children of diverse ethnic and socioeconomic groups spend a significant portion of their time there.[3] Traditional approaches to school-based obesity-prevention programs have focused on educational initiatives, including nutrition education, physical education, staff health education,[4] and/or environmental measures, such as provisions of healthful foods or beverages, quality standards for competitive foods and beverages, and quality standards for school meals.[5] Strong evidence supports the beneficial effect of obesity-prevention programs, but it is unclear yet which of these program components are the most effective.[6] To date, interventions based on informing and educating children and their parents have shown limited effectiveness. For example, a cluster-randomized trial called “Great Taste, Less Waste” tested the impact of a 22-lesson in-class curriculum message, supplemented by communication with teachers and parents, to motivate children to bring more fruits and vegetables and fewer sugar-sweetened beverages (SSBs) to school. The trial conducted in almost 600 children aged 8 to 9 years aimed to capitalize on the synergy between healthy eating and green or ecologically friendly behaviors. Despite rigorous design and development and relatively high intensity, the evaluation, based on digital photography of the snacks before and after the intervention, showed no difference in consumption of fruits, vegetables, or SSBs between the intervention and control groups.[7] As education seems important but not sufficient, experts have recommended the development of population-based approaches that make it easier for

people to make healthy choices, rather than asking them to change their behavior.[8,9] Regarding snacks, research has demonstrated that children will choose less healthy options if those are offered at the same time as healthier ones.[10] Therefore, standards or regulations regarding snacks' nutritional quality may improve children's diets. However, regulations focusing on food that schools offer and food from home vary greatly depending on the country, and systematic monitoring is often lacking.[11]

When introducing a regulation, the actors of the measure, such as teachers, have to be convinced of its soundness to play their required roles. In countries where individual freedom of choice is highly valued, regulations on what food children can eat at school may cause tensions among those who enforce the rules.[12]

In the case of Switzerland, young children cannot buy food or drinks during recess, but they can bring snacks from home. Children are free to bring a morning snack, and they are supposed to have had breakfast at home before coming to school. The children can return home for lunch, or parents can register them at a school cafeteria where they will receive a meal following nutritional standards. After trying to provide information and educational measures regarding the nutritional quality of the morning snacks brought to school, which led to unsatisfying results. In 2010, the School Health Service of the Canton of Geneva started offering support to schools that wanted to introduce school regulations regarding morning snacks. By 2017, 40 schools out of 157 had adopted 1 of the 2 types of regulations detailed in Table 1. Forty-seven schools offered various actions without institutional regulation, but 70 schools provided no specific actions on this topic. Consequently, schools enter four conditions described in Table 1.

Table 1

This configuration brought the opportunity to assess quantitatively and qualitatively the effects of 2 types of regulation based on positive (condition A) versus negative (condition

B) recommendations compared to information or no regulation. The first goal of our study was to compare the impact of the 4 conditions on the nutritional quality of snacks brought to school. As a second goal, we were interested in how the teachers perceived the process of implementation and the resources needed. The third goal was to investigate qualitatively the attitudes of the teachers involved in these different conditions toward regulation and to understand what the perceived barriers and facilitators were to the implementation of school regulation.

METHODS

This study used a mixed-methods design. To analyze the effect of the 4 conditions, we directly observed the nutritional quality of the food that children brought to school (April 2018). Furthermore, we investigated the process and resources needed to set up the regulations in place with questionnaires for the teachers (April 2018). To analyze the perceived barriers and facilitators of regulation, we conducted focus groups with the teachers (January 2019).

Direct Observation

The main part of the direct observation was to take pictures of the snacks brought to school by the children. We included the study in a course of methodology taught at the University of Applied Sciences, to teach the students attending the course how to conduct a study. The students were in charge of taking the pictures of snacks. When we contacted the school directors to obtain their approval and the names of teachers agreeing to be part of the study, we considered two factors to decide how many directors we should contact. First, because detecting differences in nutrients requires many observations, we wanted to include a maximal number of classes. Then, we had to take into account the number of students that

would be able to go on the field to take the pictures to have enough of them to cover all the classes.

Participants. Within each of the 4 conditions described in Table 1, we contacted school directors following a randomized order, taking into account the grade levels, the location (graduate students had to have time to visit three classes during one morning, see the procedures below), and cultural diversity. We contacted 31 schools, and 17 accepted (54.8%). The acceptance rate was 66.7% (6/9) in Condition A, 71.4% (5/7) in Condition B, 37.5% (3/8) in Condition C, and 42.9% (3/7) in Condition D. The main reasons for refusal were other ongoing projects and other priorities. After approval from the director, teachers volunteered to be part of the study, and we received their names from the director or the head. Teachers of 72 classes agreed to participate (= 72 teachers), representing 17 of 157 (11%) first-cycle schools (children aged 4 to 8 years) of the public schools of the canton of Geneva (Switzerland). We included five schools located in deprived areas (1 per condition and 2 in condition B) to control for the socioeconomic level of the population included. In the canton of Geneva, 24 schools (14%) are in deprived areas. Being classified in this category means that the school includes a high proportion of children with low socioeconomic levels and receives extra resources to face this situation.[13] Table 2 presents the detailed distribution of classes, children's ages, and school characteristics by conditions.

Table 2

Procedures. During two mornings in April 2018, 16 pairs of graduate students from the Nutrition and Dietetic Department of the School of Health Sciences visited 3 classes each. These 16 pairs covered the four conditions examined in this study. In the classroom, one of the students told a tale related to healthy eating, and another student documented the snacks that the children brought to school by taking pictures (1958 pictures). Following a script,

teachers asked the children to place their snacks on their tables and then move to another part of the classroom, to listen to the tale told by one of the students. This way, the children and the snacks were not associated. The teachers explained that the students wanted to take pictures of different types of snacks, while being careful to avoid stigmatizing the children with no snacks. Students placed each component of the snack on a black pad, including a graduated ruler, and took a picture. They recorded details not visible on pictures but essential for the nutritional analysis of food group intake, such as sandwich filling (eg ham, cheese, and jam), type of beverages, ingredients (eg with or without added sugar), or portion size. For this, they used a standardized form designed for the study. Students received a 2-hour training session to perform data collection, and all procedures were pretested in 2 classes. We did not perform inter-rater reliability analyses. Children and parents were not aware of the study to avoid any social desirability bias.

Data analysis. Based on the snack pictures, 2 certified dietitians coded the snack components into a project-specific database following the same procedure. They categorized each food or drink into one or several food groups, following the Swiss definitions,[14] and estimated the number of servings. In case of doubt, a third experienced dietitian was involved. The outcomes of interest were (1) the number of children bringing a snack to school, (2) the frequency of each food group, (3) the type of food brought to school, and (4) the proportion of children with a healthy or unhealthy snack. For this last part, we categorized snacks brought to school as “healthy snacks” or “unhealthy snacks.” The dietitians categorized no snacks, fruit, vegetables, unsweetened food, refined food, whole-grain starchy food, unsweetened milk products, protein-based food (eg eggs and cold meat), 100% fruit juice, water, or nuts as healthy. The dietitians categorized snacks including at least one sugar-sweetened food or drink and a high-fat food as unhealthy. We used chi-squared tests to compare categorical

variables between conditions. We also analyzed the relative risk (RR) of having a healthy snack in condition A compared to other conditions.

Process and Resources Analysis

In each visited class, teachers filled out a questionnaire with questions regarding their satisfaction, the time spent with the management of snacks in their school, and their level of comfort doing it, as well as the potential reactions of parents. The research team developed and asked the following questions. As part of the management of morning snacks in your school, (1) are you satisfied with the intervention implemented in your school, (2) how much time does this intervention take you; (3) do you feel comfortable with the intervention implemented in your school (or with the absence of intervention for condition D); and (4) how did the parents react to the implementation of the intervention (not asked in condition D). Teachers answered using a Likert scale from 1 (totally disagree/not at all) to 7 (totally agree/absolutely). We used Kruskal–Wallis tests to compare the 4 groups.

Qualitative Methods

Participants. All of the teachers (N = 72) that received visits from our student pairs were invited by e-mail to participate in the focus groups. We offered a cooking book with balanced recipes as an incentive. Eighteen participants from 5 schools, including 17 teachers (1 man) and 1 school nurse engaged in 1 of the 5 focus groups. Among the 18 participants, 3 (16.7%) belonged to condition A, 5 (27.8%) to condition B, 5 (27.8%) to condition C, and 5 (27.8%) to condition D.

Procedures. The focus groups took place within the schools at a convenient time for the participants. One certified dietitian led the discussions, and an observer took notes on the interactions. Discussions lasted an average of 39 minutes and were audiotaped. All of the

participants signed consent forms, allowing the recording and ensuring confidentiality. Confidentiality meant that the focus group discussions were not repeated outside the group and that the data would be analyzed without associating names and opinions.

Based on quantitative results of the snack analysis, the research team developed and pretested a semi-structured questionnaire grid, which included open-ended questions aimed at obtaining participants' opinions about barriers and facilitators to regulation. These questions were related to their perceived readiness and competence to apply the rules; the factors facilitating or complicating the implementation of rules; their agreement with the regulation; their perceived role in the project; the parents' reactions; the reasons for fear or refusal of the rules; and their opinion of the support that is needed to facilitate the implementation of the rules, including training, tools, and materials. We asked teachers about the condition implemented in their school, but also about their opinion on other conditions.

Data analysis. We transcribed the recordings verbatim without including the names or personal details of participants. We used the approach of qualitative description, with low-inference interpretation[15] to analyze the data. We followed the six steps described by Braun and Clarke to conduct thematic analyses[16] and applied an inductive approach to identify themes linked to the data. We analyzed the transcripts by coding conceptual similarities and differences and then identifying predominant and relevant themes. Two researchers conducted the process in parallel and shared their findings to ensure the reliability of the codes and themes. Then, they synthesized, classified, and analyzed the themes to answer the predefined research question: What are the barriers and the facilitators to the adoption of a positive regulation? For this manuscript, we translated citations from French into English.

RESULTS

Direct Observation

Most of the children brought a morning snack to school, but the percentages were significantly different between conditions ($p < .01$). In detail, 53% of children in condition A brought a snack compared to 64% in condition B, 67% in condition C, and 68% in condition D.

The proportion of children having a sugar-sweetened product varied significantly between conditions ($p < .01$). Despite the prohibition of sugar-sweetened products in condition A, 41% of children had a sugar-sweetened food or beverage in their snack. In the other conditions, 68% to 71% of children had a sugar-sweetened food or beverage in their snack. The more prevalent sweet foods included cookies, cereal bars, cakes, chocolate bread, and sweet rice cakes, and the sugar-sweetened beverages included fruit drinks, flavored milk, and iced teas. The proportion of children having fruit or vegetables also varied significantly between conditions ($p < .01$). Almost half of the children who brought a snack in condition A, had a fruit or vegetable, while 32% had a fruit or vegetable in condition C. The more prevalent fruits and vegetables included apples, applesauce, bananas, grapes, dried fruits, carrots, cherry tomatoes, and cucumbers. Table 3 describes the frequencies of consumption for each food group among the children who brought snacks.

Table 3

The proportion of children bringing a healthy snack (including no snack) differed significantly between conditions ($p < .01$). About three-quarters of children from condition A had no snack or a healthy snack, compared to 54%, 52%, and 52% in conditions B, C, and D, respectively. When considering only children who brought a snack, 54% of the children had a healthy snack in condition A, compared to 27%, 28%, and 30% in condition B, C, and D ($p <$

.01), respectively. Among the children who brought a snack, children in condition A had a significantly higher chance of having a healthy snack compared to children in condition B (RR 2.01, CI 1.61–2.52), C (RR 1.94, CI 1.45–2.60), and D (RR 1.84, CI 1.37–2.48).

Process and Resources Analysis

Among the 72 teachers we asked to answer our questionnaire, 69 responded. Compared to teachers from condition D, teachers from conditions A, B, and C were significantly more satisfied with the management of morning snacks (median [Med] of condition A = 7.0, interquartile range [IR] = 1.0; Med of condition B = 7.0, IR = 2.0; Med of condition C = 7.0, IR = 1.3; Med of condition D = 4.0, IR = 3.5; p = .005) and were more comfortable with the intervention implemented in their school (Med of condition A = 7.0, IR = 1.5; Med of condition B = 7.0, IR = 1.0; Med of condition C = 7.0, IR = 1.5; Med of condition D = 4.0, IR = 3.0; p = .004). Teachers from all conditions stated that managing morning snacks only took them a small amount of time. Among the conditions with an intervention (A, B, and C), teachers reported that parents had neutral (47%) or positive (51%) reactions.

Qualitative Analysis

In the first part of the study, a positive regulation of a permitted food and beverages list appeared to be more favorable in improving the nutritional quality of snacks brought by the children. The thematic analysis highlighted several factors favorable to the implementation of such a regulation in schools. On the other hand, teachers in the other conditions mentioned their ambivalence and saw potential obstacles toward such a regulation in their school. The favorable and unfavorable factors that emerged from the qualitative

component of the study are illustrated in Figure 1 and discussed in detail in the following subsections.

Figure 1

Factors Favoring the Implementation of Condition A

Progressive implementation. The focus group participants unanimously felt that a gradual approach was necessary to foster the buy-in of teachers, parents, and children. Teachers already applying condition A noted that their school easily implemented the regulation in their school thanks to a series of preceding educational interventions. In the participants' view, a progressive approach seemed necessary to (1) convince teachers to start the project through upstream preparation and discussions to anticipate possible reticence and consensus, such as, "It is true that there was a lot of upstream discussions between teachers who were like, 'But I like my chocolate bread during the break!'" (condition A). (2) A progressive approach needs to involve parents from the beginning of the project and pass on ideas of cheap snack alternatives through various actions: "Over 2 years, we have done a lot of actions, like this big party, where parents could see lots of different healthy snacks on different stands with exhibitions, games on food, and things like that. And the third year, we went into action. We were anxious, but it worked!" (condition A). (3) Finally, the progressive approach allows children to become accustomed to new snacks. Teachers at schools with regulations pointed out that after the preparation phase, the children adapted quickly to their new snacks: "And finally, little by little, they started to taste other things and adapted to the healthy snacks" (condition A).

Internal cohesion. A strong internal cohesion within the institutions, meaning that all the actors worked in the same direction, seems necessary to adopt regulation and for coherent

application. Teachers also insisted on the importance of the support of all the parties involved, particularly the school management: “At the information session, an official announcement by the nurse or even the director. I have the impression that there is also a notion of hierarchy in this intervention that may be useful” (condition C).

Some teachers of condition B noted that it was sometimes difficult to have a shared definition of healthy snacking, which led to a less consistent application of the regulation. “It is difficult to apply a team decision because each of us has their own interpretation of certain words. In the schoolyard, it’s easy. It’s ‘no soccer ball.’ That’s very clear. But for snacks, we easily allow a cookie with a little chocolate in it, and then, it’s confusing for children” (condition B). A regulation based on a list of permitted foods and beverages, such as condition A, would elicit more consistency and, therefore, be easier to apply with cohesion.

Visual materials for parents. Providing information to parents appeared to be an essential part of the implementation process. Teachers appreciated this approach, which was consistent with their roles. According to the teachers, some parents may also lack nutritional knowledge. Having formal educational material to present to all parents would facilitate the intervention’s implementation. The material should provide alternative ideas for healthy snacks, be visual for understanding by foreign parents, be framed in a positive way, and be colorful and attractive.

Positive effects of regulation. As the rules applied to all, the children self-regulated, or parents regulated the children. Teachers noted that children were proud to do well. Teachers who set up rules in their school have also seen several other benefits, such as a reduced volume of waste (fewer prepackaged industrial snacks) and less fights among children (jealousy, theft, etc.) during recess by creating equality between children.

Barriers and Ambivalence

Concerns. Teachers who did not work in a school that applied the condition A regulation mentioned apprehension about such a regulation, as described in more detail below. The focus group with the teachers of condition A showed the unreasonable side of all these concerns, which may be due to a lack of knowledge about the project's implementation.

Teachers perceived their primary role as conveying information, and they did not wish to endorse a repressive role. First, they did not feel comfortable deciding which snacks to allow or forbid, and they did not want to play the role of a police officer who searches school bags for forbidden snacks. In fact, the teachers of condition A did not seem to anticipate this, reporting that, once the regulation was in place, their role was ultimately one of informing more than of policing.

Teachers in the conditions without regulations worried that rules would be too rigid and would not allow exceptions for special occasions, such as school trips. Some complained that candy or chips would be banned, while casual consumption was less unhealthy. They were concerned about giving the wrong message when applying the regulation. Considering exceptions for school trips or birthdays increased the acceptance of such a regulation.

Teachers feared parents' reactions. However, the teachers from condition A testified that the vast majority of parents responded well, and those teachers noted the absence of conflict. Finally, some teachers were frightened of harming hungry children by depriving them of unhealthy snacks.

Role and legitimacy. Aside from their concerns, teachers were ambivalent about their role. Teachers of conditions B, C, and D worried that applying strict rules for snacks would be too intrusive for parents. The question of the teachers' role was discussed: what belongs to the

school and what belongs to the families? Some teachers feared interfering with the parents' personal freedom: "After all, it's something that comes from families, so we should work not only with children, but maybe with families too. And it may become something intrusive" (condition D).

Teachers believed that the regulation would be better accepted and more legitimate if health professionals introduced the initiative (eg, the School Health Service). Moreover, it would relieve them of a project perceived as educational, so that they could concentrate on teaching. Indeed, the teachers perceived introducing a rule regarding healthy snacks as assuming a new educational responsibility: "I think we feel more legitimate to teach them to count and read than to teach them how to eat. [. . .] I cannot see nutrition as a priority—for the moment, anyway" (condition D).

In condition A, these reluctances and the question of legitimacy were also present, but they disappeared following the implementation. The teachers viewed the regulation as the culmination of a consistent approach to information and a support for change: "Finally, it's been done slowly and raised awareness of the family. We are here just to check, explain, and give back the information at the beginning of the year. This role suits me" (condition A).

Personal practices and representations. In general, teachers who participated in the focus groups felt well informed about healthy snacks. However, another element underlying their ambivalence was the relationship that each teachers had with food. Some teachers expressed a contradiction between a strict rule imposed on children and the fact that they enjoy eating ice cream, sweets, or chocolates in the teachers' rooms: "Among our colleagues, we are food lovers who like small sweets during recess" (condition A).

Lack of time. Lastly, the teachers reported conflicts with numerous other educational challenges. They questioned the adequacy of investing energy to promote healthy snacks rather than dealing with other high-priority problems. They anticipated that the application and follow-up of the rules would cost time, and they already faced a heavy workload. Even if the time devoted to snack management were not different between conditions in this study, the preparation and implementation of the regulation required time from all stakeholders.

DISCUSSION

In this study, children in schools with a regulation based on a list of permitted foods and beverages (condition A) had snacks of better nutritional quality than children had in schools with a limited regulation (condition B), education without regulation (condition C), or no intervention (condition D). In addition, more children in condition A did not bring a snack to school, which is consistent with the messages children receive in class regarding a mindful approach to balanced eating and learning not to eat when not hungry.

Even if parents are aware of the importance of healthy snacks for their children, they face several barriers, such as lack of time, the convenience of prepacked industrial snacks, marketing pressure, and the fear that their children would not like or eat an alternative snack.[17] Therefore, environmental policy measures, such as school regulations, may facilitate healthy choices from individuals—in this case, from parents. However, in our study, not all regulations led to the same impact. Children in schools with a limited regulation that banned sweets, chips, and sugary drinks had snacks of similar nutritional quality compared with schools without regulations. Indeed, this regulation did not clearly prohibit all sugar-sweetened products, such as cakes, cookies, cereal, or chocolate bars. Contrary to what one might think, messages banning some types of foods appear to be more confusing for parents

and teachers than a clear list of allowed foods because banning all foods that are considered unhealthy would lead to endless lists.

Based on our results, a regulation based on a list of permitted foods and beverages should be favored to support the consumption of healthy snacks efficiently. Several arguments support the implementation of such a regulation. First, unlike interventions targeting individual education and behavior that may reach mostly educated parents, regulation applies to all children and families regardless of education or socioeconomic status and has the potential to reduce health inequalities.[18] It promotes the development of healthy habits at a younger age; most importantly, it ensures coherence with health messages promoted in class. Indeed, regulations should go with educational measures about healthy and mindful eating because children are confronted with unhealthy foods all around them and children have to learn how to consume them with awareness. In Switzerland, healthy and mindful eating is part of the official educational plan,[19] and didactic material, such as Senso5, is available.[20] Lastly, focus groups showed that the regulation applied in condition A resulted in less tension and fights between children, less waste, and cleaner schoolyards.

We observed that teachers who had not experienced regulation based on a list of permitted foods and beverages expressed some reluctance. In their view, regulations that restricted only some foods (condition B) were less invasive and more acceptable to parents. The results showed that condition B was less efficient and that parents reacted in a less conflictive way in condition A than in condition B. Public health measures often increase tension between the common good and individual freedom.[12] Furthermore, ethical consideration should be given to the justification, balance, proportionality, effectiveness, and acceptability of the measures.[21] In another qualitative study, school stakeholders, including parents, endorsed the majority of obesity prevention recommendations and supported the role

of schools in providing healthy food options and implementing nutritional standards for food sold in school.[22]

The progressive implementation and involvement of parents and other stakeholders are essential to overcoming instinctive negative reactions. Interestingly, while teachers from condition A did not feel any additional burden related to the regulation, teachers from schools without interventions had the greatest difficulties with managing snacks.

Finally, despite the total prohibition of bringing sugary food or drinks to condition A schools, these foods were in the photographs, without explanations by the teachers interviewed in the focus groups. This observation highlights the need for monitoring and follow-up to ensure consistent and sustainable implementation of the regulation.

Limitations and Strengths

The randomization of schools recruited for photographs is a methodological strength of this study. However, recruitment was complicated because we experienced many refusals of participation, especially in conditions C and D. However, the proportion of schools in deprived areas was equivalent among the conditions. In the present study, we conceived the absence of snack as being healthy because the regulation taught it this way. Even in a low socioeconomic population, food insecurity was not an issue when the canton of Geneva started to implement these regulations. This aspect of the regulation might need reconsideration with the new situation of the COVID-19 pandemic that actually affects the deprived areas of the canton, in particular.

Intervening only on the morning recess is not sufficient to modify the overall nutritional quality of intakes of children during the day. Besides, we did not assess the food consumed during the rest of the day in the present study, and children may eat unhealthy

snacks at another time of the day. However, the goal of the regulations was to familiarize them and their families to what a balanced diet included.

Nevertheless, this study sheds a unique light on the effects of several types of regulation or intervention, based on direct observation of the snacks that the children brought for recess. Future studies should measure the actual consumption of food and beverages, as well as children's weights and body images, to assess the impact of regulations in schools further.

Conclusions

Regulations based on a list of permitted foods and beverages are an effective measure to promote better nutritional quality of snacks in schools compared to limited ban regulations or educational measures without regulation. Careful, stepwise preparation and implementation that includes all stakeholders and parents should overcome teachers' ambivalence.

IMPLICATIONS FOR SCHOOL HEALTH

Based on this evaluation study, we identified recommendations to guide further action regarding the promotion of healthy snacks in schools.

- prioritize the implementation of a regulation based on a list of permitted foods and beverages compared to a limited regulation or to education without regulation;
- take into account the time needed for preparing teachers by discussing potential ambivalences and reassuring them;
- disseminate information on the regulation's feasibility in condition A and share good practices and experiences between schools to mitigate misrepresentations;
- plan for a gradual implementation of the regulation to improve acceptability for all stakeholders;

- involve parents from the beginning of the project and pass on ideas of cheap snack alternatives;
- develop and distribute visual material to facilitate communication with parents; and
- monitor schools and organize reminders for parents, children, and teachers.

Human Subjects Approval Statement

The local Ethics Committee on Research confirmed an exemption of a full examination process of this project because the procedure did not involve any direct data collection on children and no health data collection on teachers. The project received an authorization from the Research in Education Service and the General Primary Education Department.

Conflict of Interest Disclosure Statement

SBDT and IC declare they have no conflicts of interest. At the time of the study, SF worked for the School Health Service. She participated to the design of the study and the pre-testing of procedures, but was not involved in the analysis.

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REFERENCES

1. Mikkila V, Rasanen L, Raitakari OT, Pietinen P, Viikari J. Consistent dietary patterns identified from childhood to adulthood: the cardiovascular risk in Young Finns Study. *Br J Nutr.* 2005;93(6):923-931.
2. Moreno LA, Gottrand F, Huybrechts I, et al. Nutrition and lifestyle in european adolescents: the HELENA (Healthy Lifestyle in Europe by Nutrition in Adolescence) study. *Adv Nutr.* 2014;5(5):615S-623S.
3. Institute of Medicine. *Nutrition Standards for Foods in Schools: Leading the Way Toward Healthier Youth.* Washington, DC: The National Academies Press;2007.
4. Fagen MC, Asada Y, Welch S, et al. Policy, systems, and environmentally oriented school-based obesity prevention: opportunities and challenges. *J Prev Interv Community.* 2014;42(2):95-111.
5. Micha R, Karageorgou D, Bakogianni I, et al. Effectiveness of school food environment policies on children's dietary behaviors: A systematic review and meta-analysis. *PLoS One.* 2018;13(3):e0194555.
6. Brown T, Moore TH, Hooper L, et al. Interventions for preventing obesity in children. *Cochrane Database Syst Rev.* 2019;7:CD001871.
7. Goldberg JP, Folta SC, Eliasziw M, et al. Great Taste, Less Waste: a cluster-randomized trial using a communications campaign to improve the quality of foods brought from home to school by elementary school children. *Prev Med.* 2015;74:103-110.
8. Bleich SN. A Road Map for Sustaining Healthy Eating Behavior. *N Engl J Med.* 2018;379(6):507-509.
9. Institute of Medicine. *Preventing Childhood Obesity - Health in the Balance.* Washington, D.C.: The National Academies Press; 2005.

10. Beets MW, Tilley F, Kyryliuk R, Weaver RG, Moore JB, Turner-McGrievy G. Children select unhealthy choices when given a choice among snack offerings. *J Acad Nutr Diet.* 2014;114(9):1440-1446.

11. Lucas PJ, Patterson E, Sacks G, Billich N, Evans CEL. Preschool and School Meal Policies: An Overview of What We Know about Regulation, Implementation, and Impact on Diet in the UK, Sweden, and Australia. *Nutrients.* 2017;9(7).

12. Kahrass H, Strech D, Mertz M. Ethical issues in obesity prevention for school children: a systematic qualitative review. *Int J Public Health.* 2017;62(9):981-988.

13. Soussi A, Nidegger C, Dutrévis M, Crahay M. Un réseau d'enseignement prioritaire dans le canton de Genève: quels effest sur les élèves? *Revue Française de Pédagogie.* 2012;178:53-66.

14. Société Suisse de Nutrition. La pyramide alimentaire. 2012; Available at: http://www.sge-ssn.ch/media/sge_pyramid_basic_F_20161.pdf. Accessed Nov 17th 2020.

15. Sandelowski M. Whatever happened to qualitative description? *Res Nurs Health.* 2000;23(4):334-340.

16. Braun V, Clarke V. Using thematic analysis in psychology. *Qualitative Research in Psychology.* 2006;3(2):77-101.

17. Nepper MJ, Chai W. Parents' barriers and strategies to promote healthy eating among school-age children. *Appetite.* 2016;103:157-164.

18. Nickel S, von dem Knesebeck O. Do multiple community-based interventions on health promotion tackle health inequalities? *Int J Equity Health.* 2020;19(1):157.

19. Conférence intercantonale de l'instruction publique de la Suisse romande et du Tessin. Plan d'études romand. Available at: https://www.plandetudes.ch/home. Accessed Nov 17th 2020.

20. Fondation Senso5. Didactic material Senso5. Available at: https://www.senso5.ch/fr/materiel-didactique-senso5-81.html. Accessed Nov 17th 2020.

21. Nuffield Council on Bioethics. *Public health: ethical issues - a guide to the report.* London. 2007.

22. Bucher Della Torre S, Akre C, Suris JC. Obesity prevention opinions of school stakeholders: a qualitative study. *J Sch Health.* 2010;80(5):233-239.

Table 1. Description of the Four Conditions of Schools in the Canton of Geneva Regarding Morning Snacks

Condition	Type of intervention	Number of schools
A	School regulation based on a list of permitted foods and beverages: only food and drink without free sugars and high fat content (eg fruits, vegetables, unsweetened refined of whole grains such as bread, crackers or rice cake, unsweetened dairies, beverages with no added sugars) are allowed	19
B	School regulation based on a negative list: sweets, potato chips and sugar-sweetened beverages are excluded.	21
C	Various actions (information, workshops with parents, etc.) to promote healthy eating, but no regulation regarding the food and beverages for morning snacks.	47
D	No specific action regarding healthy eating and snacks (control condition).	70

Table 2. Characteristics and Number of Classes included in the 4 Conditions

Grade	Age of the children (year)	Condition A	Condition B	Condition C	Condition D
1st	4 - 5	4	5	3	4
2nd	5 - 6	4	7	4	2
1st + 2nd	4 – 6	2	3	0	0
3rd	6 - 7	7	7	4	3
4th	7– 8	1	7	2	2
3rd + 4th	6 – 8	0	1	0	0
Total number of classes		18	30	13	11
Total number of schools		6	5	3	3
Number of schools in deprived area		1	2	1	1
Number of participants to the focus groups		2	5	5	6

Table 3. Frequency of Intake of Each Food Group Brought to School by Children, Within Each Condition (Among Children Who Brought a Snack)

	A (N = 171)	B (N = 334)	C (N = 151)	D (N = *132*)	p
Fruit and vegetable (%)	48	35	32	44	< .01
UnSw refined starchy food (%)	29	20	26	20	0.09
UnSw whole grain starchy food (%)	11	9	3	8	0.05
UnSw milk product (%)	11	6	8	9	0.23
SuSw food (%)	39	66	63	66	0.01
SuSw beverage (%)	7	13	14	10	0.12
SuSw food or beverage (%)	41	71	70	68	0.01
Fruit juices (100%) (%)	2	4	3	2	0.66

UnSw: unsweetened, SuSw: sugar-sweetened

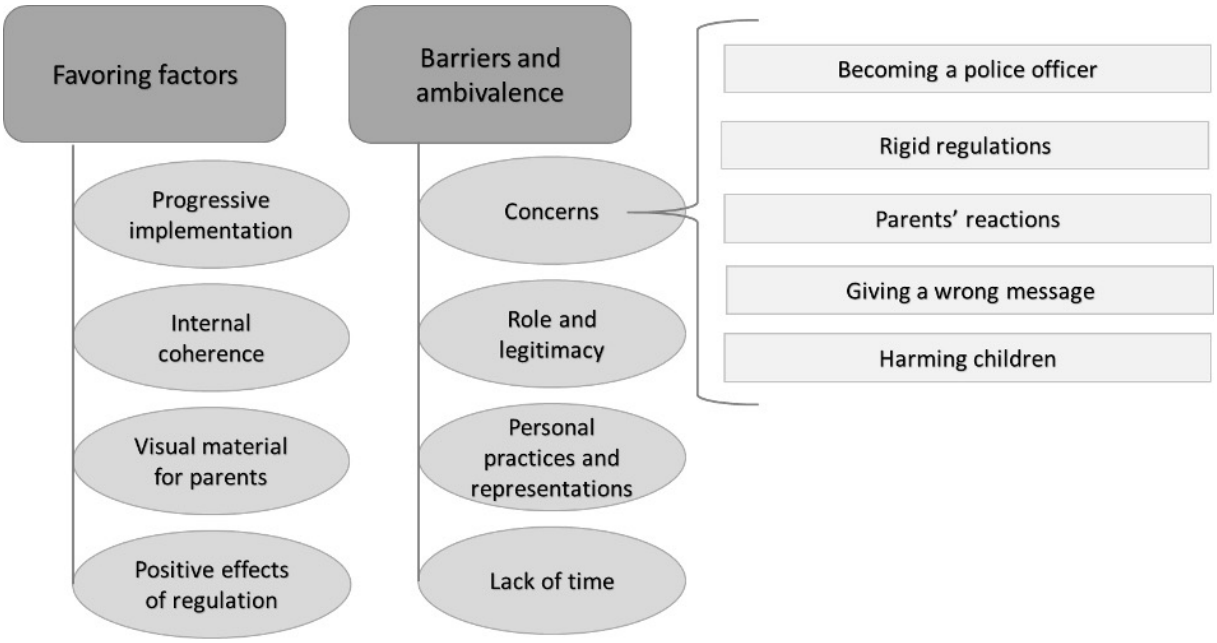

Figure 1. Favoring and Disfavoring Factors Viewed by Teachers Regarding the Implementation of a Regulation to Promote Healthy Snacks in School