How can health-promoting nutrition be offered at schools? A method for evaluating and optimizing school cafeterias.

Tamara Knopf [1,2], Julia Schatzer[2], Wolfgang Schobersberger[1]*, Friedrich Hoppichler[2,3], Birgit Wild[1], Manuel Schatzer[2]

[1]Institute of Sports Medicine, Alpine Medicine and Health Tourism, Private University for Health Sciences, Medical Informatics and Technology GmbH (UMIT Tirol), Austria
[2]Special Institute for Preventive Cardiology and Nutrition (SIPCAN), Elsbethen/Salzburg, Austria
[3]Division of Internal Medicine, Krankenhaus der Barmherzigen Brüder Salzburg, Salzburg, Austria

Abstract

Background: Studies have shown that eating behavior can be beneficially modified by changing the range of goods at school cafeterias. But most of these studies do not take the entire food and beverage offer into consideration and are also not feasible regarding all settings. Therefore, the research question is: Is the developed method and evaluation tool suitable for recording and optimizing the range of goods at school cafeterias and making it health-promoting?

Methods: Our study was implemented at 9 schools in Tyrol, Western Austria, where 6.597 students are taught. The developed method for the optimization of the food offer is divided into five phases and was designed as a tele project. The developed evaluation tool includes 29 criteria, which were defined as quantifiable objectives and assigned to 11 food groups. Descriptive statistics and the Wilcoxon Signed Rank test for paired and unpaired samples were used for data analysis.

Results: The average proportion of criteria fulfilled was increased from 60 to 86 percent. At the end of the study, all school cafeterias could be classified as health-promoting. Ten criteria changed significantly. The biggest changes were in the food groups "vegetables", "warm snacks", and "pastries".

Conclusion: With the developed method, it is possible to improve the food and beverage offer, regardless of the type of school cafeteria. The evaluation tool itself offered a clear orientation and individually achievable goals. The implementation of the method, which is based on tele-instruction, proved to be feasible, time, and cost effective.

Keywords: School cafeteria, Food and beverage offer, Nutrition, Obesity, Children.

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Introduction

It is known that suboptimal nutrition is the leading cause of poor health [1]. Recent data show that most children and adolescents do not consume the recommended amount of fruits, vegetables, and whole grains [2]. Moreover, children and adolescents show a large consumption of sugar sweetened beverages with intakes of free sugar higher than the World Health Organization (WHO) recommendation [3]. As the promotion of healthy eating and drinking behaviour in children has a positive effect on the prevention of chronic diseases in childhood and adulthood, such as obesity, diabetes, and cardiovascular diseases [4-5] and under the consideration that children consume approximately 40% of their total daily energy intake at school, it is essential to improve the food offered at schools [6]. Multiple studies have shown that some aspects of eating behaviour can be beneficially modified by changing the range of goods offered at school cafeterias by reducing servings of fat and sugar and increasing the availability of fruits and vegetables [7-8]. However, most of these studies do not take the entire food and beverage offer into consideration and are also not feasible regarding all settings [9]. Nevertheless, a growing body of literature suggests that school-based interventions affect health behaviour, but there are still remaining gaps in the literature and opportunities for further improvements in school food programmes [10-12].

The "Special Institute for Preventive Cardiology and Nutrition" (SIPCAN) was founded in Austria in 2005 with the goal to implement behavioural and environmental interventions. Therefore, SIPCAN specialized in developing and implementing school programmes [13]. A representative survey conducted by SIPCAN in cooperation with the University of Vienna, Austria, in 2018 showed that 73.5% of the Austrian schools (1.348 out of 1.834 schools from the 5th grade onwards) have a school cafeteria. This means that 81.2% of all students (455.923 out of 561.792) have access to foods and beverages offered at a school cafeteria. Thus, school cafeterias are a central component in the supply of food and beverages for young people in Austria. According to the theory of nudging, one approach to influencing students' nutritional behaviour is to create a health-promoting food supply [6]. For this purpose, school cafeteria owners were supported by SIPCAN regarding the practical implementation of a health promoting food and beverage offer. The study aimed to show that an overall health-promoting food and beverage offer can be easily implemented by using the developed approach with achievable goals in the various settings. Therefore, the

question that is addressed is: Is the developed method and evaluation tool suitable for recording and optimizing the range of goods at school cafeterias and making it health-promoting?

Methods

Study design and sample

The study took place between November 2018 and April 2019. It was designed as a tele project with process support towards a health promoting offer. The following inclusion and exclusion criteria were applied:

Inclusion criteria:

- Schools with a school cafeteria
- Schools from the federal state of Tyrol (Austria)
- The cafeteria owner is willing to cooperate

Exclusion criteria:

- Execution of only one evaluation

The schools were recruited from the "Healthy School Tyrol" project (n=7) with. In addition, one cafeteria owner voluntarily participated with two additional school cafeterias. Altogether, 9 schools with a total of 6.597 students took part in the study. The school management registered their school cafeterias for participation. Therefore, the school cafeteria owners had no intrinsic motivation to participate at the beginning of the study. Students of the included schools were in the age range between 10 to 19 years. Sales data were provided by 4 school cafeteria owners.

Implementation

The following implementation process was developed and refined in the context of approximately 200 evaluations over the last decade (**Figure 1**).

Phase 1-Preparation

The preparation phase consisted of contacting the school cafeteria owners and the school management in order to get to know the individual general conditions for each school, to establish a basis of trust and to explain the process of cooperation. As the study was designed as a tele project there were no on-site visits by the study team. A teacher was appointed by the school as internal contact person. This liaison teacher acted as the permanent supervisor on site to ensure sustainability during the process of change and beyond. The pre-intervention sales data were voluntarily provided by the school cafeteria owners.

Phase 2-Pre-intervention evaluation

For the initial assessment, the liaison teacher was instructed via video call by the study team. Together they assessed the pre-intervention food and beverage offer. The timing of the video call was always the lesson before the longest school break of the day, because at this time the assortment of goods is largest.

Phase 3-Recommendations for food and beverage optimisation

A detailed report that contained the results of the evaluation of all food groups and proposed specific individual recommendations for achieving a health-promoting food and beverage offer was sent to the school management and the school cafeteria owners. Based on this feedback the school cafeteria owners were then counselled via telephone in order to ensure that possible questions and doubts in regard to an optimisation could be answered and talked through. The liaison teacher was also instructed about the recommendations and could therefore provide on-site quality control regarding the optimisation.

Phase 4-Re-evaluation

A re-evaluation identical to the first evaluation took place 6 to 8 weeks after the initial assessment. Again, a detailed written and verbal feedback was given to the school management and school cafeteria owners.

Phase 5-Finalization

If the school cafeterias met the requirements, the schools and the cafeteria owners received a certificate valid for three years. Cafeteria owners confirmed in writing their compliance with the criteria, the possibility of unannounced check-ups and that a refusal to maintain the optimised food and beverage offer would result in the loss of the certificate. Likewise, the schools confirmed to ensure sustainability by unannounced visits through the liaison teacher. The post-intervention sales data were voluntarily provided by the school cafeteria owners.

Evaluation tool

The applied evaluation tool and the corresponding criteria were developed by SIPCAN in 2007 and improved further until 2010. These criteria were the basis for the "Guideline School Cafeteria", released in 2012, of the Austrian Federal Ministry of Health [14]. In accordance with the "Guideline School Cafeteria" the evaluation tool comprises 29 criteria defined as quantifiable objectives assigned to 11 food groups which cover the entire range of foods and beverages offered at school cafeterias. School cafeterias are a very heterogeneous group, differing greatly in local conditions, size, and implementation. Therefore, the criteria for almost all food groups are defined as measurable ratios. The ratios are linked to the Austrian school grading system (1 stands for "criterion fulfilled", 3 for "criterion partially fulfilled" and 5 for "criterion not fulfilled) in order to facilitate a better understanding of the results. The data is collected according to the quantity of foods and beverages presented and the way they are presented. In addition, the catering structure inside and outside the school building is also recorded. Inside the school building it is recorded whether vending machines for beverages, coffee, snacks or milk are available and whether a warm lunch is offered. With regard to the supply outside the school building, the number and type

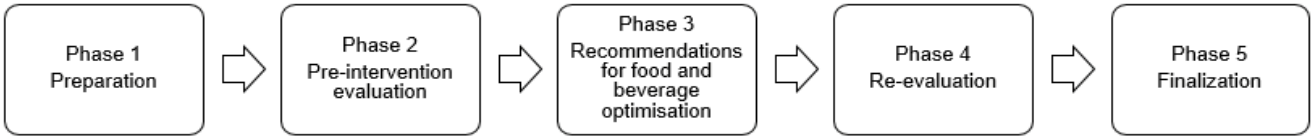

Figure 1. *Five phases of implementation.*

of businesses competing with the school cafeteria, such as bakeries or supermarkets within walking distance (250 metres), is recorded. Finally, the school size (number of students and teachers) is also collected.

Food groups and their criteria

The range of goods consists of the following eleven food groups and crucial criteria. Beverages (7 criteria); breads and buns (3 criteria); toppings for breads and buns (deli meat and meat products) (2 criteria); toppings for breads and buns (e.g. Cheese and other vegetarian spreads) (1 criterion); vegetables (3 criteria); fruits (3 criteria); dairy products (drinkable or to be eaten with a spoon) (1 criterion); pastries (2 criteria); sweets (2 criteria); savoury snacks (1 criterion); warm snacks and meals (4 criteria).

A detailed list of the food groups, all criteria assigned to them, guidelines for product presentation and how these criteria are integrated into the evaluation tool can be found in the supplementary files. The overall evaluation is calculated on the basis of three sub-areas. For the first sub-area, the number of all 29 individual criteria that can be classified as fulfilled is shown as a percentage value. For the second sub-area, the average school grade resulting from the partial grades of all 11 food groups is calculated. For the third sub-area, the number of the food groups which are classified as "not fulfilled" is recorded.

In order to be able to classify the offer at a school cafeteria as health-promoting, at least 75 % of all individual criteria must be classified as "fulfilled" (sub-area 1). The average school grade (sub-area 2) must be 2.2 or better. For this purpose, the result for the quantity of goods is weighted with 2/3 and the presentation with 1/3. With regard to sub-area 3, no food group may receive the rating "not fulfilled".

Statistical analysis

Descriptive statistics and the Wilcoxon Signed Rank test for paired samples were used to analyse the overall school cafeteria results as well as changes in individual criteria. School cafeteria sales were analysed using the Wilcoxon Signed-Rank test for unpaired samples and descriptive statistics. The number of certified schools was described descriptively. The data was quantified using IBM SPSS Statistics (version 24) and significance levels were defined as $p \leq 0.05$.

Results

None of the 9 participating school cafeterias dropped out of the study. While the average proportion of criteria that met the specifications was 60 % before the intervention, it was 86 % after the intervention (p=0.008). All locations increased the number of criteria fulfilled by 26 percentage points on average. In relation to the individual locations, a significant change was measured for 4 school cafeterias. At the beginning of the study one school (School VII) could have been certified. After the re-evaluation all schools were certified (**Table 1**).

The intervention resulted in a positive change in all food groups. The biggest changes could be measured in the food groups "vegetables", "warm snacks", and "pastries". 6 criteria were already met and therefore remained unchanged during the course of the study. 1 criterion was not yet met but remained unchanged. For 3 criteria a deterioration was measured. One of them was significant (increase in large sweets with a package size of more than 30 grams). In total, 19 out of 29 criteria improved. For these 19 criteria a significant change was measured for the following nine criteria:

- The total range of breads/buns with a high proportion of crushed grains or whole grains
- Increase of alternative grains
- The reduction of deli meat and meat products with low or moderate fat
- Increase of fresh vegetables
- Increase of bread and buns with a savoury topping served with vegetables
- Decrease of visibly offered pastries
- Decrease of non-vegetarian warm snacks
- Decrease of mayonnaise
- Increase of fresh herbs and/or garnished with vegetables (warm dishes)

Table 2 shows the change of the evaluation results between test time 1 and test time 2, the increase or decrease in percentage points and statistical significance for each of the 29 criteria.

In order to be able to describe the impact of the measure on the economic success sales figures were requested on a voluntary basis and 4 school cafeteria owners disclosed their sales data. The turnover fi were collected for one school week (5 days) one month before and one month after the intervention. Before the intervention, an average of 6.186 € was generated per week. After the intervention, this value was 6.176 € (p=0.287). The result shows that the improvement in the food and beverage offer did not generate a fi loss for these 4 school cafeteria owners.

Table 1. *Mean test time and growth in percentage points per school (n=9).*

Category	Test time 1 (mean)	Test time 2 (mean)	Growth in percentage points	p-value
School I	59	93	+34	**p=0.017**
School II	72	90	+18	p=0.103
School III	48	86	+38	**p=0.017**
School IV	58	79	+21	p=0.068
School V	64	88	+24	p=0.244
School VI	56	80	+24	**p=0.042**
School VII	76	84	+8	p=0.180
School VIII	55	83	+28	p=0.156
School IX	55	93	+38	**p=0.026**
Overall outcome	60	86	+26	**p=0.008**

Table 2. *Changes in criteria between the two test times and changes in percentage points (n=29).*

Criteria	Test Time 1 (Mean)	Test Time 2 (Mean)	Increase/Decrease in Percentage Points	p-value
Beverages				
1	80%	94%	+14%	p=0.196
2	79%	94%	+15%	p=0.173
3	22%	23%	+1%	p=0.103
4	0%	0%	0%	-
5	0%	0%	0%	-
6	0%	0%	0%	-
7	0%	0%	0%	-
Bread and buns				
8	30%	58%	+28%	**p=0.012**
9	13%	14%	+1%	p=0.812
10	2%	9%	+7%	**p=0.028**
Toppings for bread and buns				
11	46%	37%	-9%	p=0.086
12	11%	1%	-10%	**p=0.027**
13	54%	63%	+9%	p=0.086
Vegetables				
14	30%	100%	+70%	**p=0.014**
15	58%	77%	+19%	**p=0.017**
16	4.4 types	5.0 types	+0.6 types	p=0.068
Fruit				
17	100%	100%	0%	-
18	4.5 pieces	4.4 pieces	-0.1 piece	p= 0.317
19	2.8 types	3.2 types	+0.4 types	p=0.453
Dairy products				
20	77%	85%	8%	p=0.131
Pastries				
21	24.9 pieces	7.6 pieces	-17.9 pieces	**p=0.018**
22	86%	87%	+1%	p=0.655
Sweets				
23	8.8 types	7.0 types	-1.8 types	p=0.078
24	62%	73%	+11%	**p=0.043**
Savoury snacks				
25	11%	11%	0%	-
Warm snacks or dishes				
26	53%	28%	-25%	**p=0.034**
27	41%	6%	-35%	**p=0.041**
28	6%	28%	+22%	**p=0.046**
29	0%	0%	0%	-

Discussion

The main objective of the study was to investigate if a health-promoting food and beverage offer can be easily implemented in school cafeterias. The results showed that independent of the initial conditions in regards to the composition of the foods and beverages offered at a school cafeteria, it is possible to establish a better choice. A central component for the success was the clear and objective orientation that cafeteria owners received. An important prerequisite were the feasible goal-oriented measures that are also communicated on a governmental level in form of the school cafeteria guideline [14].

Regarding beverages, the key criteria in regards to sugar content and water availability improved. Results show that sugar-sweetened beverages (SSB) consumption is positively associated with or affects obesity indices in children and adults. From a health policy perspective, the aim should be to reduce the consumption of SSBs and promote healthy alternatives such as water [15]. In the case of bread/buns, the proportion of products with a high proportion of crushed and whole grains improved, while the proportion of white bread/buns decreased. This is also relevant because the consumption of whole grain products is directly related to improved insulin sensitivity and a reduction of the diabetes risk [16]. The decrease in the supply of meat products and the simultaneous increase in the vegetarian offer can also be seen as a positive study outcome, since a vegetarian diet is known to reduce the risk of various diseases such as cancer, ischemic heart disease or diabetes [17-19]. In reference to Austrian dietary guidelines children consume inadequate amounts of fruits and vegetables [20]. In systematic reviews of nutrition interventions in children most increases in consumption were attributed to fruits and less in vegetables [21]. However, with our method 2 out of 3 criteria in the category “vegetables” could be improved significantly. According to Kessler HS at least three different types of fruits or vegetables should be offered at school cafeterias [8]. With the applied method the number of both fruit and vegetable varieties could be increased to more than three different types. The range

of ideal dairy products also improved. Regarding pastries it was possible to reduce the maximum number of visible pieces significantly. Although the number of visible sweets decreased by -1.8 varieties to the low number of 7 varieties in total, the proportion of sweets with a packaging size of more than 30 grams increased. A key reason for this is that the range of sweets available in small packaging sizes that are also attractive for sale is limited. There is a need for action on the part of the industry. Fortunately, savoury snacks play a minor role at school cafeterias and remained unchanged during the course of the study. 8 out of 9 school cafeterias do not sell such products at all. As with sandwiches, the proportion of meat-containing products in warm snacks has also decreased. At the same time, the proportion of all products containing vegetables was increased. These results strengthen the development towards a greater acceptance of vegetarian offers that are associated with health benefits [17-19].

Contrary to the conclusion of a Dutch study on healthy foods at school canteens that only healthy products should be sold [6], our study shows that not issuing food bans can be successful. Therefore, pastries, sweets, and savoury snacks were still included in the school cafeteria's assortment, but in a less visible position and at a reduced amount. Our method corresponds to the results of a systematic review which indicated that nudging can be an effective way to influence healthy food choice [22]. A Swedish study concluded that it is important not to make drastic changes in school meals [23-25]. Our results also confirm this conclusion for foods and beverages offered at school cafeterias and simultaneously show that it is possible to achieve rapid health-promoting results.

In regards to the change in sales figures the small sample size (n=4) limits the validity of our findings, however, the difference in pre and post intervention sales figures suggests that the change of the food and beverage offer towards a healthy food environment does not result in economic disadvantages for the school cafeteria owner (p=0.287). Nevertheless, the results show that the chosen approach, which also takes into account economic viability, does not cause an immediate deterioration in turnover. This is a key factor for the sustainability of our approach.

The implementation of our method as a tele project proved to be feasible, time and cost effective. The implementation by a trusted person within the school, the use of a mobile video conference and the documentation via digital photography worked smoothly. The evaluation tool itself provided a clear orientation and individually achievable goals, so that an improvement of the product range with different requirements was possible. Therefore, this tele project is a suitable tool to evaluate and optimize the food offered at school cafeterias, without the presence of the project supervisors on site being absolutely necessary. However, the long-term sustainability of the results has to be verified in the future by further data.

Limitation

During the initial contact, the school cafeteria businesses were informed about the dates of the individual evaluation dates, which can affect the foods and beverages offered on the days of the evaluation. Unannounced inspections are carried out in the following years when a broad basis of trust has been established. Due to the approach as a tele-project there is no joint meeting with all stakeholders involved, so that only a limited impression of the overall situation in the setting can be gained. Furthermore, necessary changes cannot be worked out directly together with stakeholders, which limits the participation necessary for the process. The target parameters for the food and beverage offer are linked to the generally applicable ministerial guidelines. Since the information on turnover was provided voluntarily, not all companies participated. In addition, the respective turnover depends very much on the number of students on site. There is no data available on this, so interpretation for single settings is limited. As the study focuses exclusively on the supply situation, no conclusions can be drawn about changes in the eating and drinking behavior of the students. Regarding the change in sales figures a study with a larger sample size should be considered for the future.

Conclusion

In summary, we could demonstrate that it is possible to specifically improve the range of offered goods in school cafeterias with the developed method. With concrete instructions for action that take into account the individual initial situation and achievable goals, it is possible to turn the healthier choice into an easier choice. The chosen way as a tele project proved to be target-oriented and cost-saving. At the same time, the method allows for easy multiplication.

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***Correspondence to:**

Wolfgang Schobersberger
Institute of Sports Medicine,
Alpine Medicine and Health Tourism,
Private University for Health Sciences,
Medical Informatics and Technology GmbH (UMIT Tirol),
Austria
Tel: +436643052740
E-mail: wolfgang.schobersberger@tirol-kliniken.at