Multidimensional intervention to improve healthy lifestyle practices , nutritional status and health in Mexican schoolchildren: Development of an intervention platform, randomized clinical trial and escalation proposal.

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INTERVENTION TO IMPROVE HEALTHY LIFESTYLE PRACTICES AND NUTRITION AND HEALTH STATUS IN MEXICAN SCHOOLCHILDREN: DEVELOPMENT OF AN INTERVENTION PLATFORM, RANDOMIZED TRIAL AND SCALING PROPOSAL.

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Summary.

Obesity in Mexico has experienced an increase in the last three decades in both adults and children and adolescents. This epidemic has been documented through the different National Health and Nutrition Surveys. Currently more than 7 out of every 10 adults and approximately 4 out of every 10 girls, boys and adolescents live with overweight or obesity. For this reason, for several years, the National Institute of Public Health (INSP, for its Spanish acronym), the Salvador Zubirán National Institute of Medical Sciences and Nutrition (INCMNSZ for its Spanish acronym) and the Ramón de la Fuente Muñiz National Institute of Psychiatry (INPRFM for its Spanish acronym) have developed, independently, studies and interventions to generate proposals that contribute to the solution of this problem.
The experience of the three National Institutes of Health (INSalud for its Spanish acronym), in the study of various dimensions of the problem of overweight and obesity, including individual aspects (such as psychological and biological), as well as those of the physical and social environment of the spaces in which children develop (community, school and home) relevant in the context of a predominantly urban, developing, middle-income country, can be useful to propose a multidimensional intervention (MI) with evidence of effectiveness and sustainability, which considers previous interventions, and supports their correct application, verifies their effects and complements the program with innovative actions that, if proven effective, could be integrated to improve its effects.

Taking as a starting point the experience of the institutions in the design, application and evaluation of actions and programs, as well as international experience, a collaborative project between INSalud is proposed to generate a multidimensional intervention project, which applies other innovative actions in the individual (girl/boy) and environmental (family, school and community) spheres. This is a project designed to be carried out in 4 stages. The project has financing from the health sector fund (with an extension to end on January 11, 2025). The objective of this study is to evaluate the effects of an MI on the physical-built and social environment around schools, as well as the nutritional status of the school population, through a community trial in schools in 3 states of the republic. Mexican. The impact will be measured through anthropometric, biological, psychological, behavioral and environmental indicators. The target population of the intervention will be students between 9-10 years old who are in the 4th grade of primary school.

As mentioned above, the study is made up of 4 iterative stages, in which each of its components will serve to enrich the following stages, which are described below:

Stage 1. Situational diagnosis. Duration: 12 months. In the design of health promotion interventions, situational diagnostic assessment is necessary to be able to design an intervention adapted to the context and real needs of the target population. This first stage of the project will also allow us to identify previous experiences and derive from them available evidence on interventions that have been implemented in other populations. Likewise, it is necessary to identify the health problems of the population to which the intervention to be designed is directed, as well as the existing policies and programs and the participation of the target population to which the intervention to be designed is aimed. The purpose of the situational diagnostic evaluation is to guide the design of the intervention and increase its potential effect. The diagnosis includes various activities that are described below: 1) Systematic review of the literature; will allow the construction of formative research instruments; 2) Focused formative research; 3) Review and analysis of the political and structural environment for the design and implementation of a multidimensional intervention; 4) Validation of instruments and 5) Secondary analysis of a birth cohort (2005-2017).

Stage 2. Design and development of the MI and evaluation instruments. Duration: 12 months. The information generated from the situational diagnosis will serve to design the IM of this proposal, which will include different levels of intervention such as school, around school, home and community. The components of this stage are the following: 1) Feasibility study; 2) Final design of the multidimensional intervention; and 3) Definition of the components of the multidimensional intervention.

Stage 3 . Implementation, monitoring and evaluation of the multidimensional intervention. Duration: 10 months. The final IM design that will be implemented during this stage will depend on the modifications made in the stages described above. This stage consists of the following phases: 1) Randomization, 2) Initial evaluation, 3) Beginning of the intervention, 4) Monitoring and evaluation of the process and 5) Final evaluation.

Stage 4 . Institutionalization of the intervention. Duration: 12 months. In the final stage, an analysis and formulation of recommendations will be carried out for the escalation and incorporation of the intervention to the Ministry of Public Education (SEP). In addition, meetings will be held with decision makers to seek the scaling of the program

to other schools and dissemination activities of the educational materials developed (applications and printed material) aimed at various population groups.

Introduction

Obesity is an important public health problem whose trend in Mexico has experienced a constant increase in recent decades [1,2,3,4]. This condition has as its origin a complex causal chain, of multifactorial etiology, where genetic, behavioral and environmental factors interact, including lifestyles, as well as psychological, social and economic determinants. It is characterized by an increase in body fat deposits and weight gain caused by a positive energy balance; characterized by an energy intake (which comes from food) greater than the energy expenditure (product of physical activity). Positive energy balance results in turn from inadequate dietary patterns and physical activity. Obesity early in life increases the risk of chronic diseases such as type 2 diabetes, cardiovascular disease, cirrhosis and 11 types of cancer, leading to premature mortality. Given the seriousness of the problem, it is important to identify and act on the immediate, underlying and basic causes of this condition, seeking its prevention.

The environment is a determining component, since it can promote lifestyles that are not compatible with health. Eating habits and lifestyles in general are determined by environmental factors such as family, culture and society, as well as socioeconomic level (SES) and the physical characteristics of the spaces in which we live. It is still not clear whether the psychopathology present in cases of overweight and obesity is a cause or consequence of it, although it is likely that there is a reciprocal relationship between the individual and the environment. Overweight and obesity are accompanied by various psychiatric and psychological disorders, including low self-esteem, dissatisfaction with body image, depression, anxiety, phobias, eating disorders, post-traumatic stress disorder, experiences of violence and alexithymia. [5]. Low self-esteem predicts the development of obesity in children [6]. People with low self-esteem or who overvalue weight and body shape will tend to seek thinness through inappropriate methods, which may result in the development of psychopathology. On the opposite side, there are those individuals who do not perceive themselves as overweight despite having it, which promotes its increase [7]. A relationship has been found between SES and the desire to have or not have a thin body figure: the higher the SES, the lower the desire, but there is also less information about care and less access to health services. Likewise, it is known that there is a difference by sex with respect to the attitude towards being overweight. In the 2006 National Nutrition and Health Survey [8], it was

found that 2.4% and 0.3% of adolescents between 10 and 14 years old have moderate and high risk, respectively, of an eating disorder. While women, as well as people with a higher body mass index and socioeconomic level, are at greater risk of an eating disorder [9].

Obesity in Mexico has experienced an unusual increase in the last three decades in both adults and girls, boys and adolescents. This epidemic has been documented through the different National Health and Nutrition Surveys (ENSANUT). Currently more than 7 out of every 10 adults and approximately 4 out of every 10 girls, boys and adolescents live with overweight and obesity. For this reason, for several years, the National Institute of Public Health (INSP), the Salvador Zubirán National Institute of Medical Sciences and Nutrition (INCMNSZ) and the Ramón de la Fuente Muñiz National Institute of Psychiatry (INPRFM) have developed, independently, studies and interventions to generate proposals that could contribute to the solution of this public health problem. These include systematic reviews [10,11,12], studies on the school environment [13,14,15,16], community [17,18], family and individual environments [19,20,21,22]. Due to the increase in the prevalence of overweight and obesity in Mexican children and the greater possibility of influencing dietary and physical activity patterns in children compared to adults, this proposal directs its efforts to the prevention of overweight and obesity in school-age children [23,24.]

The separate impact of these efforts is relatively low. For example, the INCMNSZ initiative prevented the increase in the percentage of cases with obesity in the treated group [12]; and various INSP interventions have managed to document greater physical activity in children subject to an intervention [25], as well as positive effects on the availability of healthy foods and reduction in the ingestion of non-recommended foods [26]. However, better results could be achieved with multidimensional interventions, with a comprehensive model that takes advantage of the experience and strengths of the three National Institutes of Health (INSalud), with the potential to be scaled nationally. Therefore, this proposal represents an opportunity to consolidate the experience of the Institutes and generate a more effective, strengthened and exportable model.

National policies developed to prevent overweight and obesity in the population

Based on several studies, the Ministry of Health (SSA) developed the National Agreement for Food Health (ANSA) [27,28] from which the general guidelines for the sale

and distribution of food and beverages in school consumption establishments of basic education schools [29,30,31] that contemplated various measures such as: Improving the availability of healthy foods, the removal of soft drinks and sugary drinks (except juices and nectars), the installation of drinking fountains and the implementation of various strategies to increase the physical activity. The various evaluations of these guidelines have made it possible to identify barriers to the implementation of the proposed measures in schools. Among these is the limited time available in most of the country's schools to cover the entire curriculum, which makes it difficult to dedicate more time to physical activity, the reduced time of moderate and vigorous physical activity during classes of physical education, the lack of installation of drinking fountains or the lack of maintenance and cleaning thereof, the persistent availability of unhealthy foods and, on the other hand, a high availability of foods with high energy content and poor in nutrients (food scrap metal), street vendors and advertising around schools [32]. Finally, it is necessary to recognize that the time that children are in school, which corresponds to only 4.5 hours, for 5 days per week, is restricted to impact healthy practices and the health status of schoolchildren, especially if they are not It is accompanied by a comprehensive intervention that includes other environments (community and home) and at the various times of the day in which schoolchildren operate.

As part of the policies implemented at the national level for the prevention of overweight and obesity in children and adolescents, the SEP, in collaboration with the SSA, have developed various programs for implementation in schools of the Mexican school system, such as the Action Program in the School Context (2010) which had the purpose of preventing and controlling overweight and obesity in basic education students.

Proposal for a multidimensional intervention Approach

The experience of INSalud, mentioned previously, in the study of various dimensions of the problem of overweight and obesity, including individual aspects (such as psychological and biological), as well as those of the physical and social environment of the spaces in which children develop (community, school and home) relevant in the context of a predominantly urban, developing, middle-income country, it may be useful to propose a multidimensional intervention (MI) with evidence of effectiveness and sustainability, which considers the proposed interventions, support their correct application, verify their effects and complement the program with innovative actions.

Taking as a starting point the experience of the institutions in the design, application and evaluation of actions and programs, as well as international experience, a collaborative project between INSalud is proposed to generate an IM program that takes advantage of the actions previously carried out in the school context, which ensures its correct implementation and applies other innovative actions at the individual (girl/boy) and environmental (family, school and community) levels. The IM will contemplate three axes: 1) Biological, 2) Psychological and 3) Social. With these actions we seek to create a group of "model" schools, in 3 federal entities of the republic (Campeche, Mexico City, and Morelos), that generate an environment in the schools and in the environments around the school, which, added to the promotion of behavioral changes through educational communication, resulting in the adoption of feeding, physical activity and mental health practices recommended for the school population.

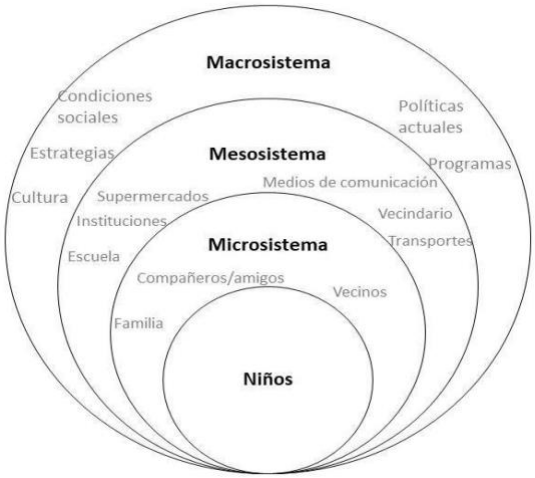
Theoretical framework

Ecological model

Obesity and overweight are caused by various factors, both genetic and environmental. As a result of the current epidemic observed throughout the world, it is recognized that the most important factors are environmental and social, among which are, for example: the availability and accessibility of food, changes in the national food system and marketing. , as well as promotion through various media. [33]

It has been listed in various publications that influences come from and are expressed at different levels of disaggregation in which the individual develops throughout life, at a personal or group level, in businesses, schools or institutions, work and even through of means of transportation, as shown in Figure 1. [34] To try to understand how an individual has a certain nutritional status (NS), it must be taken into account that each context acts at a different level. At a first level are the structural determinants of a society: social, economic, cultural, political and geographical aspects; At a second level are the underlying determinants that include aspects related to access to health services, availability and access to food, lifestyles and education. Structural and underlying determinants indirectly influence the individual's NE through proximate determinants. Finally, there are the proximate determinants and they are those directly related to energy consumption (diet, habits, physical activity) and the characteristics of the individual.

Figure 1. Ecological model, 2005.



Source: Adapted from the book: Obesity in Mexico. [1]

Theory of planned behavior (Ajzen)

The adoption by individuals of a certain behavior (e.g. consuming plain water) depends on a set of factors and variables that act at individual, social or environmental levels. Among the different theories that help us understand human behavior, we select the Theory of Planned Behavior [35,36] which will serve as a reference to guide the diagnosis/formative research and formulation of recommendations.

In this model, a set of elements such as culture, socioeconomic level and exposure to the media can in turn condition constructs that contribute to behavior such as intention, attitude, subjective norm and perceived control. In the following table, we present the definitions of the mentioned constructs.

Table 1. Definition of constructs for the Theory of Planned Behavior

Construct	Definition
Intention	It reflects how determined a person is to try to adopt a behavior or how much effort they plan to give to change the behavior.
Attitude	It reflects the agreement or disagreement with a behavior/conduct.

Rule subjective	It is made up of: (1) the perception that other people important to the subject approve, think, expect and desire their behavior and (2) the subject's own motivation to accommodate the expectations or desires of those people.
Perceived control	It is the subject's perception of having a set of skills to carry out a specific behavior.

Therefore, in the diagnosis/formative research phase, the different constructs of Ajzen's theory will be explored in relation to nutrition.

School-based interventions have been suggested for the prevention of this condition, and they identified that the most common treatments involved lifestyle interventions (i.e., regulated screen time for children). Furthermore, interventions (diet, family behavior, PA promotion, supervised exercise, lifestyle, or multicomponent interventions) were reported to be associated with a reduction in BMI.

Body response to changes in body composition

The participation of inflammatory processes has acquired great relevance in recent years as part of the pathophysiological mechanisms that accompany the development and progression of obesity. As there is an increase in fat mass, adipocytes generate a greater amount of reactive oxygen species, promoting the expression and release of proinflammatory substances such as cytosines and adipokines. The increase in inflammatory substances produces an increase in oxidative stress, thus establishing a pathological cycle that exacerbates the disease. Furthermore, oxidative stress has been associated with insulin resistance and endothelial dysfunction, comorbidities associated with diabetes and cardiovascular diseases.

Various studies carried out in adult and child populations have shown that obesity is associated with an increase in circulating concentrations of markers of inflammation and oxidative stress such as IL-6, C-reactive protein and TNFα [92,93,94] . Likewise, an imbalance has been observed in the antioxidant system, with a decrease in the activity of antioxidant enzymes (superoxide dismutase, catalase, glutathione peroxidase) combined with a decrease in nitric oxide, as well as an increase in the concentrations of stress markers. oxidative such as malondialdehyde (MDA), 8-oxo-deoxyguanosine and isoprostanes.

Because these processes occur rapidly at the cellular level and are established as the amount of adipose tissue increases, it is feasible that they can be used as early markers and detect changes before the establishment of other pathological processes such as

insulin resistance, dyslipidemias and cardiovascular diseases. The above is useful not only for diagnosis in the clinic but for evaluation in short-term population interventions related to these conditions.

- ***Assessment of inflammation in children living with obesity***

Obesity is a chronic inflammatory process that involves the accumulation of proinflammatory macrophages not only in adipose tissue, but in different organs such as the liver and muscle, etc., which contributes to the development of different chronic diseases associated with it. Obesity is also a risk factor for metabolic syndrome, a group of metabolic complications that include insulin resistance, hypertension, glucose intolerance, hepatic steatosis, dyslipidemia, and atherosclerosis.

Insulin resistance associated with obesity is the greatest risk factor for the development of type 2 Diabetes (T2DM), which involves multiple organs, such as hypertrophic and fatty adipose tissue and fatty liver. Obesity was recently determined to correlate with chronic low-grade inflammation, suggesting that inflammation is necessary for obesity-associated insulin resistance and subsequent onset of T2DM.

During the development of obesity, macrophages permeate white adipose tissue, and together with adipocytes, secrete various proinflammatory cytokines and chemokines [100] . For example, visceral adipose tissue secretes resistin, interleukin (IL)-6, tumor necrosis factor (TNF)-α, IL-1β, and monocyte chemoattractant protein (MCP)-1, of which TNF-α e IL-6 has been shown to impair insulin sensitivity. It is important to highlight that the visceral adipose tissue in obese people is infiltrated by macrophages which cooperate in the generation and maintenance of inflammatory responses. Several studies have identified different polarization states of infiltrated macrophages within adipose tissue. Galectin-3 (also known as Mac-2) is a 30 kDA lectin located in the nucleus, cytoplasm and extracellular membrane which plays an important role in the exacerbation of different inflammatory processes. It is also a factor abundantly secreted by macrophages, and an important regulator of the polarization of macrophages themselves, which could serve as an indirect marker reflecting the degree of tissue inflammation observed in obesity. Furthermore, there is evidence of the role of Galectin-3 as a predictive marker for the development of heart failure. For example, in the Framingham Heart Study, it was observed that previously healthy patients in whom elevated levels of Galectin-3 were observed had a higher risk of developing cardiovascular disease.

Given all the negative implications that obesity can have on the development of chronic diseases with a significant impact on the quality of life of our population, in this study we have decided to implement intervention measures focused on trying to reduce obesity in the child population.

General objective

To evaluate the effects of an MI on the physical-built and social environment around schools and the nutritional status of the school population, through a randomized community trial, in schools in 3 states of the Mexican Republic, using anthropometric indicators. , biological, psychological, behavioral and environmental.

Specific objectives

1. Carry out a situational diagnosis in schools in three states of the Mexican Republic (Campeche, Mexico City and Morelos) to document the implementation of the strategies that are implemented and identify the risk and protective factors for overweight and obesity in the school population.
2. Evaluate the effects of the strategies that are currently being implemented on the physical-built and social environment around schools and the nutritional status of the school population.
3. Design, develop, pilot and implement an IM that allows to improve the state of health and nutrition of the school population, reaching the family environment and the school environment and the environments around the schools.
4. To evaluate the effects of IM on health and nutrition status in the school population, through anthropometric, behavioral, environmental and psychological indicators. In the case of schoolchildren in Mexico City, biochemical indicators and body composition will be used.

Research questions

1. What are the main risk and protective factors for overweight and obesity in the school environment and in the environments around schools in primary education schools in three states of the Mexican Republic?

2. Is there a relationship between risky eating behaviors and the body mass index of schoolchildren?
3. Are the strategies that are being implemented effective in reducing the presence of risk factors and increasing the presence of protective factors for overweight and obesity in the school environment and in the environments around schools?
4. Are the strategies that are being implemented effective in reducing the presence of risk factors and increasing the protective factors for overweight and obesity in the family environment?
5. Are the strategies being implemented effective in modifying key risk or protective behaviors related to overweight and obesity and mental health?
6. Are the strategies that are being implemented effective in reducing the prevalence of overweight and obesity in schoolchildren?
7. Are the strategies that are being implemented effective in reducing cardiometabolic risks in Mexican schoolchildren?
8. Are the strategies that are being implemented effective to improve body composition in Mexican schoolchildren?
9. What is the impact of MI on risky eating behaviors, internalization of the aesthetic ideal of thinness, dissatisfaction with body image, and negative affect in children?
10. Can MI affect the degree of low-grade systemic inflammation in Mexican schoolchildren?

Methodology

The present study is divided into four stages. The general description of each stage is presented in Table 1. The study is a randomized community trial that includes 24 schools from 3 states of the Mexican Republic (Campeche, Mexico City and Morelos) (Figure 2) and a randomized clinical trial in parallel in 4 of the schools in Cuernavaca, Morelos. Both studies together will address the questions raised in the previous section. The selected schools (8 in each federal entity) will be randomly assigned into two groups: 1) Schools control , in which the strategy will not be implemented (4 per state entity); and 2) Schools with multidimensional intervention, in which IM actions will be implemented (4 per federal entity). In these schools, an initial diagnosis of the environment around the schools, monitoring and evaluation of the implementation of the strategies will be carried out; In addition, an initial and final measurement will be carried out with anthropometric, behavioral and environmental modification indicators around the schools.

In parallel, a randomized clinical trial will be carried out in four of the schools in Cuernavaca, Morelos, of which two will be controls and two will receive the multidimensional intervention. In these schools, an initial diagnosis of the environment will be carried out, monitoring and evaluation of the strategies implemented and a more in-depth initial and baseline measurement will be carried out, since in addition to using anthropometric, behavioral and environmental modification indicators, the measurement of body composition using dual x-ray absorption densitometry (DXA), cardiometabolic health indicators such as glycated hemoglobin (HbA1c), lipid profile, liver function and biological markers, inflammation markers, among others.

Table 2. Stages of the study, its components and duration.

Stage	Components	Duration
Stage 1 1. Situational diagnosis.	1.1 Systematic literature review, 1.2 Focused formative research, 1.3 Review and analysis of the political and structural environment for the design and implementation of a multidimensional intervention,	12 months
	1.4 Validation of instruments, 1.5 Secondary analysis of a birth cohort (2005-2017).	
Stage 2 2. Design and development of the IM and evaluation instruments.	2.1 Feasibility study and validation/pilot test of the intervention materials. - Workshop to define IM - Field work 2.2 Feedback and modification of the activities and communication materials of the initial MI proposal on healthy and sustainable eating, movement behaviors and psychosocial determinants. 2.3 Implementation logistics	12 months
Stage 3 3. Implementation of the multidimensional intervention.	3.1 Basal measurement, 3.2 Implementation, 3.3 Monitoring of the intervention, 3.4 Final measurement.	10 months
Stage 4 4. Institutionalization of the intervention	4.1 Analysis of information, 4.2 Conceptualization of escalation, 4.3 Report writing.	12 months

Selection of the sample of schools and children

Those in charge of implementing strategies by the Ministry of Public Education (SEP) will be asked for a list of schools in each federal entity. From these, we will randomly select schools (4 control schools and 4 intervention schools per state) from urban locations that meet the selection criteria shown below.

Within the school, one or two groups (depending on school enrollment and the number of students per group) of 4th grade will be randomly selected. Subsequently, we will distribute the letters of consent and assent to all the students in the assigned group, and those who return on the agreed date the letter of consent signed by the parents/guardians and the students (letter of assent), will be taken into account to participate in the study. The age of the boys and girls who will participate in this study will be between 9 and 10 years old. This age period corresponds to schoolchildren who will be in the 4th grade .

Of the children eligible to participate, 30 boys and girls will be selected within each group for the purposes of applying the baseline and final measurements. It should be noted that we do not consider it appropriate to reject any student who wants to participate and who has parental/guardian permission, so they will be included in the study. All boys and girls in a school will be exposed to the corresponding type of intervention.

School selection criteria

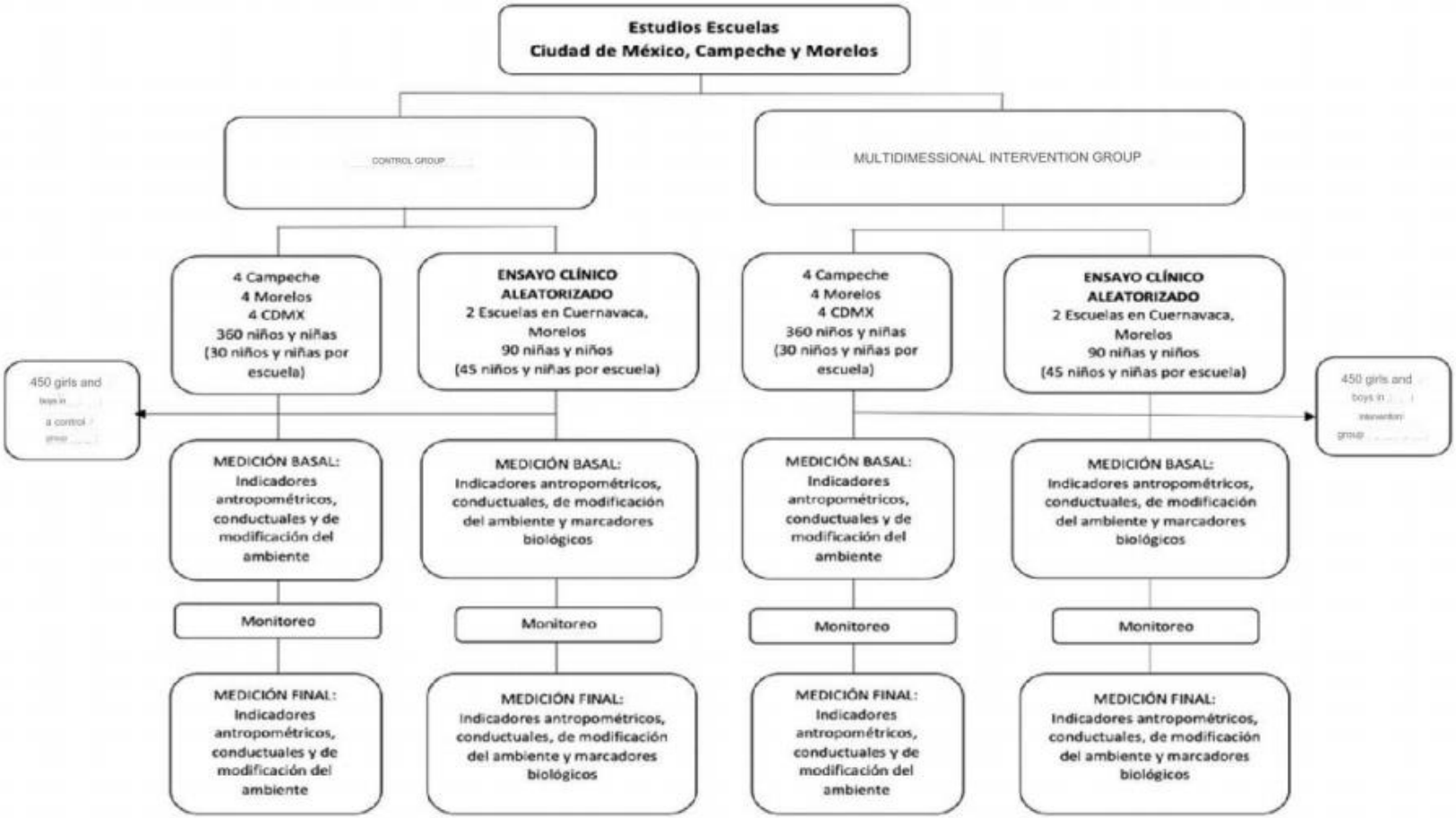
For the study, the following characteristics of the schools will be taken into account:

They must be located in the three federal entities in which the study will be carried out (Campeche, Mexico City and Morelos). In the case of Campeche and Mexico City, the educational authorities will be requested that primary schools be of public order, that they have an enrollment of at least 1,000 students, that they have two or more groups of each school grade and that they are morning or morning shift (8:00-12:30 hrs) or extended shift (8:00-14:00 hrs).

For the state of Morelos, it will be sought that primary schools be private, that they have an enrollment of at least 1,000 students, that they have a morning or morning session (8:00-12:30 hrs) or an extended day (8:00 a.m.-12:30 p.m.) 00-14:00 hrs).

It is important to specify that, according to the National Commission for the Continuous Improvement of Education (MEJOREDU for its Spanish acronym), in primary education at the national level in urban localities, their distribution is homogeneous. On the other hand, the National Council for the Evaluation of Social Development Policy (CONEVAL) the cities that participate in the "Multidimensional intervention to improve healthy lifestyle practices and nutrition and health status in Mexican schoolchildren: Development of a intervention, randomized clinical trial and escalation proposal" have low levels of social backwardness (Cuernavaca: 1.196; Campeche: 0.557; Ciudad del Carmen: 0.5888; Mexico City: 0.9504), so the socioeconomic conditions are not different from each other.

Figure 2. Design of the randomized community trial and the randomized clinical trial. Mexico, 2023



1. Stage 1. Situational diagnosis

Generalities of stage 1

In the design of health promotion interventions, situational diagnostic evaluation is necessary to be able to develop an intervention adapted to the context and real needs of the target population. This first stage of the project made it possible to identify previous experiences and derive from them available evidence on interventions that have been implemented in other populations. Likewise, we identify the health problems of the population to which the intervention to be designed is directed, as well as the existing policies and programs and the participation of the target population for which the intervention is designed. The purpose of the situational diagnostic evaluation was to guide the design of the intervention and increase its potential effect [37].

The situational diagnosis was based on the Social Cognitive Theory [38], the Ecological Theory of Behavior [39] and the work of Springer and collaborators [33], which included evaluation in different environments:

Political environment: Review and analysis of the political and structural environment for the implementation of an intervention.

Social/cultural and organizational environment: Inquiry into existing groups that can support or serve as a platform to implement an intervention.

Information environment: Exploration of the media, communication channels and opportunities that favor the implementation of an intervention.

Environment of the environment (diet, physical activity and risky eating behaviors): Exploration of the situation in terms of availability of healthy and unhealthy foods and drinks, as well as infrastructure and opportunities to carry out physical activity and risky eating behaviors both in the environment school and community (included: school, family and community environment).

The information that was generated from the situational diagnosis served to design the IM of the present proposal, which includes different levels of intervention such as the school, school, family and community environment. The diagnosis included various activities described below:

1) Systematic literature review.
The systematic review covered the available scientific and gray literature on formative research and interventions and strategies for the prevention of overweight and obesity in girls, boys and adolescents implemented at the national and international level, identifying those that have been successful in different areas and that They could be part of the study.

2) Focused training information.
a) It allowed the updating of information on the availability of healthy foods and beverages within schools, focused on identifying barriers and opportunities for compliance with school guidelines, for healthy and sustainable eating, as well as opportunities for physical activity and activities. recreational activities during school hours.
b) It explored the environment around schools and at home to identify availability of healthy foods and beverages, as well as infrastructure and opportunities for physical activity.
c) It identified the barriers and opportunities for the implementation of interventions that allow improving healthy lifestyle practices at the school, home and community levels as perceived by school authorities, teachers, parents and community authorities.
d) Identified communication channels and opportunities for communication that could favor the intervention (For example: ease of using technology to receive training through virtual courses, access and use of cell phones to receive SMS messages, among others).

3. Review and analysis of the political and structural environment for the implementation of a multidimensional intervention.
It served to obtain information on the political and structural context to implement the multidimensional intervention.

4. Evaluation of the strategies or programs implemented.
The implementation of interventions associated with overweight and obesity in Campeche, Mexico City and Morelos that have been implemented in previous years was documented in the selected schools. In addition, possible barriers and facilitators for the alignment and complementarity of school programs and policies with some current public policy instruments were explored, such as: 1) the knowledge areas of the "Learn at Home" program aimed at promoting healthy eating. and to the practice of physical activity, and 2) general guidelines for the sale and distribution of prepared and processed foods and beverages in schools of the National Educational System.

5. Instrument validation.

During this stage, the instruments that will be used in the multidimensional intervention were validated.

Below, each of the components that were part of the situational diagnosis is described in greater detail.

1.1. Systematic review of the literature

The accumulation of scientific evidence of formative research and interventions and strategies for the prevention of overweight and obesity in school children and adolescents, implemented at the national and international level, was carried out through a systematic review of the scientific literature and gray literature, identified in databases and search engines Medline/Pubmed, Cochrane Library, Lilacs, PsycINFO, Scopus and Web of Science, identifying those interventions that have been effective in different areas, through a systematic and clearly defined and explicit process that adhered to the design of search, Cochrane analysis.

Study selection criteria:

Inclusion criteria:

- Articles, reports, theses and other manuscripts that described obesity interventions were identified, including strategies focused on physical activity, nutrition, sedentary behavior and risk eating behaviors (CAR), as well as eating disorders. Articles were also identified that explored aspects such as internalization of the aesthetic ideal of beauty-thinness, dissatisfaction with body image, negative affect, criticism-teasing, negative comments about weight and body shape, and stigmatization of obesity.
- Studies published in English, Spanish and Portuguese languages.
- Studies in the form of educational interventions, published from January 1, 2010 to November 30, 2019.
- Studies that measured the event of interest (strategies for the prevention and treatment of overweight and obesity in children and adolescents).
- Studies that quantitatively estimated the implementation of interventions.

Search methods for identifying studies:

The search process was carried out using the protocol for the systematic review that was developed including inclusion and exclusion criteria, methods for evaluating the quality of the studies and interpretation of the findings, among others. To find and choose the appropriate interventions and strategies, a systematic search for information was carried out through specialized engines and search engines with the application of subject headings from the Medical Subject Headings (MeSH), which covered the main areas of: measurement of obesity, comparison groups in interventions, measurement of nutrition, physical activity and public awareness, essentially through the search algorithms proposed with an equivalent syntax for each type of interventions proposed.

All gray literature in Mexico (reports from government or other institutions, theses, summaries or unpublished research) was reviewed. We worked with a review group to interpret the results and establish recommendations and collaborate in the development of the final manuscript.

With the systematic review, a synthesis of the interventions in schools that have been developed globally for the treatment and prevention of overweight and obesity was carried out.

1.2. Focused formative research

As part of the stage of situational diagnosis and design of the intervention, a formative research was carried out focused mainly on the schoolchildren, the actors that make up their immediate community (parents and teachers) and the environment that surrounds them, considering the determinants socio-environmental consequences of obesity. Formative research, or needs assessment, consisted of determining the interests, attributes, and needs of different populations within a community (primarily those likely to use the intervention, but also other groups of interest in the response or who may be affected by it). , as well as designing interventions that meet these needs and that are culturally acceptable and viable [40].

From the aforementioned literature review, information gaps for the development of IM were identified and when necessary, focused formative research was carried out (collection of information in the field) that fed back into the design of the intervention.

At this stage, key information on healthy and sustainable eating, physical activity and CAR was briefly explored. Facilitating factors and barriers to the adoption of healthy behaviors and self-care were identified, as well as the most appropriate communication

channels to reach children, teachers, and caregivers responsible for schoolchildren. Among other information, the following were documented: a) Access and availability of food and beverages, food context (meal times, family environment, family meals), in addition to knowing if there are CARs; b) Opportunities and barriers to increase the time and intensity of physical activity; c) Availability of water; d) Advertising and street sales of unhealthy foods and beverages, e) Means of transportation to school and f) Access and availability of infrastructure for safe physical activity (for example, parks and other recreational sites, sidewalks, lighting, among others) and Community participation.

The diagnosis was carried out in the intervention schools of Campeche, Mexico City and Morelos and there were two diagnostic modalities:

- For IM schools, a more in-depth diagnosis was carried out which included focus groups and semi-structured interviews, and application of questionnaires aimed at parents, teachers, food and beverage vendors (inside and outside the schools), food inventory and beverages and infrastructure observation formats for physical activity inside and outside school and around the home.

The diagnosis was also carried out in different environments in which intervention can be carried out, as well as among the different groups (target population) to which the interventions will be directed.

Environments:

- *School:* As a complement to the available scientific evidence, the conditions and resources available by the educational establishment for the development of the intervention and possible communication channels and opportunities to improve its implementation were investigated.
- *Home:* Availability of healthy foods and drinks, CAR.
- *Community:* Conditions of the school outskirts, nearby shopping centers or places where food and beverages are purchased, infrastructure and public spaces for recreation and physical activity as well as active transportation opportunities.

Target population:

Those in which the perception of barriers and opportunities for the implementation of the intervention and for the modification of behaviors, as well as communication channels, were explored:

- 4th grade boys and girls,
- Teachers,

- school directors,
- school administrative staff,
- Food and beverage vendors (inside and outside of school),
- Parents of family.

Based on the above, the information that was collected for each level of interest is described below, as well as the methods and instruments that were used:

a. Individual level

The focus groups were conducted by a trained facilitator and a non-participant observer, who used guides with trigger questions to develop the sessions.
multidimensional intervention schools , focus groups were carried out with boys and girls in the 4th grade of primary school. In total, 6 focus groups were held (2 per federal entity). Each group was made up of a minimum of four participants and a maximum of eight, which took place within the school facilities during school hours when the epidemiological traffic light allowed it, or virtually, with prior informed consent from the parents or guardians (Annex 1) and the consent of the children (Annex 2). Focus groups were conducted by a trained facilitator and a non-participant observer. A guide with a semi-structured format was used with triggering questions and supportive teaching materials piloted prior to its application. Through participatory techniques, information related to the school population's preference for food and beverages, and physical activity (activity preference) was obtained; barriers and windows of opportunity for the adoption and maintenance of healthy behaviors, as well as environments, were identified. harmful and favorable for physical and emotional development within school and at home, opinion of children about including health programs in schools, ways to get involved in said programs, opinion of children about changing eating habits and physical activity at home, communication channels and opportunities that could favor the intervention (Annex 3).

In addition, 5 4th grade students from each school were randomly selected (5 students per school, in the 4 schools per state - total 60 students), to whom questionnaires were administered (via telephone / video call) with some of the topics included in the focus groups and other complementary topics. Additionally, an observation of the food consumed and the physical activity carried out at recess or at school was carried out, with prior assent and informed consent for the application of the questionnaire (Annexes 4 - 8).

b. School environment

Complementary to the available scientific evidence and the previous experience of INSalud, in the schools of the community trial (4 schools per federal entity, - 4X3=12 schools in total), with prior authorization from the school director (Annex 9), through an observation guide applied inside the school, aspects such as: Practices, spaces and materials available for carrying out physical activities, in addition to asking some questions to the physical education teachers (Annexes 10 - 11). To document the availability and operation of drinking fountains, availability of other sources of drinking water, number of fixed and mobile establishments that sell food within schools, type of food and beverages that are sold during recess, among others, an inventory of sources of simple water and food and drinks (Annexes 1 2 - 1 3).

The following activities were carried out:

Directors, group teachers (4th grade), physical education teachers, and those responsible for food stores or vendors within the school. Through 24 semi-structured interviews (8 interviews per state/4 interviews in 2 schools per state), knowledge and perception of current strategies to prevent overweight and obesity in schools, perception of healthy and non-recommended foods and beverages, barriers and opportunities to implement interventions that promote healthy lifestyles in schools, communication channels and opportunities to improve an intervention, as well as barriers to compliance with school guidelines (Annexes 1 4 - 18).

Additionally, a questionnaire on health programs, habit change and perception of overweight and obesity was sent to the directors via email (Annexes 1 9 - 20). This questionnaire was applied in the diagnosis of the community trial schools (in total 16 questionnaires, 1 per actor per school per federal entity (4X4X3=48)).

c. Family atmosphere

In clinical trial schools: To triangulate the information previously obtained, the parents, guardians or caregivers of the children who participated in the focus groups mentioned above (at least two interviews per school per federal entity – 2X4X3=24) were asked to provided relevant information for the study through an interview, where topics such as: Family nutrition (schedules, foods consumed most frequently, family meals, etc.), physical and recreational activities at home, use of media, were discussed. transportation to get to school, exposure to media, shopping centers and other places where they purchase food and beverages, and communication channels and opportunities to improve an intervention (Annexes 2 1 - 2 3).

Through focus groups with parents (6 focus groups = 2 per state/2 schools, with at least 5 parents), information was obtained on parents' opinions about including health programs in schools, forms of getting involved in these programs, opinion about changing eating habits and physical activity at home, importance of their participation so that their children modify their behavior, what are the barriers they face to get involved in school programs and strategies to participate in these programs (Annexes 24 - 2 5).

Additionally, a questionnaire on the perception of overweight and obesity in parents and children and another on health programs and habits at home were applied to parents of at least 5 children per school (5X12=60), preference was given to parents or caregivers of the children who participated in the focus groups. The questionnaires were administered by telephone (Annexes 2 6 - 2 7).

The semi-structured interviews and response to the questionnaires were voluntary and were carried out according to the time availability of the interviewees. The communication strategy used considering the COVID-19 pandemic was telephone calls.

d. Community

In community trial schools: In the school outskirts, information was obtained through an observation guide, about the fixed and mobile establishments that offer food and beverages (availability, type of food, costs, hours, proximity to access to the school, etc.), as well as the infrastructure for the practice of physical activity (Annex 2 8). The methodology described by Hernández-Barrera and collaborators [41] was used , which defines that the area of greatest vulnerability in the school periphery is within a perimeter of 100 meters around, due to the proximity and density of establishments and mobile food stalls. . The size of the perimeter was defined according to the recommendation of the Pan American Health Organization (PAHO) [42]. Using the ArcGIS software, the schools were geolocated and for each of them the perimeter was generated with the aforementioned dimension, considering the main entrance as the centroid of the perimeter. The Collector for ArcGIS mobile application was used to geolocate stores, establishments and food and beverage stands, as well as the characteristics of the infrastructure for the practice of physical activity (presence and quality of sidewalks and parks, availability of road signs, presence of obstructions to walking, aesthetics, among others) within this perimeter. In the identified establishments, an inventory of food and beverages was made, as well as their advertising through observation (Annexes 2 9 - 31).

Food vendors in the school periphery: in the schools of the multidimensional intervention, Through semi-structured interviews (6 interviews = 2 per state/school), knowledge and perception of healthy and unhealthy foods and beverages, motives and preference for the sale of certain products, perception of the problem of overweight and obesity in children and adolescents, communication channels and opportunities to improve an intervention. Additionally, a closed questionnaire was applied to complement the information collected through the semi-structured interviews. For the above, 2 vendors were selected per school, per federal entity, for a total of 24 questionnaires. In this case, the interviews were voluntary and were carried out according to the time availability of the interviewees, within the educational establishments, when the epidemiological traffic light allowed it. Particularly, in the case of sellers, they were carried out in person when the epidemiological traffic light allowed it.

Finally, in the multidimensional intervention schools, through a brief questionnaire, which was sent to the home of some randomly selected children (5 per school, per federal entity - 5X4X3= 60 questionnaires) and where parents were asked to respond and send back the questionnaires, the following community aspects were identified: Shopping centers and nearby establishments where the family buys food and drinks (stores, supermarkets, fixed markets, flea markets, etc.), access (cost) and availability of vegetables and fruits in said establishments; advertising of unhealthy foods and beverages, presence of nearby walking destinations, safety (from crime and traffic), access to parks and other recreational sites, infrastructure for practicing physical activity, availability and access to public transportation systems .

Both the interviews and the questionnaires and instruments were applied by a team of professionals experts in qualitative research techniques, focus groups and direct interviews with the study subjects (both the school population and adults). The information collected was captured through mobile devices on a platform designed for this purpose. For their part, the interviews and focus groups were audio recorded and transcribed. The information was coded and a thematic analysis was carried out using the N-vivo qualitative analysis software. The information was emptied into Excel matrices for the subsequent analysis-synthesis process of barriers and facilitators. Finally, the text that synthesized all this information was processed in Word. Table 3 shows the indicators for diagnosis and methods for collecting information.

Table 3. Diagnosis indicators and description of the information obtained.			
Level of inquiry	**Actors**	**Information collected**	**Proposal inquiry method**
Individual.	Boys and girls in the 4th year of primary school.	Preference for food, drinks and physical activities. Identification of barriers and facilitators for the adoption and maintenance of healthy behaviors. Identification of harmful and favorable environments for physical and emotional development within school and at home. Opinion on the importance of including health programs in schools, how to get involved in these programs and opinion on changing eating habits at home. Communication channels and opportunities that may favor intervention.	2 focus groups in IM schools per federal entity, in total 6 focus groups with 4th grade primary school boys and girls from the selected schools. Schools in Campeche, Morelos and Mexico City: Questionnaires administered to children who explored the same topics. The questionnaire was applied to 5 children from each school per federal entity. (5 X4X 3= 60 children)
		Spaces and materials available for carrying out physical activities. Availability and operation of drinking fountains, availability of other sources of drinking water. Number of fixed and mobile establishments that sell food inside schools, type of food and beverages sold during recess inside the school.	City Schools Mexico, Campeche, and Morelos: Guides for observing facilities at school (for physical activity and drinking fountains). Food and beverage inventories. In total, 4 schools were visited per federal entity (4X3=12 schools).
	Directors, 4th grade teachers, physical education teacher and person responsible for food stores or vendors within the school.	Knowledge and perception of current strategies to prevent overweight and obesity in schools and about healthy and non-recommended foods and drinks. Barriers and opportunities to implement interventions that promote healthy lifestyles in schools. Communication channels and opportunities to improve an intervention.	4 actors in 2 IM schools per federal entity, 24 semi-structured interviews.
School.		Barriers to compliance with school guidelines. Physical activity during school hours	

Table 3. Diagnosis indicators and description of the information obtained.			
		Availability of healthy foods and beverages and non-permitted foods and beverages.	
	Managers Teachers Administrative staff.	Perception of obesity, eating behavior and physical activity.	City Schools Mexico, Campeche, and Morelos: Questionnaire (1 manager for each school – 1X4X3= 12 managers answered the questionnaire)
Familiar.	Parents of family.	Family nutrition (schedules, foods consumed most frequently, family meals, etc.). Physical activities at home. Use of transportation to get to school. Exposure to the media, shopping centers and other places where they purchase food and beverages. Your opinion about including health programs in schools, ways to get involved in these programs, opinion about changing eating and physical activity habits at home, importance of your participation for your children to modify their behavior, what are the barriers to that they face to get involved in school programs, strategies to be able to participate. Communication channels and opportunities to improve an intervention.	Focus groups: one focus group in two IM schools per state, in total 6 focus groups. Interviews with parents or caregivers of children from community trial schools (at least two interviews per school per federal entity – 2X4X3=24)
		Perception of obesity, eating behavior and physical activity.	schools **:** Questionnaire sent to parents through the children (5X4X3= 60).

Table 3. Diagnosis indicators and description of the information obtained.			
Community.	Parents of family.	Shopping centers and nearby establishments where the family purchases food and drinks (stores, supermarkets, fixed markets, flea markets, etc.), access (cost) and availability of vegetables and fruits in said establishments; advertising of unhealthy foods and drinks aimed at children, street sales of unhealthy foods and drinks, presence of nearby walking destinations, safety (from crime and traffic), access to parks and other recreational sites, infrastructure for the practice of physical activity, availability and access to public transportation systems.	**Multidimensional intervention** schools : Questionnaire (5 questionnaires per school per federal entity - 5X4X3= 60).
	Food outlets and infrastructure for physical activity on the school outskirts.	Fixed and mobile establishments that offer food and drinks (availability, type of food, costs, hours, proximity to school access, etc.) as well as the characteristics of the infrastructure for the practice of physical activity (presence and quality of sidewalks and parks, availability of road signs, presence of obstructions to walking, aesthetics, among others) within a 100 m perimeter around the school.	**Multidimensional intervention** schools : Observation guide, food and beverage inventory (1X12=12).
		Knowledge and perception about healthy and unhealthy foods and drinks, motives and preference for the sale of certain products, perception of the problem of overweight and obesity in children and adolescents, communication channels and opportunities to improve an intervention.	**Multidimensional intervention** schools : semi-structured interviews (6 interviews = 2 x state/2 schools)
	Food vendors on the school outskirts.	Reasons and preference for the sale of certain products. Perception of the problem of overweight and obesity in children and adolescents. Communication channels and opportunities to improve an intervention.	**Multidimensional intervention** schools : 2 closed questionnaires per school per federal entity (2X4X3= 24 questionnaires).

Due to the pandemic due to the SARS-CoV2 virus (COVID-19), in March 2020 the Federal Government of Mexico issued an Agreement from which classes were suspended in preschool, primary, secondary, normal and other schools. for the training of basic education teachers of the National Educational System, as well as those of the

upper secondary and higher types dependent on the SEP. [1]Due to the above, the need to collect information on the project was considered, taking into account the epidemiological risk traffic light that existed at the time of the visit in the states contemplated in the framework of this study. On that occasion, the recruitment of participants and the collection of information was carried out in person.

1.3. Review and analysis of the political and structural environment for the implementation of multidimensional intervention

In this diagnostic phase, the main policy instruments related to the implementation of school-level interventions for health promotion in schoolchildren were compiled, specifically those focused on improving healthy lifestyle practices and health status. nutrition and health, such as programs, guidelines, standards, laws and regulations. With this information, an analysis of the design of the main public policies for health promotion in the school environment was carried out. The recommendations of the World Health Organization (WHO) for the creation of Health Promoting Schools [43] and the WHO recommendations for the school environment [44] were used as reference instruments . A mapping of actors was carried out to facilitate the implementation of measures that improve the various environments of healthy eating and physical activity.

According to the results of the instruments previously applied, focus groups and/or in-depth interviews were carried out with the informants who were considered key according to the particularities of each school. This allowed us to document, in the selected schools, the implementation of the interventions associated with the strategies to improve school health in Campeche, Morelos and Mexico City, with the purpose of identifying the actions that this program carries out, to be considered in the design and implementation of the multidimensional intervention.

1.4. Instrument validation

During the diagnosis stage, the validation of several instruments designed to evaluate risk eating behaviors (CAR for its Spanish acronym), monitoring of the intervention and evaluation of outcome variables of the intervention was carried out.

Validation of CAR instruments : Validation of self-report instruments for measuring CAR, internalization of the aesthetic ideal of beauty, body dissatisfaction, negative

[1]https://www.dof.gob.mx/nota_detalle.php?codigo=5589479&fecha=03/16/2020

affect, and negative comments about body shape and weight in boys and girls from 9 to 12 years old was carried out. 12 years old, in two stages:

1) The first stage consisted of carrying out 2 cognitive laboratories per school grade in groups of men and women of 10 children each, with the purpose of adapting the format and content of the measurement instruments to the age of the boys and girls participating in the study. For this, 40 girls and boys in the 4th grade of primary school were selected from schools in Mexico City (different from those selected for the situational diagnosis). The cognitive laboratories were audio recorded with the prior permission of the participants and their parents or guardians, transcribed and analyzed to detect the relevant themes indicated.
2) In the second stage, based on the information obtained in the cognitive laboratories, relevant adaptations were made to the questionnaires both in form and content. The resulting version was exposed to the opinion of experts on the subject of obesity and eating disorders to reach a consensus.
3) The validation of the above-mentioned instruments was carried out in children between 9-10 years of age in schools in Mexico City (different from those selected for diagnosis). The reliability and construct validity of each instrument were obtained through internal consistency analysis, exploratory and confirmatory factor analysis. For internal consistency, Chronbach's alpha and item-total correlations were used for the total scale and subscales. For construct validity, a principal components factor analysis with oblique rotation and a confirmatory factor analysis with structural equation models were performed [48].

1.4.1 Logistics diagnostic stage

The survey was planned to be carried out with electronic devices (laptops/tablets) with simultaneous capture in the field; that is, carrying out observations, semi-structured interviews and focus groups with the support of recorders and laptops. The recorded audio and capture information was stored by the supervisors via the Internet to a central server, in which the database was automatically integrated with daily cuts. For the latter, the interviewers took the computers with the supervisor daily to back up the information. The supervisors integrated the information from the respective work group and uploaded it to the server via the Internet. For security reasons, the information was also backed up on USB keys in case of any eventuality.

The field team consisted of one work couple per federal entity (in total 3 couples - 6 interviewers) and one supervisor per federal entity (3 supervisors). The interviewers were personnel currently living in the same city where the study was carried out. Each

pair of the federal entities were in charge of collecting the information on the situational diagnosis in the selected schools in Campeche, Morelos and Mexico City.

The collection of information was carried out in three months, and the analysis of the information in three months, finally the analysis of results and prioritization of intervention needs in 2 months. The development of the systematic literature review was carried out in 8 months, while the validation of the instruments took 6 months (see schedule).

1.5. Analysis of information from the 2005-2017 birth cohort

To identify information that contributes to generating instruments for the development of MI on dietary and physical activity factors that are at risk for the development of obesity and metabolic alterations in the school stage, a secondary analysis of the information from a birth cohort (2005 – 2017). This study collected data from the school population from the pregnancy stage of their mothers to the ages of 1, 6, 12, 24, and 48 months and to the ages of 5, 7, and 11 years of their children. During the first stage of this project, the information that was considered for analysis was: anthropometry, biochemistry (glucose, insulin, lipid profile), feeding practices (breastfeeding and lactation), diet, morbidity, and health history, to which ages of 1, 6, 12, 24 and 48 months and at 5, 7 and 11 years of age. In addition, physical activity data measured by physical activity questionnaire at ages 5, 7, and 11 would be analyzed (and accelerometry for this last year). Additionally, conventional procedures were used to protect the confidentiality of the study population through the use of numerical identification codes in the databases used for the analyses.

Stage 1 Ethical Considerations

Obtaining information from primary sources for conducting interviews respects the principles of the Belmont Report (1979), which establishes three basic principles based on ethics, which refer to respect, benefit and justice for people. It is confirmed that people have autonomy and deserve to be treated as autonomous agents, also increasing their benefits if possible and decreasing, if possible or not, increasing damages and finally justice, where it is sought that all people are treated equally, according to their

needs and efforts. [2]By taking precautions to protect privacy and confidentiality, we sought to reduce and eliminate the consequences of the investigation towards their physical and mental integrity.

For the interview and focus group exercise, the letters of informed consent and assent in the case of schoolchildren, with the sections detailing the objective of the project, description of participation, means of collecting information, as well as the declaration of confidentiality, rights and benefits, ending with contact information.

The confidentiality of the information was protected at all times; on the other hand, the collection of information is expected to have an impact in the future on the management of public policies focused on the health of the population in general and the child population in particular. Access to information is for academic purposes for those involved in the project. The rights available to all individuals range from decline to participation, withdrawing or not answering if they are uncomfortable with the questions asked, feel offended or threatened. It is declared that there is no financial, political or other conflict of interest with third parties.

Generalities of the results of stage 1

In general, in stage one it was identified that multi-component interventions that involve different actors, for example, including physical activity, nutrition and behavior changes, where the school, family and community are involved, could be the more effective both in preventing and reducing overweight and obesity in boys and girls between 6 and 12 years old. Also, programs were identified in the school context that have been implemented in Mexico, for example: national physical culture and sports program, action program in the school context (PACE), 5-step strategy for school health, Intersectoral Education Program Healthy (FEET), among others.

Likewise, based on the review and analysis of the political and structural environment, the main policies and programs implemented in Mexico in the last 20 years in the school context were identified, for the promotion of healthy lifestyles: it was identified that throughout Each six-year period, various actions and programs have been implemented aimed at Mexican children and adolescents, in which, through Health Education (EPS) and Health Promotion (PS), it is desired to encourage the adoption of health styles.

[2] National Commission for the protection of human subjects of biomedical and behavioral research. Belmont Report Ethical principles and guidelines for the protection of human research subjects. Natl Institutes Heal [Internet]. 2003;12. Available from: https://www.etsu.edu/irb/Belmont Report in Spanish.pdf

Healthy lives through the teaching of topics such as: healthy eating, adequate hydration, physical activity, basic sanitation, among others.

Birth Cohort Analysis Progress

To date, the information on the biochemical indicators has been cleaned, the adiposity indicators have been generated for the different contacts, the dietary information for 4, 5, 7 and 11 years has been processed, the dietary inflammation index has been estimated for each contact and they are finishing creating about 20 dietary indicators to characterize dietary patterns in children. Likewise, physical activity and inactivity indicators were estimated at the ages of 5, 7 and 11 years .

2. Stage 2. Design and development of the multidimensional intervention and evaluation instruments.

Generalities of stage 2

Next, the design that was proposed to carry out the IM is presented, derived from the results of the situational diagnosis, the focused formative research, the review and analysis of the political and structural environment, and the analysis of the implementation and evaluation of previous strategies. .

Stage 2 objectives

Design and develop a multidimensional intervention, considering the ecological model of behavior, which is based on the premise that individuals are a product of the environment.

Implement a feasibility study to explore acceptance by future users and quantify the requirements of the intervention through the constructs of effectiveness, adoption, consistency of implementation and maintenance.

Study design for stage 2

To design stage two, we will start from the results of the review of the literature and the results obtained in formative research. From this, the data were analyzed considering the strategic axes of the intervention, target population, practices and expected goals. These axes were:

1) Healthy and Sustainable Eating (ASS)
2) Movement behaviors (CM)
3) Psychosocial component (PC)

Each of the axes has an intervention objective at a behavioral level (that is, the expected target practices), and differentiated strategies and activities were carried out by actor, taking into account their specific needs and described below:

1) Healthy and sustainable diet (ASS for its Spanish acronym)

The objective of the intervention at the behavioral level is:

I. Increase the consumption of vegetables and fruits in girls and boys

II. Increase natural water consumption in girls and boys
III. Reduce the consumption of sugary drinks in girls and boys
IV. Reduce the consumption of ultra-processed foods in girls and boys

Table 4 (Annex 32) shows the target population, the construct that was worked on based on Azjen's previously accepted behavioral theory, as well as the activities that were carried out to achieve the objectives of this axis, among which we can find: animated projections, snacks that incorporate fruits and/or vegetables, measurement of their hydration status through images where they can observe the color of their urine and relate it to the simple water consumption they have had, as well as activities through the messaging platform via mobile, WhatsApp.

2) Movement behaviors (CM for its Spanish acronym)

In this axis, the following practices were established as expected goals:

I. Increase levels of physical activity, mainly of moderate to vigorous intensity inside and outside of school hours.
II. Reduce sedentary time, including screen time, inside and outside of school hours.
III. Improve the duration and quality of sleep.

Table 5 (Annex 32) presents the target population, the constructs that were related to the preselected theory of behavior. Among the activities that were carried out to achieve the goals of this axis were the educational projection on movement behaviors.

3) Psychosocial component (PC for its Spanish acronym)

The objectives of the intervention at the behavioral level (expected target practices) were:

I. Reduce stigmatization regarding weight and body shape.
II. Improve the emotional management of girls and boys regarding food.
III. Identify signs of hunger and satiety.
IV. Reduce Risky Eating Behaviors (CAR).
V. Decrease the internalization of the aesthetic ideal of thin beauty

Table 6 (Annex 32) shows the elements that were taken into account for the implementation of the psychosocial component. Some activities that were carried out were the holding of workshops on key topics of psychosocial determinants in boys and

girls, virtual workshops on topics of psychosocial determinants such as obesity and. healthy nutrition.

Multidimensional intervention design

To establish the IM design, these three steps were followed:

2.1 Feasibility study and validation/pilot test of the intervention materials.

- **Workshop to define the IM Design.** To develop the intervention package, four workshops were held with the project researchers to define the audience, behaviors and interventions, including the selection of target audiences, behavioral objectives, barriers to consider, and multilevel and multichannel interventions to achieve behavioral change.
  The objective of the workshops was to prioritize the package of activities of the Multidimensional Intervention, based on Ajzen's social marketing methodology and theory of planned behavior.

- **Field work to identify the barriers and facilitators** associated with the activities and recommendations proposed from the formative research and that were outlined in the workshops to define the design of the IM; as well as validate the components of the communication strategy that will be directed to the school community where the study intervention will be carried out.

Feasibility study methodology

In this study, a survey was carried out that approximately reflected the acceptance by future users and its distribution method. It also allowed the quantification of requirements. This survey was carried out in the different federal entities selected for this research project (Morelos, Campeche, Mexico City), where constructs such as: **Effectiveness** or efficacy, **Adoption** by staff, environments, systems were analyzed. and target communities, **Consistency of implementation** , costs and adaptations made during delivery, **Maintenance** of intervention effects on individuals and environments over time. The three strategic axes were represented by a field team made up of four expert professionals in the different areas, who also had comprehensive training regarding the implementation of the objectives and goals of the study and instruments.

Regarding work logistics, the coordinating team sought the pertinent permits and authorizations for the selected schools, once the permits were obtained; The field work team contacted the educational authorities of the schools to explain the implementation logistics that will derive from the school activities of each institution. After signing consent (Annexes 33-36) and informed assent (Annexes 37), the field team applied different instruments, such as guides for focus groups and interviews (Annexes 38-43), incorporating topics from the three strategic axes that They will seek precise information on knowledge, attitudes, practices and perceptions of the proposed activities, as well as group activities, in the target population.

From this information, the activities, distribution method and implementation time were detailed.

The design and results of the feasibility study are described in detail in Annex 44.

2.2 Feedback and modification of the activities and communication materials of the initial IM proposal on healthy and sustainable eating, movement behaviors and psychosocial determinants based on the results of the field work.

Based on the results of the feasibility study.

2.3 Implementation logistics.

Definition with each of the federal, state and school authorities for implementation.

Description of the intervention by axis

The objectives of the key components that are contemplated within the intervention are broken down below.

Table 7. Components of the Multidimensional Intervention for behavioral change:

1. Healthy and Sustainable Eating: Nourishing Bodies and the Planet.	Our program focuses on educating and empowering girls and boys about the importance of choosing foods that nourish their bodies, integrating the importance of caring for the environment. With the help of interactive educational activities, the connection between our dietary choices and their impact on the sustainability of the planet will be explored. Likewise, we will work with primary caregivers to provide them with tools that allow them to make informed decisions regarding family nutrition.

2. Movement Behaviors: Get Active for an Active Future.	Encouraging movement habits from an early age is essential for healthy physical and mental development. Through fun games and exercises, we encourage girls and boys to incorporate more physical activity into their daily routines. Additionally, we will collaborate with teaching staff to integrate moments of movement into the educational environment, thus creating a culture of activity in the school.
3. Psychosocial Component: Cultivating Resilient Minds.	We recognize the importance of psycho-emotional aspects in general well-being. We will work closely with teachers to offer strategies that promote emotional intelligence, self-esteem and resilience in girls and boys. By cultivating these skills, we seek to prepare them to face challenges with the confidence and empathy required.

In IM, each of the components, already mentioned above, were designed with the purpose of obtaining a lasting impact on the health and well-being of fourth-year girls and boys, as well as their families and school communities. By working together, we will build a future where health and sustainability are fundamental pillars in the education and growth of new generations.

AXIS 1. HEALTHY AND SUSTAINABLE FOOD

Increase consumption of vegetables and fruits

Action description

1. Capsule "Let's eat more fresh vegetables and fruits in all our meals."

With the aim of promoting healthy eating habits and encouraging the intake of fresh vegetables and fruits in their daily diets, one of the first activities involves the visualization during the Launch of the audiovisual material of the educational capsule titled "Let's eat more fresh vegetables and fruits in all our meals" designed for girls and boys. Through this capsule, we seek to raise awareness among girls and boys about the importance of incorporating fresh vegetables and fruits into their daily meals to maintain a balanced and healthy diet. The capsule offers information and practical advice on how to integrate these foods into your diet in a delicious, attractive and sustainable way.

2. Promotion of healthy vegetable and/or fruit snacks

It is an activity designed for girls and boys , which seeks to instill in them the importance of adopting conscious food choices and fostering a positive relationship with food, while promoting a healthy school environment.

The activity consists of that from Monday to Friday, all fourth grade primary school students bring with them a snack consisting of vegetables and/or fruits . To ensure compliance with this healthy practice, we have assigned a person in charge of supervising that snacks are brought during school hours before recess.

Once students submit their healthy snacks, they will receive a ticket as a reward from the supervisor. These tickets will be cumulative and, at the end of the school year, you will have the opportunity to participate in a drawing. Among the prizes they can win are bicycles, balls and other prizes that promote well-being and fun.

3. Sale of healthy vegetable and/or fruit snacks for the Promotion of Nutritious Snacks: Collaboration with School Vendors

In the search to promote healthy eating habits among schoolchildren, the modification of the environment is sought with the *sale of healthy snacks of vegetables and/or fruits in school cooperatives* . This initiative is aimed at food vendors within schools, with the aim of providing nutritious and delicious options for the school community.

An invitation to the Launch will be extended to food vendors operating within the school premises to join this noble cause. Your collaboration plays a fundamental role in promoting healthy eating in the school community. Additionally, at the launch, the following materials will be distributed in print:

By incorporating healthy snacks of vegetables and fruits in your offering, you will be contributing to the well-being and comprehensive development of our students. This activity not only benefits the health of girls and boys, but also establishes a valuable message about the importance of making informed and balanced food decisions.

newsletter : ***Encouraging nutritious snacks, fun movement and happy minds with our healthy intervention*** **with the key messages to promote.**

On the day of launch, delivery will be made in printed format. This material is specifically designed for those in charge of caring for girls and boys in fourth grade, with the purpose of instilling healthy and positive habits from an early age. Its crucial influence in the formation of these beneficial behaviors is recognized. Through this publication, we seek to provide fundamental tools that allow them to guide girls and boys in aspects related to healthy and sustainable eating, as well as in promoting an active life and healthy psycho-emotional behaviors.

Within the informative Gazette, you will find the 10 recommendations:

- Let's eat more fresh vegetables and fruits in all our meals. Let's choose seasonal ones, which are cheaper and, when possible, locally produced.
- Let's avoid ultra-processed foods, such as: sausages, chips, cookies, sweet bread and boxed cereals, since they have a lot of fat, salt and/or sugar. Let's choose foods without stamps or with as few stamps as possible.

- Let's do more physical activity like walking, running or dancing. Let's spend less time sitting or in front of the screen (cell phones, television, video games and others). Every move counts!
- Let's drink more natural water throughout the day and with all our meals, instead of sugary drinks such as soft drinks, juices, waters prepared with powder sachets and sports drinks. Excess sugar is harmful to our body and the packaging pollutes the environment.
- Let us consume beans, lentils or broad beans daily, prepared as stews, soups or with vegetables. They have protein and fiber, they are practical and economical.
- Let's choose whole grains such as corn tortillas, oats, rice or tubers, such as potatoes. They have vitamins, fiber and give energy.
- Let's eat less beef and processed meats. Instead, you can eat beans, lentils, eggs, chicken or fish. For our health and that of the planet, let's choose more plant-based foods.
- Let's enjoy our meals with family or friends when possible. Let's all participate in the planning and preparation of meals, without wasting food.

4. Sending messages via WhatsApp throughout the school year. The messages are aimed at mothers, fathers, caregivers and teaching staff in short texts that touch on the topics of Healthy and Sustainable Eating, in order to raise awareness of the importance of increasing the consumption of vegetables and fruits, paying attention to the constructs of knowledge, attitude and subjective norm when presenting practical information to carry in your daily life.

20-hour Virtual Course . The course is geared toward fourth grade teaching staff and will address a wide range of topics, including Healthy and Sustainable Eating, Movement Behaviors, and Psychoemotional Determinants. The course will be available from January to March 2024. During this period, both teachers and physical education teachers will have the flexibility to select the time that best suits their comfort and determine the duration they consider appropriate. However, it will be necessary to complete a total of 20 hours within this established period, as an essential requirement for the successful completion of the course. The fundamental purpose is to contribute to strengthening the foundations of knowledge by reinforcing key messages.

Increase the consumption of natural water and reduce the consumption of sugary drinks

Action description

1. Capsule "Let's drink more natural water throughout the day and with all our meals."

During the launch of the IM, the information capsules will be announced. The objective is to promote an increase in the consumption of natural water and reduce the

consumption of sugary drinks. The capsule has the name “Let's drink more natural water throughout the day and with all our meals”, it is aimed at girls and boys to provide information about the benefits to the body and health that water consumption brings us, in addition to the advantages it has over sugary drinks. The capsule has simple and accessible language so that girls and boys can learn the information that is intended to be shared.

2. Daily record of pee/urine color .

The activity is aimed at girls and boys in order to provide knowledge about the importance of consuming natural water and reducing sugary drinks, at the same time showing how they can know their state of hydration or water consumption through the color of their urine by contrasting it with a scale present in the communication material called “pipimeter”, which tells them if it is necessary to increase water consumption according to the color of their urine.

The activity will take place from the first week of IM implementation until its completion. The IM promoters will go to the fourth grade classrooms and explain to girls and boys about the importance of consuming natural water and reducing sugary drinks, they will show the “pipimeter” material so that they become familiar with what the color scale tells us, this instrument will be placed in the school bathrooms; Lastly, girls and boys will be given material to record the color of their urine, with the instruction to do it daily during the school day.

3. Digital and printed infographic with the recommendation “Let's drink more natural water throughout the day and with all our meals” included in a Gazette with the rest of the key messages to promote.

4. Sending messages via WhatsApp throughout the school year. The messages are directed to mothers, fathers, caregivers and teaching staff in short texts, addressing the topics of Healthy and Sustainable Eating, in order to raise awareness of the importance of increasing the consumption of natural water and reducing the consumption of beverages. sugary, fertilizing the constructs of knowledge, attitude and subjective norm by presenting practical information to carry in your daily life.

5. 20- hour Virtual Course . The course is aimed at fourth grade teaching staff, in which Healthy and Sustainable Eating topics will be taught. It will take place from October to December 2023, where the teacher will have the possibility of taking the course at the time that is most comfortable for them and for the time that seems convenient to them with the condition of completing the 20 hours in the established period. The objective is to contribute to the knowledge constructs by reinforcing the key messages regarding the increase in the consumption of natural water and the decrease in the consumption of sugary drinks.

Reduce consumption of ultra-processed foods

Actions.

1. Capsule "Ultra-processed foods."

The capsule will be unveiled during the launch of Multidimensional Intervention. It is aimed at girls and boys with the aim of promoting the reduction of ultra-processed foods. It is titled "Ultra-processed foods" and contains information that ranges from what a food of this type is, mentioning its characteristics and the manufacturing process, to the possible damage to health that its consumption implies, it presents practical information to avoid or reduce their consumption, as well as making them aware of how to use labels and seals on packaging. All of this is communicated in simple and pleasant language so that the message is accessible to girls and boys.

2.Sending videos to the WhatsApp platform, in the " Healthy Reporter " activity .

Girls and boys are invited to make an informed video where an ultra-processed food is exposed, explaining the risks involved in its consumption and a healthy option to replace it, all with the help of educational material, such as a drawing they created. The videos will be made with the support of their mothers, fathers and caregivers, who will send the video to the IM's own WhatsApp group. This content will be selected to be projected during the two events that will take place in the middle of the IM and at its culmination. The objective of this activity is to contribute to the constructs of knowledge, attitude and subjective norm favorable to the consumption of vegetables and fruits, as well as to strengthen the subjective norm.

3. Digital and printed infographic with the recommendation "Let's avoid ultra-processed foods. Let's choose foods without stamps or with as few stamps as possible" included in a gazette with the rest of the key messages to promote.

4. Sending messages via WhatsApp throughout the school year. The messages are aimed at mothers, fathers, caregivers and teaching staff in short texts that touch on the topics of Healthy and Sustainable Eating, in order to raise awareness of the importance of reducing the consumption of ultra-processed foods, contributing to knowledge constructs. , attitude and subjective norm when presenting practical information to carry in your daily life.

20-hour Virtual Course . The course is aimed at fourth grade teaching staff, in which topics of Healthy and Sustainable Eating will be covered. It will take place from September to December 2023, where the teacher will have the possibility of taking the course at the time that is most comfortable for them and for the time that seems convenient to them with the condition of completing the 20 hours in the established period. The objective is to contribute to the knowledge constructs by reinforcing the key messages regarding the reduction in the consumption of ultra-processed foods.

AXIS 2. MOVEMENT BEHAVIORS

Increase physical activity levels

Mainly moderate to vigorous intensity inside and outside of school hours. Reduce sedentary time, including screen time, in and out of school hours.

Action description

1. Capsule "Let's do more physical activity like walking, running or dancing. Let's spend less time sitting or in front of the screen."

The capsule will be shown to the entire school community during the launch of the IM. This material is aimed at fourth grade girls and boys due to its simple and accessible language. It is called "Let's do more physical activity like walking, running or dancing. Let's spend less time sitting or in front of the screen." Its objective is to promote physical activity in and outside of school, as well as to make them aware of the damage to health that can be caused by spending prolonged periods of time sitting or in front of a screen, and thus encourage its reduction.

2. Active breaks regularly during classes.

Girls and boys, with the support of teachers, take active breaks. The teaching staff would be given a manual and videos indicating various activities.

Aimed at girls and boys.

3. Active recreation.

The IM promoters together with the physical education teachers, hand in hand with the implementation manual for active recreation, will carry out a series of exercises and activities aimed at fourth-grade primary school girls and boys. This activation will take place after recess, prior to returning to the classrooms. It is planned that active recreation will be implemented during the months in which the Multidimensional Intervention is implemented. At first the promoter will advise the teacher on physical education and over time the teacher will implement it in its entirety.

4. Paint your patio workshop.

In the first week of IM implementation, on a day agreed upon together with mothers, fathers and caregivers, fourth grade girls and boys, as well as school directors, games such as airplanes, hopscotch, stop, etc. will be painted. , in the courtyards of the school facilities. This activity has the purpose of providing spaces that encourage physical activity during the school day.

5 . Digital and printed infographic with the recommendation "Let's do more physical activity, like walking, running or dancing. Let's spend less time sitting or in front of the screen " included in a Gazette with the rest of the key messages to promote.

6. Sending messages via WhatsApp.

Throughout the implementation, messages will be sent regularly via WhatsApp to mothers, fathers, caregivers and teaching staff on the topics of Movement Behaviors, aimed at raising awareness of the importance of increasing the practice of physical activity. The messages are made with the objective of contributing to the constructs of knowledge, attitude, subjective norm, perceived control, intention and practice of the key messages related to encouraging increased physical activity in school-age girls and boys.

Improve the duration and quality of sleep.

Action description

1. Sending messages via WhatsApp.

Throughout the implementation, messages will be sent regularly via WhatsApp to mothers, fathers, caregivers and teaching staff on the topics of Movement Behaviors, aimed at raising awareness of the importance of improving the duration and quality of sleep in girls and boys. . The messages are made with the objective of contributing to the constructs of knowledge, attitude, subjective norm, perceived control, intention and practice of the key messages related to improving practices, in girls and boys, related to sleep.

AXIS 3. PSYCHOSOCIAL COMPONENT

A pilot study was carried out for a comprehensive understanding of the workshops with a total of 100 children between 9 and 10 years old divided into groups of 12 members, 4th grade students at the "Salvador Varela Reséndiz" public school, morning shift in the city of Zacatecas, Zacatecas in the month of June 2023. The purpose of the study was to determine the acceptance of the activities, measure the time of each one and per session, and assess the understanding of the topics and instructions. The response was generally favorable, but as a result of the study, adjustments were made to some activities, mainly regarding some reflection questions, simplifying the language and providing more specific explanations.

Reduce stigmatization regarding weight and body shape. Reduce risky eating behaviors. (CAR)

Description of actions.

1. Workshop "Prevention of stigmatization with weight and body shape; and Risky Eating Behaviors (CAR)."

Face-to-face workshops will be implemented for girls and boys, and online for mothers, fathers, caregivers and teaching staff. on key topics of Psychosocial Determinants . The workshop is called "Prevention of stigmatization with weight and body shape; and Risky Eating Behaviors (CAR)." It will be applied in a session of one duration of 40 min for girls and boys, while the online workshop is planned for a duration of 1 hour. The purpose of the workshop is to contribute to the construct of knowledge about stigmatization with weight and body shape, as well as risky eating behaviors in girls and boys, in order to reduce them.

2 . Sending messages via WhatsApp

Throughout the implementation, messages will be sent regularly via WhatsApp to mothers, fathers , caregivers and teaching staff on the topics of Psychosocial Determinants, aimed at raising awareness of the importance of preventing weight stigmatization and the body figure; and CAR. The messages are made with the objective of contributing to the constructs of knowledge, attitude, subjective norm, perceived control, intention and practice of the key messages related to reducing the stigmatization of weight and body shape, and risky eating behaviors in girls. and school-age children.

Improve the emotional management of girls and boys regarding food

Description of actions

1. Workshop " Emotional management of children about food."

An in-person, one-session workshop lasting 40 minutes will be implemented, aimed at girls and boys on key topics of Psychosocial Determinants, with the name "Emotional management of children on food." This workshop aims to contribute the constructs of knowledge, attitude, subjective norm, perceived control, intention and practice of messages to the topic of management, in girls and boys, of emotions related to eating.

2. Sending messages via WhatsApp

Throughout the implementation, messages will be sent regularly via WhatsApp to mothers, fathers, caregivers and teaching staff on the topics of Psychosocial Determinants, aimed at raising awareness of the importance of emotional management of children regarding food. The messages are made with the objective of contributing to the constructs of knowledge, attitude, subjective norm, perceived control, intention and practice of the key messages to help identify emotions related to eating in school-age girls and boys.

Identify signs of hunger and satiety. Reduce symptoms of anxiety and depression

Description of actions.

1. Workshop "Identification of hunger and satiety signals; and symptoms of anxiety and depression."

A one -session workshop will be implemented in person for girls and boys, and online for mothers, fathers, caregivers and teaching staff, where key topics of Psychosocial Determinants in girls and boys will be addressed, the workshop is named from "Identification of hunger and satiety signals; and symptoms of anxiety and depression . " The objective is to contribute to the constructs of knowledge, attitude, subjective norm, perceived control, intention and practice of key messages to help the school community identify signs of hunger and satiety, as well as reduce symptoms of anxiety and depression in girls and boys of school age.

2. Workshop "Limits, parenting and self-care".

A one- session workshop will be taught in online format aimed at mothers, fathers and caregivers on key topics of Psychosocial Determinants in girls and boys, with the name "Limits, parenting and self-care." The purpose of this workshop is to contribute to the constructs of knowledge, attitude, subjective norm, perceived control, intention and practice that help improve the relationship between mothers, fathers and/or caregivers with their girls and boys.

3. Workshop "Teaching and self-care".

There will be given a One-session online workshop , aimed at teaching staff, where various key topics of Psychosocial Determinants in girls and boys will be addressed. The workshop is called "Teaching and self-care." Its purpose is to contribute to the constructs of knowledge, attitude, subjective norm, perceived control, intention and practice in teachers related to their professional work.

4. Sending messages via WhatsApp.

During the implementation of the IM , messages will be sent via WhatsApp to mothers, fathers, caregivers and teaching staff , where topics pertaining to Psychosocial Determinants are addressed, with the aim of raising awareness of the importance of the Identification of hunger and satiety signals; and symptoms of anxiety and depression. This activity seeks to pay the constructs of knowledge, attitude, subjective norm, perceived control, intention and practice related to the key messages of the Psychosocial Determinants.

Reduce the internalization of the thin aesthetic ideal of beauty.

Description of actions.

1. Workshop "Internalization of the aesthetic ideal of thin beauty."

A one-session workshop will be conducted to fourth grade girls and boys , with the name “Internalization of the thin aesthetic ideal of beauty”, which will be taught in person and will address key topics of Psychosocial Determinants in girls and boys . The objective of this workshop is to contribute to the constructs of knowledge, attitude, subjective norm, perceived control, intention and practice on the key messages related to the internalization of the aesthetic ideal of thin beauty in girls and boys.

2. Sending messages via WhatsApp.

During the implementation of the IM, messages will be sent via WhatsApp to mothers, fathers, caregivers and teaching staff, the messages touch on topics of Psychosocial Determinants, with the aim of raising awareness of the importance of identifying hunger signs. and satiety; and symptoms of anxiety and depression. This activity seeks to pay the constructs of knowledge, attitude, subjective norm, perceived control, intention and practice related to the key messages of the Psychosocial Determinants aimed at publicizing the Internalization of the aesthetic ideal of thin beauty.

Generalities of the results of stage 2

The design of the IM was based on a wide range of local, national and international studies, tests and experiences for the promotion of healthy lifestyles in school-age girls and boys. The IM was developed with a Behavior Change Communication (BCC) approach, which involves the systematic application of interactive communication processes, based on behavioral theories and models, in our case: Social Marketing1 and Ajzen's Theory of Planned Behavior2 -3 and driven by the Ecological Model approach that considers the key factors for change at the individual, community and social level. The above consolidates a conceptual thought that looks at the relationships between individuals and their environment, as well as the principles of social marketing.

The design and development of the IM includes the translation of the results of the formative research carried out in 2022 in the states of Morelos, Campeche and the State of Mexico.
It also includes key decisions and strategies proposed in the Workshops developed by the team of researchers who collaborate in the IM of the selection of target audiences, behavioral objectives, barriers to consider and multilevel and multichannel interventions to achieve behavioral change. Likewise, the main results of the feasibility study carried out in Campeche and Morelos during the months of May-June 2023 are included. Derived from the results of the feasibility study, the activities for each component are proposed and adjusted. This document describes the design of the MI, that is, what to do to implement the package of interventions to foster an environment that promotes healthy lifestyles and send effective messages among the target audiences and the process used for the design. Therefore, it will guide and provide direction in the development of the rest of the intervention to ensure that activities, materials and messages are aligned and integrated towards the goal of modifying

behaviors to improve eating, nutrition, movement behaviors and Psychosocial aspects of school-age girls and boys. The results of stage 2 are detailed in annex 44.

3. Stage 3. Implementation, monitoring and evaluation of the multidimensional intervention.

In accordance with what was previously described (figure 2), to evaluate the effect of MI, two studies will be carried out in parallel: 1) Randomized community trial in 3 states of the Mexican Republic: Campeche, Morelos and Mexico City and 2) Trial randomized clinical trial in Cuernavaca, Morelos with a more exhaustive evaluation. In both studies, the intervention will be implemented for the same time and an initial evaluation will be carried out, before implementation, and a final evaluation, at the end of the intervention.

3.1. Basal Measurement

The baseline measurement offers a set of evidence and insights about the initial situation of a project, as well as the context in which it intervenes, so that this information can be compared with the changes achieved in subsequent analyses. Baseline is defined as a set of indicators selected for systematic monitoring and evaluation of policies and programs.

3.2. Implementation of the intervention

For the selection of schools (control and intervention), the educational authorities of each of the participating states sent a list of schools that meet the inclusion criteria. In this sense and to reduce the risk of contamination between individuals, random selection was carried out. carried out at the school level. Additionally, we confirmed that the control and intervention schools do not share directors and/or teachers.

This stage consists of the following phases:

1. **Randomization and recruitment of participants.** Randomization will be carried out in 2 blocks (intervention and control) with 4 schools in each block, by state, in the program https://www.randomlists.com/ .

Subsequently, randomization will be carried out, and the control group and the intervention group will be established. Table 8 shows the list of schools proposed by the educational authority, differentiated by intervention and control group.

Table 8. Primary schools integrated in the Multidimensional Intervention, stratified by state

State	Cluster	School name	Clue
Morelos	Intervention	Latin American Institute	17PJN0008D
	Intervention	Loyola Educational Group	73/LXII/12
	Control	Hope School	17PJN0571A
	Control	Cervantes School of Morelos	17PES0054Z
Campeche	Intervention	Justo Sierra Mendez	04DPR0362C
	Intervention	Republic of Honduras	04DPR0216S
	Intervention	Gunner Boy	04DPR0007M
	Intervention	Lucila Alayola Laura	04DPR0089M
	Control	Presidente Ruiz Cortines School Center	04DPR0353V
	Control	Josefa Ortiz de Dominguez	04DPR0716N
	Control	CE Pdte. Avila Camacho	04DPR0360E
	Control	Children of workers	04DPR0167Z
Mexico City	Intervention	First of May	09DPR2005X
	Intervention	Somalia	09DPR2231T
	Intervention	Gen. José Mariano Monterde	09DPR2302X
	Intervention	State of Querétaro	09DPR2816V
	Control	Prof. Mazimiliano Molina Fuente	09DPR5147P
	Control	Prof. José S. Benitez	09DPR0045K
	Control	Jose Azueta	09DPR0849Z
	Control	Luis de la Brena	09DPR2011H

Additionally and only for the accelerometry component (measurement of physical activity, we request that we be allowed to include two public schools in Guadalajara, in order to increase the sample size (100 additional participants). The school chosen for this purpose is: School José María Morelos y Pavón primary school
Pirul Street # 25 Lomas de la Solitude, Tonala, Jalisco. CP 45403

Once the group to which each school will belong has been defined, the consent of the teachers and managers of the school cooperatives that will participate in the intervention will be requested (Annexes 45 – 46). Subsequently, a meeting will be held with parents and fourth grade primary school students to extend an invitation to participate. A total of 30 students will be selected for each control and intervention school. As part of the recruitment process, letters of consent and informed assent will be delivered and explained to participating parents and students (Annexes 47 – 50), respectively. Once the recruitment of participants is completed, the initial evaluation will be carried out.

2. **Initial evaluation:** Represents the first measurement, whose methodology must be replicated at the end of the project cycle. The baseline measurement must focus on: a) showing evidence that characterizes the target population at the beginning of the intervention, b) analyzing the dynamics of the context and, especially, those external factors that would affect the achievement of the project results for its subsequent monitoring, and c) determine the starting situation of the project's results and impact indicators, raising their first value using research techniques.

3. **Implementation:** Once the baseline measurement has been carried out, considered as activity 1, the following activities will be carried out (Annexes 51 – 55):

Activity 2. Launch of the Multidimensional Intervention The school community (schoolchildren, teachers...) is made aware of the activities that will be carried out by each actor that will be part of the Multidimensional Intervention.	
Aim	So that the school community is aware of the activities in which they will be participating within the IM.
Development of the activity	With some time in advance (at least 2 weeks before), an invitation is sent to the entire school community, with detailed information about the event. Subsequently, a reminder will be sent to them to attend the event. The invitation will be shared through teachers and directors to mothers, fathers, and caregivers of schoolchildren. Additionally, 4th grade teachers, physical education class teachers and school store salespeople will be sent the invitation through the promoters of the Multidimensional Intervention. The printed material of the communication campaign will be placed in the school facilities, for example: canvases and banners with key IM messages in strategic spaces inside and outside the school. So that the school community has the comfort of attending, the launch will take place within the school facilities, in a large space, indicated by the directors, and conditioned to carry out the activity optimally, placing chairs and installing visual and audio equipment. . The promoters will make known what the activity is about, what they seek to obtain with it and the benefits of participating in the workshops and other proposed dynamics. With the help of a PowerPoint presentation, the key messages will be shown to the school community, the development of the activities to whom they are directed and the moment in which they will be developed. Educational capsules with the key IM messages described below will be projected to the school community. Informed consent letters will be given to parents for authorization to participate and sign. Registration will be made (ADTA) to receive mobile messaging via WhatsApp with key messages aimed at mothers, fathers and 4th grade teachers. Printed material with the key messages will be given to the school community, for example: Manual on Movement Behaviors, flyers with all the key messages, magnet to stick on the refrigerator, etc. Finally, the contact channels will be announced in case they require

	more information and any doubts that the school community may have will be dispelled to later close the launch.
Who does it?	The IM team is made up of: Doctors (or), Nutritionists (or), Lic. Physical Education, who are the promoters of the IM of the National Institute of Public Health and are the people who will be implementing the activities corresponding to the Intervention Multidimensional.
Material	To launch the IM you need: ● Audio and video equipment. ● Manual of movement behaviors. ● Flyer with messages to send. ● Refrigerator magnet. ● Database for WhatsApp REGISTRATION. ● PowerPoint presentations. ● Educational capsules.
It will be aimed at the entire school community, including mothers, fathers, caregivers of school-age girls and boys, school directors, 4th grade teachers, Physical Education class teachers and school store salespeople.	

Activity 3. Projection to the school community of the educational capsule with the key messages of CM, ASS and DS

Screening of the educational capsules of the key messages of the IM regarding the importance of consuming fruits and vegetables, the importance of water consumption, the benefits of physical activity, and the school community during the launch of the IM.

Aim	1. Improve knowledge about the importance and benefits of consuming vegetables and fruits, generate favorable attitudes towards their consumption, and thereby favor the subjective norm regarding consumption, leading to creating confidence in girls and boys in their ability to eat them and increasing confidence. intention to consume them. 2. Improve knowledge about the risks of consuming ultra-processed foods, increase negative attitudes towards the consumption of ultra-processed foods, strengthen the negative subjective norm regarding consumption, increase confidence in girls and boys in their ability not to consume ultra-processed foods, increase the intention to Do not consume ultra-processed foods and reduce the consumption of ultra-processed foods.
Development of the activity	The material will be shown with the help of audiovisual equipment, whether projector or screens, to mothers, fathers, caregivers and teaching staff, during the launch activity. Subsequently, the IM team will reflect with the participants on the content of the capsules.
Who does it?	The projection of the educational capsules will be carried out by the IM promoters.

Material	The materials necessary for the activity are: ● Educational capsules. ● Audiovisual equipment.
The screening will take place during the launch of the IM with the entire school community. The activity is aimed at the entire school community participating in the IM.	

Activity #4. Delivery of communication material: infographics and magnet Printed communication material, infographics of the IM's key messages and refrigerator magnets promoting water consumption are delivered to mothers, fathers and caregivers of school-age children.	
Aim	1. Improve knowledge about the importance and benefits of consuming vegetables-fruits and natural water, generate favorable attitudes towards their consumption, and thereby favor the subjective norm regarding the consumption of vegetables-fruits and water, leading to creating in girls and boys the confidence in their ability to eat vegetables-fruits and natural water, as well as increasing the intention to consume them, all with the aim of increasing the consumption of vegetables-fruits and natural water.
Development of the activity	The IM promoters will present and explain each of the materials to the school community during the launch of the IM, delivering the physical material. The infographics contain key messages to promote knowledge about: 1. **Let's eat more vegetables and fruits:** Let's eat more fresh vegetables and fruits in all our meals. Let's choose seasonal ones, which are cheaper and, when possible, locally produced. 2. **Let's drink more natural water every day:** Let's drink more natural water throughout the day and with all our meals, instead of sugary drinks such as soft drinks, juices, waters prepared with powder sachets and sports drinks. Excess sugar is harmful to our body and the packaging pollutes the environment. 3. **Let's avoid ultra-processed foods and drinks.** Let's avoid ultra-processed foods such as sausages, chips, cookies, sweet bread and boxed cereals, since they have a lot of fat, salt and/or sugar. Let's choose foods without stamps or with as few stamps as possible. 4. **Let's do physical activity.** Let's do more physical activity like walking, running or dancing. Let's spend less time sitting or in front of the screen (cell phones, television, video games and others). Every move counts!
Who does it?	The delivery of printed materials and their presentation will be carried out by the promoters of the IM

Material	To carry out the activity you need: ● Audiovisual material. ● Printed infographics. ● Refrigerator magnet.
The printed material is aimed at mothers, fathers, caregivers of 4th grade girls and boys, and teaching staff and is delivered during the launch of the IM.	

Activity #5. Communication strategy through WhatsApp messaging As part of the IM, an important messaging component via WhatsApp has been designed and included focused on topics to identify risk and protective factors for overweight and obesity in the school population. These messages facilitate access to information on health and nutrition issues for schoolchildren.	
Aim	The purpose of these messages is to reinforce the learning of the topics addressed in the rest of the components on knowledge and appropriate feeding practices, movement behaviors and health.
Development of the activity	An invitation and registration (HIGH) is made to receive mobile messaging via WhatsApp with the key messages directed: The telephone number provided by the IM promoters is saved, with the name, later the word HIGH is sent and they will begin to receive a series of questions to be answered. Upon completion of registration you will receive the following message: **Congratulations! We have completed your registration. The messages will soon begin to arrive on your cell phone.** About 1 message will be sent per week for 10 months, for a total of approximately 46 messages. Messages will be sent via WhatsApp throughout the school year, on the topics of healthy eating, movement behaviors and psychosocial determinants during childhood. In all cases, it is essential to encourage people to respond to messages and continue receiving all the benefits of sending messages. There are two types of messages: **Informative:** These are those that seek to teach or reinforce key messages. **Challenges:** These are messages that seek to motivate students to put health and nutrition learning into practice in a fun way and involving the entire school community. The idea of this activity is to reinforce the learning of the topics addressed in the rest of the components. Within the design, the following elements were considered: Spanish language, an average length of 130 characters, and a focus on profit framework. Additionally, messages will consider diversity, equity and inclusion through inclusive language and trying to avoid bias between groups that differ socially, economically, demographically or geographically. In addition to this, some messages will be accompanied by audiovisual material such as videos or infographics, as appropriate, to complement the recommendation that is being provided. **Reminder: shipping frequency and time** **Sending WhatsApp messages:** Every third day **Planned days:** Monday, Wednesday and Friday. However, you may occasionally send

	messages on other days of the week. **Shipping duration:** Approximately nine months from the date of REGISTRATION. **Note:** If any person in the school community does not have a smartphone or does not have constant access to the internet, this activity will not be part of their activities within the IM.
Who does it?	The registration of contacts for the creation of the WhatsApp group and the sending of messages is the responsibility of the IM promoters.
Material	To carry out the activity you need: ● Registration database ● Equipment for sending messages.
Contact registration will be done during the IM and messaging will be sent from the start of the intervention (October 2023) until it ends (June 2024). Sending key messages through WhatsApp is aimed at mothers, fathers, caregivers of girls and boys, and teaching staff at schools that participate in IM.	

Activity #6. Virtual course A 20-hour online course will be taught aimed at teaching staff, mothers, fathers and caregivers of 4th grade primary school boys and girls, on topics of the three components of IM.	
Aim	To strengthen continuing education for teachers of selected primary schools and mothers , fathers and caregivers on topics of healthy and sustainable eating, movement behaviors, and psychosocial determinants in school girls and boys, this with the aim of increasing knowledge , practices, intention, attitude, subjective norm and perceived control.
Development of the activity	4th grade teachers, mothers, fathers and caregivers of girls and boys are invited to take the course virtually, whose design and structure is developed in a simple way, its contents are organized as follows: ● Introduction ● Division of the three components. 1. Healthy and sustainable eating. 2. Movement behaviors. 3. Psychosocial determinants. ● Recommendations for each component. ➢ Central recommendation. ➢ Detail of the recommendation. ➔ Recommendation audio. ➔ Downloading resources (printable, videos, etc.) ➔ Evaluation (mini test with 2 to 5 “true/false” questions, multiple choice, etc.) ➔ Additional information (extra resources such as infographics, videos, manuals, etc.)

	The time dedicated to the course will be managed by each participant until the required hours are covered. Upon completion and completion of the evaluation, they will be given a certificate issued by the INSP.
Who does it?	The online course will be developed by researchers and promoters of Multidimensional Intervention.
Material	The material necessary to develop the activity will be: ● Virtual course. ● Computer. ● Internet access. ● Records.
The activity will be carried out during the first two months after starting the Multidimensional Intervention. The course is aimed at 4th grade teaching staff in primary schools where MI is carried out, mothers, fathers and caregivers of girls and boys.	

Activity #7. P.E. Class

It is planned to work together with physical education teachers to positively influence the development of the physical education class. The activities range from the delivery of sports equipment to use during class, to the training of teachers through courses and workshops. . The activities that will be carried out during the intervention have been proposed by the movement's technical behavior team. These consider: a) Providing appropriate material and equipment for the education class to the intervention schools; b) Avoid the cancellation of physical education classes; c) Provide knowledge about physical activity during physical education class and its benefits on health, academic performance, and social relationships of students, and work together with the physical education union to collect, provide feedback, select and distribute activities relevant and experientially supported to promote physical activity during classes.

Aim	Complement the constructs of knowledge, subjective norm, perceived control and intention to increase physical activity of moderate-vigorous intensity of girls and boys during physical education class. Optimizing the physical education class suggests that upon reaching adulthood, schoolchildren may be more likely to have a normal weight and fewer musculoskeletal problems.
Development of the activity	Participating schools and teachers will be provided with a variety of materials and equipment relevant to the class, which may include: hoops, balls, cones, ropes, nets, among other items. This is so that schools have the necessary material to carry out an adequate physical education class. To deliver information to the teachers of each school, content from the MOOC Quality Physical Education in Basic Education will be distributed among the school community. This course lasts 20 hours. With the same purpose of supporting teachers in their training, through work groups together with physical education teachers, we will seek to collect, provide feedback, select and distribute a series of intervention dynamics among schools to promote practice of moderate-vigorous intensity physical activity during most of the class To prevent physical education classes from being canceled, management meetings will be sought with the management staff of each school, the union of general and physical education teachers.

Who does it?	The team of promoters in charge of implementation will be in charge of providing the materials mentioned above, as well as providing and explaining to teachers access to the Quality Physical Education course in Basic Education.
Material	The material that will be provided to schools to carry out this activity is: ● Sports equipment: hoops, balls, cones, ropes, nets, among other elements. ● Mooc Course.
The material will be delivered at the beginning of the implementation and the course modules will be enabled from the second week of the start, teachers will be able to access it whenever they want, and being virtual, they will be able to advance in the course from their homes at the time it is provided to them. They will have 3 months at the beginning of the implementation to complete the course. The extra modules of the course will be aimed at teachers of the physical education class.	

Activity #8. Healthy Snack. To increase the consumption of vegetables and fruits 4th grade girls and boys are encouraged to bring a healthy snack based on vegetables and/or fruits every day of the school year.	
Aim	To improve knowledge about the importance and benefits of consuming vegetables and fruits, generate favorable attitudes towards their consumption, and thereby favor the subjective norm regarding the consumption of vegetables and fruits, leading to creating confidence in girls and boys in their ability. to eat vegetables and fruits and increase the intention to consume them, all with the aim of increasing the consumption of vegetables and fruits. To give rise to generating changes in the constructs of attitude, subjective norm, perceived control, intention and consumption practice of vegetables and fruits in girls and boys in 4th grade of primary school. Activity that contributes to the constructs of attitude, subjective norm, perceived control, intention and practice.
Development of the activity	This activity will be briefly explained at the launch, however, before starting the activity, clear and precise information will be given to the girls and boys in the classroom through the Multidimensional Intervention promoters. Girls and boys are invited to bring a vegetable or fruit of their choice to school as a healthy snack. The promoters will regularly visit the classrooms to register the girls and boys who bring the healthy snack. This registration will be carried out in a group that will be in charge of the promoters. Each girl and boy will be given a ticket or badge every time they manage to accumulate 5 registrations. This ticket will help the girl and boy so that in the middle of the school year and at the end of it, a type of raffle will be held, with the purpose of encouraging them to continue bringing the healthy snack. The raffles will be held on two different dates, the first in the middle of the school year and the second at the end of it. It will be done in person at an event within the school facilities, where 4th grade primary school girls and boys, mothers, fathers and caregivers are invited. The way the raffle is carried out will be through a raffle, where the tickets, tokens or numbers of the winning girls and boys will be drawn. The prizes are sports materials, such as balls, ropes and bicycles, with the intention of promoting physical activity in girls and boys.

Who does it?	The IM team is made up of: Doctors (or), Nutritionists (or), Lic. Physical Education, who are the promoters of the IM of the National Institute of Public Health and are the people who will be implementing the activities corresponding to the Multidimensional Intervention.
Material	The materials to use for this activity are: ● Database for the registration of girls and boys. ● Printed information material. ● Badges or tickets. ● Sports equipment for the raffle.
It will be carried out from the first two weeks after the launch and will continue during the 10-month duration of the Multidimensional Intervention. The activity is aimed at girls and boys in 4th grade of primary school.	

Activity #9. Physical activation before the start of the school day Physical activations are structured physical activity sessions , lasting 10 to 15 minutes and carried out on a massive scale. These sessions will be implemented in fourth grade children during the IM implementation time.	
Aim	This behavior will contribute to the constructs of attitude, subjective norm, intention and practice of increasing the levels of physical activity and reducing the sedentary time of schoolchildren. Active breaks as well as physical activations had already been implemented by the SEP in conjunction with CONADE through the National School Physical Activation Program, but were discontinued with the change of administration and also due to the COVID-19 pandemic. Therefore, one objective of the strategy is to resume these activations as they used to be done previously.
Development of the activity	The training regarding physical activations will be carried out in conjunction with active breaks in the Workshop to improve the knowledge of teachers and managers about the importance and benefits of promoting physical activity and limiting sedentary time, as well as active breaks and active recess, teachers and administrators will receive demonstrations of a variety of activities that they can implement in the activations and will learn about the health and academic benefits of these. The physical activations will be taught through structured routines that minimize the risk of injury and may be accompanied by music to motivate students. The activation is structured in 3 phases: <u>Initial phase (warm-up):</u> Dosed and ordered actions and movements at low intensity that prepare the body for better performance and must involve muscles and joints. The duration of this phase will be 20% of the total activation time (e.g. 2 min in a 10 min activation). <u>Medullary phase (central phase):</u> Motor actions, which require greater effort or difficulty in their execution and which comprise the main component to be developed.

	Dynamic or recreational alternatives may be included, the games or exercises will be carried out with greater impetus, effort and difficulty (moderate intensity). This phase will last 60% of the total activation time (e.g. 6 min in a 10 min activation). Final phase (relaxation): Motor actions to reduce heart rate, respiratory rate and body temperature, returning to a normal state after the effort made in the spinal cord. It is characterized by slow and deliberate movements, encouraging you with deep breaths. The duration of this phase will be 20% of the total activation time (e.g. 2 min in a 10 min activation).
Who does it?	The implementation of the physical activations will be carried out by the IM promoter or a volunteer from the school site (physical education teacher, classroom teacher or director and parent) with experience in the activations. If there is no experienced volunteer, it will be done in the same way as with active breaks, through the 3 stages explained in their respective session.
Material	● Health promoters ● Manual for the implementation of physical activations
The physical activations will be carried out 5 days a week, from Monday to Friday, throughout the school year, they will last 10 to 15 minutes, at the discretion of the person in charge of carrying it out and will be carried out before the start of classes in the schoolyard. The physical activations will be aimed at the 4th grade girls and boys participating in the implementation.	

Activity #10. Pipimeter . Increase consumption of plain water and avoid consumption of sugary drinks The communication material " Pipimeter " is presented and explained to the girls and boys, so that they become familiar with it and can record the color of their urine based on what the material shows us, and thus know how their urine is. water consumption.	
Aim	To improve knowledge about the importance and benefits of consuming natural water, generate favorable attitudes towards the consumption of natural water, promote the subjective norm on the consumption of natural water, create confidence in girls and boys in their ability to drink natural water. , increase the intention to consume natural water, increase natural water consumption. Activity that contributes to the constructs of attitude, subjective norm, perceived control, intention and practice of natural water consumption.
Development of the activity	The IM promoters will present the material in the classrooms to the girls and boys in the 4th grade of primary school. They will be explained what it is and the color scale and how this shows their level of water consumption. They will be given a sheet to record the color of their urine, which they will do every time they go to the bathroom during the school day. The IM promoters will place the communication material " Pipometer " on the doors of the bathrooms and in front of the urinals of the schools so that girls and boys can register against the scale shown. Weekly the MI promoters will be checking that the girls and boys are recording their urine in the material. Girls and

	boys who have the highest consumption of plain water will be recorded depending on the color of their urine.
Who does it?	The activity will be implemented by the IM team, which is made up of: Doctors (or), Nutritionists (or), Lic. Physical Education, who are the promoters of the IM of the National Institute of Public Health.
Material	To carry out this activity you need the following material: Pipimeter printed material Scotch tape Printed urine recording material. Printed information material on water consumption.
From the start of the intervention (October 2023) until it ends (June 2024). Monday to Friday for approximately 10 months. The activity is aimed at 4th grade primary school girls and boys.	

Activity # 11. Active pauses

Active break activities for boys and girls can include games and dynamics, such as imitating animals, jumping, running, stretching, breathing movements, joint movements, among others. You can also include dancing, singing, and other activities that promote physical activity and fun.

An active break will be taken 2 times a day, on the 5 days of classes (Monday to Friday), considering that the recommendation is to take an active break for every hour of sedentary time.

Considering that the primary school school schedule is from 8:00 am to 2:00 pm, the first active break will be between 9:00 and 9:30 am, 1 hour after school starts; While the second active break will take place 1 hour after the end of the school break, a schedule will not be determined since the time of the school break is variable in each school.

Active breaks will have a minimum duration of 5 to 6 minutes at the discretion of the teacher, and may be extended if the dynamics so demand. They must also have the following components:

Phase 1) Warm-up, which consists of warming up and mobility.

Duration: 1-2 min.

Phase 2) Exercise or dynamic session: which consists of the central phase of physical activation through different strategies (e.g. High Intensity Interval Training (HIIT) , dance, games, following instructions, etc.).

Duration: 3-4 min.

Phase 3) Cool down: which consists of a breathing exercise and a return to calm to incorporate into the school class. Duration 1-2 min.

The teacher will be able to choose the ideal moment to take the active break so as not to interrupt the planned activities. The teacher will be recommended to take breaks when he observes and considers that the students have been sitting for a long time, considering the schedules mentioned above, or are tired of school activities and need to recover their attention with some dynamic activity.

Aim	This behavior will contribute to the constructs of knowledge, attitude, subjective norm, perceived control and intention to reduce prolonged sedentary time in girls and boys. The main objective of active breaks is to reduce sedentary time during the school day, trying to prevent students from spending more than two hours sitting continuously. Evidence has shown that sitting for long periods of time can increase the risk of cardiovascular diseases, diabetes, obesity and other health problems, which is why it is advisable to limit sedentary time with physical activities in the classroom.
Development of the activity	In order to improve adherence to the protocol, active pauses are initially carried out through an MI promoter to gradually be implemented by the teacher. The above will be achieved through three stages: <u>Stage 1:</u> An IM promoter and the classroom teacher will implement active pauses together. <u>Stage 2:</u> The classroom teacher will implement active pauses while the IM promoter observes and provides feedback at the appropriate time. <u>Stage 3 onwards:</u> The classroom teacher will make the active breaks on his or her own without the presence of the promoter. During this stage, the team of researchers will be on the lookout and the teachers will be able to contact them or the MI promoter at any time, to resolve doubts, if they have concerns or need more help. .
Who does it?	The active breaks will be taught by group teachers or managers trained through the Workshop to improve the knowledge of teachers and managers about the importance

	and benefits of promoting physical activity and limiting sedentary time for schoolchildren.
Material	• Health promoter or teacher • Active breaks manual
The active breaks will take place from the beginning to the end of the IM and are aimed at 4th grade girls and boys.	

Activity #13. Accelerometry

Accelerometry is a method that allows objective monitoring of physical activity and provides a large amount of information about the physical activity patterns of girls and boys . The accelerometers will be distributed among a subsample of 500 girls and boys in schools. To control the use of accelerometers, the research team will use an exit and entry log. (Annex 56)

ActiLife and Matlab software through an algorithm prepared by the research team. The Freedson cut-off points for school girls and boys will be used to estimate the time per day dedicated to different intensities of physical activity.

Aim	Evaluate the effect of the intervention on physical activity and sedentary time. Actigraph GT3X+ accelerometers (ActiGraph , LLC, Pensacola, FL, USA) will be used.
Development of the activity	The accelerometers will be charged and initialized (programmed) prior to delivery to the girls and boys. ActiLife 6.13.4 software will be required for initialization and data download . When delivering the accelerometers to the girls and boys, the project will be explained clearly and briefly, the instructions for use will be explained, and the correct position of the device will be demonstrated. The device will be placed on the right side of the hip. It is important that the device and the belt are used appropriately each time the child uses them. When wear time has ended, the accelerometers will be collected by the research team at the school. Once collected, the data will be downloaded and compliance with the required time will be reviewed. In order to verify the appropriate use of the accelerometers, members of the research team will be present in the schools during the mornings. To keep a record of the verification of accelerometer use, a daily checklist will be used (Annex 57). In addition to verifying use, the research team will be attentive to answering questions and clarifying instructions for use. Additionally, reminders about use will be sent via SMS/phone at the beginning of the week of use and one day during the weekend. Girls and boys who use the accelerometer daily will receive an incentive (stickers) at the time of verification by the research team. The accelerometers will be charged and initialized (programmed) prior to delivery to the girls and boys. ActiLife 6.13.4 software will be required for initialization and data download . When delivering the accelerometers to the girls and boys, the project will be explained clearly and briefly, the instructions for use will be explained, and the correct position of the device will be demonstrated. See instructions in Annex 58. The device will be placed on the right side of the hip. It is important that the device and the belt are used appropriately each time the child uses them. When wear time has ended, the accelerometers will be collected by the research team at the school. Once collected, the data will be downloaded and compliance with the required time will be reviewed.
Who does it?	Research team, Boys and girls
Material	Accelerometers

Activity #14. 24 hour reminder The 24-hour Reminder is a quantitative instrument that presents an excellent alternative to evaluate the food and drink consumption of the person interviewed in the last 24 hours. With this instrument you can know the preparations consumed, as well as each of the ingredients that make them up. (Annex 59)	
Aim	Evaluate the type and quality of food available to the children included in the study.
Development of the activity	Complete a questionnaire with parents about what was consumed the previous day .
Who does it?	Research team Parents
Material	Questionnaire

During the first two months of the implementation of the IM, group workshops will be held with the purpose of reinforcing behaviors within the three main components ASS, CM and CP , including girls and boys in the 4th grade of primary school, mothers, fathers and caregivers of girls. and children, managers, teachers and physical education teachers . Table 9 shows the topics, objectives and audiences of the IM workshops.

Chart. 9 Topics, objectives and audience of IM workshops

Workshop	**Aim**	**Workshop participants**
Group workshop 1: Workshop to paint and recondition the patio	Offer greater opportunities for physical activity to girls and boys within school facilities.	4th grade girls and boys, mothers, fathers and caregivers of girls and boys.
Group workshop 2: Emotional management of children about food.	So that girls and boys become aware of the emotions related to eating and knowledge about how to manage them.	Girls and boys of 4th grade.
Group workshop 3: Importance and benefits of promoting physical activity.	So that teaching staff and managers are aware of the benefits of physical activity in school-age girls and boys and, thanks to this, encourage its implementation within school.	Aimed at teaching staff
Group workshop 4: Healthy and sustainable eating	To contribute to the construct of knowledge in mothers, fathers and caregivers about the benefits of eating a healthy diet for girls and boys.	Mothers, fathers, caregivers of girls and boys and teaching staff

Group workshop 5: Prevention of stigmatization with weight and body shape.	So that girls and boys become aware of the impact caused by criticism of figure and weight.	Girls and boys of 4th grade.
Group workshop 6: Prevention of stigmatization with weight and body shape.	So that mothers, fathers and caregivers become aware of the impact caused by criticism of figure and weight.	Mothers, fathers and caregivers of girls and boys.
Group workshop 7: Obesity and healthy eating.	This behavior will contribute to the knowledge constructs on the topic of obesity and healthy eating in girls and boys aimed at teaching staff.	Staff
Group workshop 8: Identification of hunger and satiety signals.	That girls and boys become aware of the signs of hunger and satiety.	Girls and boys of 4th grade.
Group workshop 9: Identification of hunger and satiety signals, and symptoms of anxiety and depression.	So that mothers, fathers and caregivers become aware of the signs of hunger and satiety in school-age girls and boys.	Mothers, fathers and caregivers of girls and boys.
Group workshop 10: Prevention of stigmatization with weight and body shape.	So that teaching staff become aware of the impact caused by criticism of figure and weight.	Staff
Group workshop 11: Internalization of the aesthetic ideal of beauty. Aimed at girls and boys	So that girls and boys become aware of the content of information in the media and the normalization or internalization of a certain ideal of beauty reflected in them.	Girls and boys of 4th grade.
Group workshop 12: Obesity and healthy eating.	This behavior will contribute to the knowledge constructs on the topic of obesity and healthy eating in girls and boys aimed at mothers, fathers and caregivers of girls and boys in fourth grades.	Mothers, fathers and caregivers of girls and boys.
Group workshop 13: Identification of hunger and satiety signals, and symptoms of anxiety and depression.	Raise awareness among teaching staff about the management of anxiety related to eating in school-age boys and girls.	Staff.
Group workshop 14: Parenting and self-care limits.	Raise awareness among mothers, fathers and caregivers about parenting practices, emotional communication, anxiety	Mothers, fathers and caregivers of girls and boys.

	management, child development and limits.	
Group workshop 15: Teaching and self-care	Raise teachers' awareness about emotional communication, anxiety management, child development and limits.	Staff.
Group workshop 16: Official Mexican STANDARD NOM-251-SSA1-2009, Hygiene practices for the processing of food, beverages or food supplements **.**	Raise awareness among food vendors about good practices in the processing of food and beverages in the school environment	Food sellers in stores and school cooperatives.

3.3. Intervention monitoring

Currently, it is known about the need to have evidence-based interventions to improve the nutritional status of a population. However, it is recognized that the impact of evidence-based interventions could be limited by a lack of certainty in the best strategies to implement and scale interventions [45] . Therefore, in the evaluation of an intervention, it is important not only to evaluate its impact, but also to include monitoring and evaluation of the implementation process. The objective of implementation research is to know and understand the execution of programs or interventions in real conditions and contexts, rather than controlling these conditions or removing their influence and possible effects. This involves working with the community in which a program or intervention is implemented, which includes both the different actors involved in the operation of the program and its users. Implementation research also includes the study of contextual factors that affect the program implementation process [46,47] .

In order to conceptualize and evaluate the success or failure of the implementation of a program or intervention, it is necessary to use some characteristics that allow identifying aspects of the implementation response, called implementation outcome variables. Therefore, as previously mentioned, the following will be used in this study: Acceptability, adoption, feasibility and fidelity.

Therefore, in the present study, implementation monitoring will be carried out in schools with multidimensional intervention. Additionally, simpler monitoring will be carried out in the control group schools , which will allow identifying possible important changes that may result in modifications in the diet and physical activity of this group.

Procedure:

1. ***First phase:*** "Review of the operating rules of the intervention." The review of the activities proposed by previous strategies in the school environment will be carried out to identify the components, periodicity and procedures planned to provide the intervention.

2. ***Second phase:*** "Information gathering". Information will be collected from the perspective of the children who receive the intervention and their parents, as well as the teachers and decision makers involved in the implementation of the intervention.

Qualitative monitoring indicators

In the monitoring of schools with a control and multidimensional group, the following will be carried out:

In a subsample of the following informants, focus groups and semi-structured interviews will be carried out to identify barriers and possible solutions to improve the implementation of the intervention:

Informants:

a) 4th grade boys and girls participating in the study.

b) Parents of the children participating in the study.

c) Teachers and directors and managers of the school cooperative or food sale within the school where the intervention takes place.

d) Decision-makers: Key actors from each of the federal entities or school zones where the study will be carried out and who are related to the implementation of the intervention.

e) Food vendors in and around the schools participating in the study.

f) Community decision-makers: Key actors in the implementation of legislation and regulations related to the sale of food in the community and the development, maintenance and safety of the infrastructure of streets and areas for physical activity (e.g. parks, sports units, among others).).

Through qualitative methodology, a work team with knowledge and experience in implementation evaluation will collect the information. The information gathering techniques will be the same as those used in the situational diagnosis stage: Non-participant observation, semi-structured interviews and focus groups, which were already described previously.

These activities will be carried out in all schools with control and IM groups in Cuernavaca, Morelos. The information derived from the interviews and audio focus groups will be recorded, considering the prior consent of the study subjects. In the case of monitoring for schools with a control group and IM in Campeche and Morelos, it will be carried out through observation, with simple recording instruments. The objective of these instruments will be to record the implementation of the intervention strategies.

Table 10 describes the periodicity of each of the implementation monitoring indicators, the sample sizes for each indicator, as well as the number of focus groups per actor, in the case of the schools of Cuernavaca, Morelos.

3. Third phase: "Information analysis". The content analysis technique of the interviews will be used, triangulating with the observations made. For this, detailed summaries of the individual and group interviews will be made from field recordings, focus groups and observation exercises. Subsequently, content matrices will be developed to organize the information by relevant themes. The thematic categorization of the tables of contents will be made from the instruments plus the contributions of the informants.

Quantitative monitoring indicators

Table 10 describes the monitoring indicators proposed for the multidimensional intervention. The indicators to monitor during this phase are described below:

Training component: Attendance at face-to-face sessions, courses or workshops with tutorial videos taught as part of the intervention, for school teachers. Monitoring will be done through an electronic platform designed to record attendance at these courses.

Component of availability of food and beverages and infrastructure for physical activity within the school: Through direct observation, the availability of food and beverages, as well as the infrastructure for physical activity within the school campus, will be recorded. Special attention will be paid to the availability and operation of drinking fountains within the school campus. The information will be obtained through a food and beverage inventory format where the type and quantity of food available will be documented, as well as an infrastructure format for physical activity where the presence of drinking fountains and other characteristics that encourage this behavior will be documented. (for example, school playgrounds with painted games). In the case

of the availability of food and drinks at home, this will be done through a questionnaire that will be sent to be filled out by parents.

Physical activity component: The quality of physical education classes and teacher behavior, active recess sessions, will be evaluated through direct observation. In the case of physical education classes and active recesses, 2 physical education classes and 2 active recesses will be randomly selected in each school, during the monitoring week for each occasion (at 3 and 6 months after the intervention) [83,84,85] Other instruments will also be considered to evaluate PAFI components (e.g., active breaks, extracurricular activities, and active transportation programs) that are considered part of the IM based on the formative and policy evaluation .

Educational communication component : SMS messages will be included, the number of messages received by parents and/or teachers through mobile devices on various topics (nutrition, physical activity, food risk behaviors, among others) will be estimated. Additionally, a brief exam will be taken on knowledge of the topics included in the messages.

Community environment component: As advocacy actions to improve walking infrastructure (sidewalks, road signs, pedestrian crossings), street sales of unhealthy foods and beverages, advertising of unhealthy foods and beverages, means of transportation, physical safety and food, access to parks and other recreational sites, improvements in lighting and community participation around schools, promotion of healthy eating, the number of sessions held with the corresponding authorities will be documented. Likewise, using a food and beverage inventory, the number of food stores/stalls and advertising of unhealthy foods and beverages around the school (100m perimeter) will be evaluated. Finally, the infrastructure for physical activity (walking infrastructure, recreational spaces, etc.) will be evaluated using street-level audits within a 100 m perimeter around the school.

Monitoring schools with a control group : As mentioned above, monitoring will be carried out in the schools with a control group . The above in order to identify possible strategies or actions carried out at the individual, school or family level to modify diet and physical activity. Monitoring in these schools will be carried out with the instruments indicated in table 10 and correspond only to those that will be used in the monitoring of schools with a control group and IM in Campeche, Morelos and Mexico City (marked with an * in table 4 aforementioned). Monitoring in the 12 schools with a control group (4 per federal entity) will be carried out only 6 months after starting the intervention.

Table 10. Intervention monitoring indicators and periodicity of information collection.

Level of inquiry	Actors	Information to collect	Proposed method	Federal entity where monitoring will be carried out
Individual	Boys and girls of 4th year of primary school [2] **(annex 50)**	Perception of the intervention: Content of the messages and workshops on nutrition and self-care, physical activity, mental health Acceptability of the intervention: Barriers and windows of opportunity to make changes in promoting healthy eating, physical activity and self-care Fidelity, the number of strategies that were implemented aimed at children, and that were actually received, will be evaluated.	Focus groups (2 focus groups per school, one for each grade level, with 6-7 children each) Questionnaire on participation in strategies directed at the individual level (for boys and girls), as well as acquired knowledge*	Cuernavaca clinical trial schools Schools with control group and IM in Mexico City, Campeche, and Morelos
	Food vendors inside the school **(annex 46)**	Acceptability of the intervention: Barriers and windows of opportunity for the implementation of each component of the intervention (on promotion of healthy eating, physical activity and self-care) Acceptability of the intervention: barriers and windows of opportunity for the implementation of each component of the intervention (on the	Semi-structured interview (2 per school- 2X12=24) Questionnaire for food vendors	Cuernavaca clinical trial schools Schools with control group and IM in Mexico City, Campeche, and Morelos

		type of food and beverages available in food outlets within schools)		
		Availability of food and drinks within the school, as well as the foods most in demand by students Availability of drinking water (drinking fountains, their operation, water jugs) Availability of infrastructure and materials for physical activity (painted school yards, hoops, balls, etc.)	Food and beverage inventory * Availability and operation of drinking fountains or water jugs * Inventory of school infrastructure for physical activity	Schools with control group and IM in Mexico City, Campeche, and Morelos
	Physical activity within schools **(annex 50)**	active recreation	Direct observation of the type of activities carried out during active recess sessions (2 pro-school recesses 2X4X3=24)*	Schools with control group and IM from Mexico City, Campeche and Morelos
Community	Availability of food and drinks around school and at home (annex 50)	Feasibility, related to the infrastructure to carry out the planned activities of the intervention (food sales and areas for physical activity)	In-depth interview with vendors around the school on the viability of the strategies proposed by the intervention to improve availability of healthy foods and beverages around the school (100 m radius) (2 vendors per school- 2X12=24) Questionnaires for vendors around the school on the viability of the strategies proposed by the intervention to improve availability of healthy foods and beverages	Cuernavaca clinical trial schools

			around the school (100 m radius) (2 vendors per school- 2X4X3=24)	Schools with control group and IM from Mexico City, Campeche, and Morelos
			Availability of food and drinks around the school. Observation (100 m school radius)	
			Food and beverage inventory. 2 establishments will be selected around the school per federal entity (2X4X3=24)*	Schools with control group and IM from Mexico City, Campeche, and Morelos
			Availability of infrastructure for physical activity around the school. Observation (100 m perimeter around the school)	Schools with control group and IM from Mexico City, Campeche, and Morelos
				Schools with control group and IM from Mexico City, Campeche, and Morelos

[1] It refers to the months after the start of the implementation of the intervention.

[2] In the case of monitoring 3 months after starting the implementation, the focus groups will be carried out only with 4th grade boys and girls.

* Information to be collected and instruments to be used in the control group schools (12 control group schools in 3 states: Mexico City, Campeche and Morelos) 6 months after the intervention began. Monitoring will consist of identifying possible strategies at the school or home level, as well as at the individual level, adopted in order to prevent overweight and obesity or improve nutrition and promote an increase in physical activity.

** Based on the results of the feasibility of implementation of the remaining components of the PAFI (active transportation programs, active breaks and extracurricular activities) the need to include additional measurements and indicators of these components will be determined.

Monitoring information collection

Monitoring will be carried out 3 months after starting MI. The survey is planned to be carried out with electronic devices (lap-tops/tablets) with simultaneous capture in the field; that is, carrying out observations, semi-structured interviews and focus groups with the support of recorders and laptops. The recorded audio and capture information will be safeguarded by the supervisors via the Internet to a central server, in which the database will be integrated automatically, with daily cuts. For the latter, the interviewers will take the computers with the supervisor daily, to back up the information. The supervisors will integrate the information from the respective work group, and upload it to the server via the Internet. For security reasons, the information will also be backed up on USB keys in case of any eventuality.

The field team will consist of one work couple per federal entity (in total 3 couples - 6 interviewers) and one supervisor per federal entity (3 supervisors). The interviewers will be personnel who live in the same city where the study will be carried out. Each pair of the federal entities will be in charge of collecting the monitoring information in the control group schools and in the IM schools of Campeche, Morelos and Mexico City. All field staff will have personal identification and will wear t-shirts with the INSalud logo.

Multidimensional intervention evaluation

The evaluation of the effect of MI will be carried out both in schoolchildren participating in the community trial and in the clinical trial, including in the latter case measurements of body composition as well as biological measurements. The components of the evaluation are described below.

Community trial

In the schools that participate in the community trial with different types of intervention, measurements will be made to the school population at 2 moments from recruitment: 0 (recruitment and initial or baseline measurement) and at 6 months (final measurement).

The main outcome variables and the instruments through which they will be measured are also presented in Table 10 and are summarized below:

At the individual level

Health indicators: To evaluate the effect of the interventions implemented in this study, the following measurements in schoolchildren will be considered as biological measures: anthropometry (weight, height and waist circumference), body mass index (BMI) and blood pressure, in the same way described for the clinical trial.

Behavioral change indicators: Changes in knowledge, attitudes, intention to change (as intermediate indicators) and behaviors (outcome indicators) on key topics, food and beverage consumption inside and outside of school, physical activity and sedentary lifestyle inside and outside school. out of school, CAR and ED, in children as well as in mothers and fathers. In children it will be measured through a printed questionnaire and in parents through the mobile application that is developed.

School environment: Availability of food and drinks, physical activity. The number of physical education classes, active recesses, active breaks, active transportation programs and extracurricular activities will be measured through registration forms. The availability of food and beverages, as well as infrastructure for physical activity within the school will be measured with an inventory.

Family environment: Food: Risky eating practices - eating out of hours, not eating at the table, physical activity with the family and sedentary time. It will be measured through questionnaires in children and the mobile application in parents.

Community environment : At a perimeter of 100 meters around the school, the availability of food and beverages around the school, advertising of unhealthy foods and beverages, type of transportation used to get to school, and infrastructure for physical activity around the school will be measured. the school.

Clinical trial

A randomized clinical trial will be carried out in Cuernavaca, Morelos, which will be carried out at the National Institute of Public Health, Cuernavaca headquarters. Within the clinical trial there will be 2 control schools and 2 intervention schools, as shown previously in Figure 1, from which the children who will belong to each group will be selected, with prior consent and informed assent (Annexes 56 - 64) . The schoolchildren who participate in schools with MI, in addition to the previously mentioned evaluations, will undergo more detailed analyzes to determine the effect of said intervention. These measurements will be carried out at 0 months (baseline

measurement) and at 6 months (final measurement) (figure 3). For the evaluation of the effect of MI in this study, the following biological measurements will be considered in schoolchildren:

a) Anthropometry: Weight (kg), height (cm), waist circumference (cm), and BMI (kg/m^2).

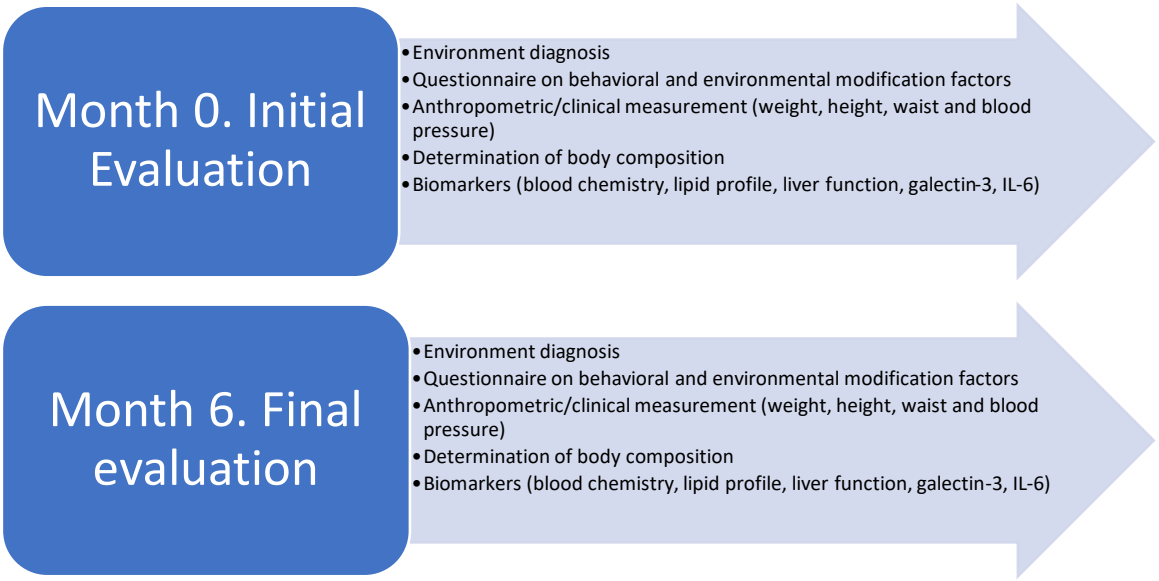
b) Body composition using dual x-ray densitometry.

c) Biomarkers: The blood sample will be used to determine metabolic syndrome risk: cholesterol (mg/dl), lipids (HDL-c), triglycerides (mg/dl), glucose(mg/dl), glycated hemoglobin (%), leptin (ng/mL), adiponectin (µg/mL) and markers of oxidative stress and inflammation (galectin-3 (ng/mL) and Inter Leucine-6 (Pg/mL)). These last measurements will be carried out in serum.

d) Blood pressure.

A baseline sample will be taken at the beginning of the study and another sample at the end of the intervention stage (6 months) and a comparison will be made between the two groups (control group and multidimensional intervention group). To obtain the blood sample, take blood pressure and anthropometry, the "Manual of procedures for nutrition projects" developed by INSP researchers and which was used in the 2016 National Health and Nutrition Survey (ENSANUT-2016) will be used. It is possible that during the participation of children and parents they may be photographed or videotaped (Annex 64-65) in order to demonstrate to the financing agencies that the project processes are carried out in a timely manner, during implementation, monitoring. of the intervention.

Figure 3. Measurements from the clinical trial evaluation.



The activities that will be carried out in the clinical trial are broken down below:

Anthropometric evaluation

The weight, height and waist circumference of boys and girls in the 4th grade of primary school will be evaluated. Measurements will be made with a floor scale, with a precision of 100g and with a wall stadiometer, with a precision of 0.5 cm. The waist circumference will be measured using a tape measure, with an accuracy of 0.5 cm. These measurements will be made inside the school in a designated area. School authorities usually designate a location that is semi-private, usually in an empty classroom, or in the auditorium, or in a meeting area that is closed but accessible. The measurements are made with three field workers (female) present where the first measures, the second records and there is a third observing/supervising their quality; while ensuring confidentiality and correct performance of the measurement. Likewise, we will request the presence of a member of the school community while the measurements are carried out, however, the participation of the member of the school community is under the consideration of the school authorities.

With the data obtained on weight and height, the BMI (kg/m^2) will be calculated. It should be noted that field workers will not have the opportunity to analyze the information or calculate BMI or make any medical diagnosis. Field workers will only take and record anthropometric measurements and will not be able to analyze them on the spot.

Individual anthropometry results can be provided once the analysis is done. Once children with an overweight or obesity problem have been identified or diagnosed, a list will be made and provided to the school director to notify parents and suggest their evaluation by the school doctor or center. for guidance and treatment regarding the child's weight. Finally, the information will be analyzed with a group approach without revealing the identity of the individuals. The group results will be delivered to the school once the study is completed.

a) Body composition using DXA

Body composition will be measured through DXA (hologic, discovery WI, 93097), which includes the evaluation of fat-free mass, fat mass and fat percentage, using CORE software version 15 (Madison, WN). This method allows a more precise evaluation of the distribution of fatty tissue and lean tissue in the visceral area, which allows a more accurate estimate of cardiometabolic risk.

The system that uses DXA generates X-rays at two different energy levels. The quality or length of the wave emitted by X-rays is expressed in kilo-Volt (kV). The generator alternately emits radiation (140 kilo maximum voltage [kVp] and low (70-100 kVp) that moves over the surface of the body to be studied. In this sense, there is the effective dose, which is the sum of the dose absorbed by each irradiated organ weighted by the type of radiation and the radio-sensitivity of said organ, expressed in Sievert (μSv), generated during the DXA test is extremely low [88].

DXA can be used in human populations of all ages due to its low radiation exposure. The radiation emitted by DXA is minimal, therefore, no special protection is required in the room where the measurement is performed or for the technical personnel performing the procedure. In whole body studies, this radiation ranges from 0.1 to 75 μSv depending on the type of beam that emits the radiation. This dose is low compared to that used in other common The radiation from DXA is less than what a person receives on a cross-country flight or the radiation received on a normal day. This low exposure is safe for repeated measurements even for infants and children. However, for safety reasons it is recommended not to perform the measurement in pregnant women [90]. The overall scan takes 5 to 10 minutes and does not require sedation.

According to NOM-229-SSA1-2002, bone densitometry (which allows evaluating body composition) does not require a license [91]. Room protection is not necessary, since the densitometer is internally protected.

In addition, body composition will be evaluated using an ultrasound with the Body Metrix device, which is a low-cost device that measures the thickness of subcutaneous fat in seven sites to calculate, using formulas, the percentage of body fat.

Based on the pathophysiology of obesity, the measurement of galectin-3 and IL-6 as biomarkers is proposed as a biological measure to evaluate at a systemic level the effect of the interventions implemented in this study. of inflammation. The objective of this component is to evaluate the alterations observed in the different systemic inflammation parameters analyzed (galectin-3, IL-6), in the children of the control and IM groups to which they were exposed during a period of 12 months.

Regarding the galectin-3 serum analysis (which will be performed on 100 boys and girls; 50 in the control group and 50 in the multidimensional intervention), it will be carried out using the immunoassay technique (ELISA) using a commercially available kit. This technique consists of the incubation of serum samples obtained from the study subjects in well plates that contain antibodies against said glycoprotein, together with biotinylated antibodies that will bind to streptavidin conjugated with horseradish peroxidase; The activity of said enzyme will be measured with a spectrophotometer, which will allow the levels of galectin-3 in the samples to be quantified. No CRETI substance will be used for these procedures.

b) Obtaining the blood sample

180 children will be recruited from 4 schools in Cuernavaca, who will undergo a detailed evaluation at the INSP Cuernavaca headquarters (anthropometric studies, physical activity, DXA, sample collections for evaluation of cardiometabolic and inflammatory risk factors for chronic diseases, etc.).

For biochemical determinations, two blood samples will be collected from each child (at the beginning and at the end of the study). To take a blood sample, new, disposable and sterilized material will be used in accordance with the standards for the management of Hazardous Infectious Biological Waste (RPBI).

The samples will be taken by trained personnel, in the INSP laboratory at its facilities in Cuernavaca, by venipuncture of the antecubital vein under prior asepsis technique with a hypodermic needle (21g) or a vacutainer of the same caliber. The sample will be collected in a red-top tube which contains coagulation activator and separating gel to obtain serum. A total of 10mL of blood will be enough to obtain approximately 4-5mL of serum. The sample will be centrifuged at 3000rpm at the collection site, the serum component will be separated and the aliquots will be transported in coolers with liquid nitrogen, and subsequently stored at -80°C until analysis. The quantitative

determination of Galectin-3, Interleukin-6 (IL-6) will be performed by enzyme immunoassay (ELISA).

- **Biosecurity**

The sample collection will be carried out by trained personnel and will be processed at the INSP headquarters in Cuernavaca, under the supervision of Dr. Rosario Rebollar who will be in charge of the biosafety aspects of the project. For training, the procedures manual for nutrition projects will be used, which describes the general principles of obtaining blood samples and their management [105] . All material for sample collection will be new, disposable and sterilized. The blood sample will be correctly labeled for identification of the individual.

As a consequence of the procedures to obtain the blood sample, a small bruise may appear, on rare occasions, without important consequences for the health of the participants. Other potential risks involved in participating in this study are unlikely, however, you may experience dizziness when your blood is drawn. The symptoms that may occur do not imply a greater risk; if they occur, you can use a cold compress to obtain relief. You can use the cold compress for 10 to 15 minutes every 3 to 4 hours as desired **.**

The blood will be for study use only. All used material will be disposed of according to the standards for the management of hazardous Infectious Biological Waste (RPBI) described in the INSP Procedures Manual for Nutrition projects.

To take blood samples, we must observe and comply with various safety rules that guarantee the safety of both study subjects and staff.
The general procedures for personal protection are: mandatory use of a gown, gloves, face mask and glasses or goggles during the taking and handling of the blood sample. Don't forget to wash your hands before and after contact with the blood sample.
Minimum universal precautions should be taken into account with all patients treated and do not forget the following:

1. Every sample must be considered *potentially infectious* , so precautions must be taken to guarantee the safety of personnel and study subjects.
2. Place a clean work field each time.
3. Be careful when handling needles and lancets to avoid getting stuck.
4. Do not leave used needles and lancets in the work field, throw them away immediately in an appropriate container.

5. If there is blood spillage, change the work field with a new one, discarding the contaminated in the contaminated waste bag.
6. If you are stuck with a needle contaminated with blood from a study subject, find out if there is any type of infection and report it immediately. immediately report the incident to your supervisor.
7. Prevent children from touching or playing with the equipment in use.

Equipment and consumables

Procedure for taking blood samples

The sample must be taken under the most favorable conditions to avoid errors. This includes identifying the study subject, labeling the name of the vacutainer tube(s) to be used, identifying the puncture site and the volume to be collected. The patient should be in a comfortable position, sitting or lying down if he is an adult; if the child is in the arms of an adult or wrapped in a sheet with the point to be punctured outside of it to avoid movement.

The personnel responsible for taking samples will use disposable gloves, which must be worn throughout the procedure.

Before starting the procedure you must have all the necessary material within reach and prepared.

In the presence of the study subject and family members, the warranty seal of the vacutainer equipment (which allows filling as many tubes as necessary) will be broken by screwing it into the universal tube holder without uncovering the needle. Before collecting blood samples, the identification of the study subject will be written on each vacutainer tube.

Before proceeding to puncture, a vein of good caliber must be located, preferably in the elbow crease. The best way is to palp them to make that decision. To do this, place the tourniquet 10 to 15 cm above the selected site, to better visualize the vein. You should not keep the tourniquet on for more than 3 minutes, to avoid hemoconcentration.

The veins most used for venipuncture are located in the anteulnar area. Among these we have:

a) Ulnar vein: it is the longest and thickest of all and is preferred for bordering the muscles of the arm.

b) Cephalic vein: has the same characteristics as the previous one, but is a little less thick.

c) Basilic vein: smaller than the previous ones. This vein is close to the brachial artery, so puncture is risky and its area is more sensitive and painful for the patient.

When palpating, do so with your fingertips, trying to follow the veins. Your knowledge of the anatomy of the veins of the upper extremities is also useful here. Sometimes if

you don't see the vein, you can force blood into the vein through a gentle bottom-up massage.
Have the patient make and unclench his fist three to five times to better pump blood, and then have him keep his fist closed.
If it is a child, it is advisable to place two fingers of your hand under the patient's elbow to prevent them from bending their arm during extraction.
Once the vein to be punctured has been decided, an alcohol swab will be taken with tweezers, cleaning the area surrounding the vein from top to bottom and from the center to the periphery at least twice, rotating the swab in each of the movements to do not contaminate again. This can be repeated as many times as deemed necessary.
Never return the alcohol swab to the starting point, unless it is new. Neither squeeze the excess alcohol from the swab to be used into the swab, nor on the floor, do it in the red bag.
The needle will be inserted into the selected vein with the bevel facing up, with the tip of the needle at an angle of 15o to 30o above the surface of the chosen vein, pass through the skin in a firm and safe motion, to the lumen of the vein. vein, and insert into the opposite end of the needle the corresponding vacutainer tube that must be mounted on the universal plastic tube holder, pressing until the rear metal tip pierces the rubber stopper of the collecting tube. At this point the blood will begin to flow rapidly into the tube.
Remove the tourniquet to allow better blood flow. The tube will be removed from the tube holder once the desired volume is reached.
Avoid applying strong pressure to the puncture site during sample collection and needle extraction.
The needle will be immediately placed in the sharps container intended for that purpose.
The tube with the sample will be placed in a rack inside the cooler. A dry swab will be placed on the puncture site and pressed for a few minutes.
The person responsible must remove the gloves at the end of the sample collection and discard them immediately. Under no circumstances may you reuse them again for this or other procedures. In the event that there has been an event
Preparation and processing of blood samples. The staff will have identified a suitable place where they can process venous blood samples (preferably a Health Center, a school, municipal offices, municipal assistant office or ejidal police station) and will request permission from the corresponding authority by choosing a room that can be closed, that has contacts for electrical energy and, if possible, a sink. All samples will be concentrated there for processing as indicated below.

The blood sample must be centrifuged in portable centrifuges, approximately 30 minutes after collection. This time allows the retraction of the clot and thus an improvement in serum yield. During this time the samples should be kept in the cooler. The tubes are balanced by weight before being placed in the centrifuge. That is, two tubes containing the same volume of sample must be placed in opposite locations. When there is an odd tube, an empty tube is used, which is filled with water to the same level as that containing blood, to balance them.

Once the tubes have been balanced, centrifugation begins at low speed, which is gradually increased, with 10-second intervals until reaching _ parts of the centrifuge speed (around 3000 RPM). Centrifugation is maintained for approximately 20 minutes. After this time, the speed should be gradually reduced until the centrifuge stops completely.

At the end of this procedure, the sample will be divided into two parts: at the bottom, the red erythrocyte mass (or globular package) will be located and on the surface there will be the slightly yellow or amber serum. Using a glass Pasteur pipette, the serum will be transferred to the cryotubes. These cryotubes have a capacity of 2 ml but should only be filled to 1.5 ml. If there is excess serum, fill another cryotube. After filling they will be covered again, ensuring that they are hermetically closed.

Labeling of processed blood samples

A subject identification label will be attached to each of the 2 ml cryotubes that will be used to permanently store the serum. Some of these, according to the study, are wrapped with aluminum foil.

The labels of all cryotubes will be secured by covering them with a piece of transparent Diurex tape, which will go around the circumference of the tube 1 time. And the cryotubes obtained from the same study subject must be wrapped in self-adhesive plastic to deposit them in the nitrogen tank.

Once all the cryogenic tubes have been labeled and protected, wrap them in transparent self-adhering plastic (the one used to wrap food at home or in the supermarket), place them as soon as possible in the liquid nitrogen tank to keep them frozen until they are delivered to the laboratory. for your analysis . Care of the study subject after taking a blood sample

Once the extraction has been carried out, it is our responsibility to ensure that the study subject is fit to get up from the chair and leave. Some study subjects experience dizziness, weakness, or fainting after an extraction.

To prevent him from falling and hurting himself, we must observe him and ask if he is okay before telling him to leave.

If the patient is sweaty, has a very white face, or is shaking, he or she may need our help; We can smell alcohol. In case of possible fainting, we should tell him to place his head

between his legs, to help irrigate his brain. If necessary, we can put him to bed until he recovers.
Study subjects who are fasting will be given instructions to have breakfast soon, in order to avoid fainting.
Once the procedure for taking blood samples is completed, the staff has the obligation to leave the assigned place clean and tidy. This task includes cleaning the area, organizing the tubes and excess needles, and placing trash remains in the corresponding container as indicated below.

c) Blood pressure

Blood pressure will be measured using OMROM HEM-907 Baumanometers, which have 4 cuff sizes, allowing different arm diameters to be measured – including severe obesity – and due to their automatic design, they provide very precise measurements. The result of the blood pressure measurement will be delivered on an information card along with the weight and height results. Blood pressure measurement will take approximately 2 minutes.

Statistic analysis

First, for each group (control group and multidimensional intervention group), stratification will be carried out based on body mass index, and through multivariate correlation analysis and/or through Spearman's correlation coefficient, the correlation that will be determined will be determined. exists in each of the levels of the different cytokines and markers of inflammation and BMI.

Subsequently, a comparison will be made between both groups, and it will be determined if the type of intervention had an impact by evaluating the baseline samples and the sample taken at the end of the intervention for each of the inflammation parameters evaluated (galectin-3 , IL-6 IL-1B, TNFa), first at a general level and subsequently by stratified group. To compare the samples in the serum, and the moments of collection (before and after the intervention), in terms of cytosine levels, Analysis of Variance (ANOVA) for repeated measures will be used. The p value <0.05 is considered statistically significant.

Likewise, for the community intervention, analyzes of the baseline characteristics of the population will be carried out. Differences between groups will be observed and, if necessary, adjustment variables will be used, as well as mixed effects models.

Analysis of the information

The information collected during the evaluations carried out on the control group and the evaluation of the effect of the multidimensional intervention will be analyzed.

In the case of monitoring, as described in the corresponding section, information will be obtained with qualitative methodology, which will be analyzed through methods such as those described in said section. Quantitative information (example: Number of SMS messages received) will be presented summarized through measures of central tendency and dispersion, as well as frequencies, according to the nature of the information collected.

In the case of the multidimensional intervention effect results, the initial (baseline) characteristics will be described by study group (control group and multidimensional intervention). Measures of central tendency and dispersion will be presented for continuous variables and percentages for categorical variables. The effect of the intervention will be estimated in the outcome variables, described above, at both the individual, behavioral change and environmental levels (Table 10). For the effect at the individual level, an analysis of intention to treat [106] will be used , so it will include information from all participants according to the study group to which they will be assigned. Generalized linear models will be used [107] .

Schedule of activities for the implementation of the intervention

Tables 11, 12 and 13 present the proposed schedule of activities for the implementation of the MI divided by state, which will be carried out simultaneously in the three entities.

Table 11. Intervention project schedule

Activity	Place, date and time	Participants and description of the activity	Observations
Information session (INSP proposal).	October 31, 2023 Time: 10:00am – 11:00am	Directors Objective: To inform about the activities included in the IM. Virtual Meeting	
Baseline measurement of participants (intervention schools).	**School: May Day** November 6 to 10, 2023 Time: 8:00 a.m. – 2:00 p.m. **School: Somalia** November 6 to 10, 2023 Time: 8:00 a.m. – 2:00 p.m. **School: General José Mariano Monterde** November 6 to 10, 2024 Time: 8:00 a.m. – 2:00 p.m. **School: State of Querétaro** November 6 to 10 **School: Prof. José S. Benítez** November 6 to 9, 2023 Time: 8:00 a.m. – 2:00 p.m. **School: José Azueta** November 6 to 9, 2023 **School: Luis de la Brena** November 10 to 15, 2023 **School: Prof. Maximiliano Molina Fuente** November 10 to 15, 2023 Time: 8:00 a.m. – 2:00 p.m.	**Participants:** - Fourth grade girls and boys. **Activities:** - Signing of the informed consent addressed to parents or guardians of students - Assent addressed to 4th grade girls and boys. - Filling out questionnaires and anthropometric measurement for 4th grade girls and boys.	Review the document "Considerations prior to the baseline evaluation". Start date October 23 and end date November 21 (tentative)

Launch in each intervention school.	**School: May Day.** November 27, 2023. **Time:** 8:00 – 10:00 a.m. **School: Somalia.** November 28, 2023. **Time:** 8:00 – 10:00 a.m. **School: State of Querétaro.** November 29, 2023. **Time:** 8:00 – 10:00 a.m. **School: General José Mariano Monterde.** November 30, 2023. **Time:** 8:00 – 10:00 a.m.	**Participants:** Directors , teachers, fathers, mothers, tutors, food vendors, as well as fourth grade boys and girls. **Activities:** The purpose of the "Launch" is for the school community to be aware of the activities that will be carried out throughout the school year and, in this way, not only keep them informed, but also encourage their participation. The objective will be for the team to give an informative talk to the participants about the activities that will improve the nutrition and health of the girls and boys. 1. We will project a presentation detailing the activities that will take place during the rest of the school year. This presentation will describe the duration, objective and activities by component aimed at fourth grade boys and girls, fathers, mothers, tutors, teachers and food vendors. 2. We will show videos related to healthy and sustainable eating, as well as movement behaviors and psycho-emotional determinants. 3. We will invite mothers, fathers and caregivers, as well as school teachers, to register through the WhatsApp platform to receive messages about healthy and sustainable eating, movement behaviors and determinants psycho-emotional of girls and boys. 4. We will deliver printed communication material to mothers, fathers, people in charge of caring for girls and boys, as well as a Manual aimed at food vendors. This material will include magnets, infographics, brochures, among other information resources. 5. We will place printed communication material called " Pipimeter " in the girls' and boys' toilets, whose objective is that they can monitor whether the color of their urine meets the water consumption recommendations. 6. We will conclude the event with a Healthy Intervention question and answer session, aimed at clarifying any questions that attendees may have.	Two hours are contemplated due to any delays that may occur , but it is expected that the entire event will take place. a maximum duration of 90 minutes.

Start of activities in the four implementation schools (November 2023 to June 2024).			
Virtual course 8 p.m.: Healthy intervention.	**Schools:** **1. First of May .** **2. Somalia** **3. Gen. José Mariano. Monterde** **4. State of Querétaro.** From December 1, 2023 to January 31, 2024. **Time:** Available 24 hours a day.	**Participants:** - Fourth grade primary school teachers. - Optional. Fathers, mothers, guardians of fourth grade girls and boys. **Activity:** Self-managed 20-hour virtual course designed especially for teachers with the purpose of strengthening their understanding and mastery of the topics of healthy and sustainable eating and movement behaviors. Upon completing the course, participants will have the opportunity to receive a certificate with curricular validity issued by the School of Public Health of Mexico.	During the Launch, you will be informed how you can access the "Virtual Course: Healthy Intervention".
Receiving messaging via WhatsApp (Mobile Health).	**Schools:** **1. First of May .** **2. Somalia** **3. Gen. José Mariano. Monterde** **4. State of Querétaro.** From December 1, 2023 to May 24, 2024. Messages will be sent on Mondays, Wednesdays and Fridays. **Shipping time:** 18:00.	**Participants:** - Fathers, mothers, guardians of fourth grade girls and boys. - Physical education teachers. - Optional. Fourth grade primary school teachers. **Activity:** Messages will be sent via WhatsApp every third day throughout the school year, addressing topics related to healthy eating, movement behaviors and emotional health during childhood. The purpose of this activity is to consolidate the knowledge acquired in the other components of the program.	During the "Launch" you will be told how you can access WhatsApp messaging.
Promotion of the daily intake of vegetables and fruits in the school environment by promoting healthy snack options.	**Schools:** **1. First of May .** **2. Somalia** **3. Gen. José Mariano. Monterde** **4. State of Querétaro.** Monday to Friday from December 1, 2023 to May 24, 2024. **Time:** To eat them during the break.	**Participants:** - Fourth grade girls and boys. **Activity:** The habit of bringing a healthy snack, which includes vegetables, fruits or both, from Monday to Friday by girls and boys, will be promoted.	Random supervisions will be carried out with the purpose of ensuring that the boys and girls bring their healthy snack, ideally on a daily basis.

Promotion of the daily intake of natural water in the school environment with the support of the ' Pipometer '.	**Schools:** **1. First of May .** **2. Somalia** **3. Gen. José Mariano. Monterde** **4. State of Querétaro.** Monday to Friday from December 1, 2023 to May 24, 2024. **Time:** During the entire stay at school.	**Participants:** - Fourth grade girls and boys. **Activity:** Promotion of the habit of consuming natural water and reaching the recommendation of 5 to 8 glasses a day. During the supervisions, the color of the urine will be recorded. On a permanent basis, they will be able to use the ' Pipimeter ', available in all school bathrooms, as a visual reference.	Random supervisions will be carried out with the purpose of ensuring that children maintain the recommendations for natural water consumption.
Workshop: Emotional management of children about food.	**1. First of May .** **2. Somalia** **3. Gen. José Mariano. Monterde** **4. State of Querétaro.** November 8 or 9, 2023. Hours 8:00 a.m. – 9:00 a.m.	**Participants:** 4th grade girls and boys **Activity:** Theoretical-practical workshop for emotional management on topics related to food and nutrition **In-person**	
Workshop: Prevention of stigmatization with weight and body shape; and Risky Eating Behaviors.	**1. First of May .** **2. Somalia** **3. Gen. José Mariano. Monterde** **4. State of Querétaro.** November 15, 2023. Hours 8:00 a.m. – 9:00 a.m.	**Participants:** 4th grade girls and boys **Activity:** Theoretical-practical workshop for the definition, recognition, management and weight stigma, risky eating behaviors. **In-person**	
Workshop: Identification of hunger and satiety signals; and symptoms of anxiety and depression.	**1. First of May .** **2. Somalia** **3. Gen. José Mariano. Monterde** **4. State of Querétaro.** November 22 or 23, 2023. Hours 8:00 a.m. – 9:00 a.m.	**Participants:** 4th grade girls and boys **Activity:** Theoretical-practical workshop for the identification of signs of hunger, anxiety and depression. **In-person**	

Workshop: Internalization of the aesthetic ideal of thin beauty	**1. First of May .** **2. Somalia** **3. Gen. José Mariano. Monterde** **4. State of Querétaro.** November 22 or 23, 2023. Hours 8:00 a.m. – 9:00 a.m.	**Participants:** 4th grade girls and boys **Activity:** Theoretical-practical workshop for the aesthetic identification and internalization of beauty. **In-person**	
Workshop: Prevention of stigmatization with weight and body shape; and Risky Eating Behaviors.	**1. First of May .** **2. Somalia** **3. Gen. José Mariano. Monterde** **4. State of Querétaro.** November 22 or 23, 2023. Schedule To be defined	Participants: Mothers and fathers or guardians Virtual, schedule to be defined with mothers and fathers or guardians.	
Workshop: Identification of hunger and satiety signals; and symptoms of anxiety and depression.	**1. First of May .** **2. Somalia** **3. Gen. José Mariano. Monterde** **4. State of Querétaro.** November 8 or 9, 2023. Schedule: To be defined	**Participants:** Mothers and fathers or guardians **Virtual,** schedule to be defined with mothers and fathers or guardians.	
Workshop: Prevention of stigmatization with weight and body shape; and Risky Eating Behaviors.	**1. First of May .** **2. Somalia** **3. Gen. José Mariano. Monterde** **4. State of Querétaro.** November 15, 2023. Schedule: To be defined	**Participants:** Mothers and fathers or guardians **Virtual,** schedule to be defined with mothers and fathers or guardians.	
Workshop: Limits, parenting and self-care.	**1. May Day** **2. Somalia** **3. Gen. José Mariano Monterde** **4. State of Querétaro** November 22, 2023 Schedule: To be defined	**Virtual,** schedule to be defined with mothers and fathers or guardians. Aimed at mothers and fathers or guardians	

Workshop: Identification of hunger and satiety signals; and symptoms of anxiety and depression.	**1. First of May .** **2. Somalia** **3. Gen. José Mariano. Monterde** **4. State of Querétaro.** November 22, 2023. **5.** Schedule to be defined	**Participants:** Teaching staff. **Virtual,** schedule to be defined with the teaching staff	
Supervision of the promoter of the 'Healthy Intervention'.	**School: May Day .** 1.December 4, 6, 12 and 14, 2023. 2.January 9, 11, 15, 17, 23, 25 and 29, 2024. 3.February 6, 7, 14, 15, 21, 22, 26 and 27, 2024. 4.March 6, 7, 13, 14 and 19, 2024. 5.April 9, 11, 15, 19, 23, 24 and 29, 2024. 6.3, 7, 13, 17, 21, 23, May 2024. **Time:** 8:00 a.m. to 11:00 a.m. **School: Somalia.** 1.December 4, 6, 12 and 14, 2023. 2.January 9, 11, 15, 17, 23, 25 and 30, 2024. 3.February 6, 7, 14, 15, 21, 22, 26 and 27, 2024. 4.March 6, 7, 13, 14 and 20, 2024. 5.April 9, 11, 15, 19, 23, 24 and 29, 2024. 6.May 3, 7, 13, 17, 21, 23, 2024. **Time:** 8:00 a.m. to 11:00 a.m.	**Participants:** - Fourth grade girls and boys. **Activities:** **1. Verify that they have a healthy snack.** The person in charge of the Healthy Intervention will go to each 4th grade classroom to verify that they bring it with them and, if they comply with this practice, they will be given a numbered ticket that will allow them to participate at the end of the school year in an incentive contest. . **2. Recording the color of the last urine.** During the visit to the classroom, the person in charge of this intervention will provide each girl and boy, at least twice a week, with a log-type recording sheet called 'My Pipimeter '. On this sheet, you can mark the color of your last urine observed in the bathroom. In addition, they will have the constant support of the ' Pipometer ', a visual resource that will be permanently installed in all school bathrooms as a reference. **3. Make regular visits to food vendors in schools to encourage nutritious and healthy food and drink options.** During these visits, guidance and support will be provided to food and beverage vendors to promote more nutritious and healthy food options. The main focus is to ensure that the food options offered at	Activities 1 and 2 will take approximately 20 minutes per 4th grade group, while interaction with food and beverage vendors will take 5 to 10 minutes per food and beverage outlet. The schedule has been planned in a way that allows for transitions between groups and waiting times without interfering with teaching activities.

	School: General José Mariano Monterde. 1.December 5, 7, 11, 13, 2023. 2.January 8, 10, 16, 18, 22, 24 and 31, 2024. 3.February 8, 9, 12, 13, 19, 20, 28, 29, 2024. 4.March 4, 5, 11, 12, 21, 2024. 5.8, 12, 16, 18, 22, 25, April 2024. 6.2, 6, 9, 14, 16, 20, 24 May 2024. **Time:** 8:00 a.m. to 11:00 a.m. **School: State of Querétaro .** 1. December 5, 7, 11, 13, 2023. 2.January 8, 10, 16, 18, 22, 24, 2024. 3.1, 8, 9, 12, 13, 19, 20, 28, 29 February 2024. 4.March 4, 5, 11, 12, 22, 2024. 5.8, 10, 16, 18, 22, 25, April 2024. 6.2, 6, 9, 14, 16, 20, 24 May 2024. **Time:** 8:00 a.m. to 11:00 a.m.	school are balanced and beneficial to the health of students. The ultimate goal is to transform the food sales environment at school into a place that promotes the health and well-being of students, thus helping to prevent problems such as overweight and obesity, and allowing girls and boys to grow up healthily. .	
Delivery of 'Recognition of healthy perseverance' carried out by the promoter of the 'Healthy Intervention'.	**School: May Day.** January 29, 2024. **Time:** 8:00 a.m. to 11:00 a.m. **School: Somalia.** January 30, 2024. **Time:** 8:00 a.m. to 11:00 a.m. **School: General José Mariano Monterde.** January 31, 2024. **Time:** 8:00 a.m. to 11:00 a.m.	**Participants:** - Fourth grade girls and boys. **Activities:** Within the framework of supervisions for *"Verifying that they have a healthy snack"* and *"Recording the color of their last urine"* during visits to 4th grade classrooms will be carried out:	This activity will take approximately 5 minutes additional to those contemplated during the supervision of the promoter of the 'Healthy Intervention'.

	School: State of Querétaro. February 1, 2024. **Time:** 8:00 a.m. to 11:00 a.m.	- Delivery of a Diploma for carrying a healthy snack. - Delivery of a Diploma for complying with the recommendations for natural water consumption.	
Promotion of the reduction of the consumption of sugary drinks and ultra-processed foods - two, promoting healthier alternatives through the "Healthy Reporter" activity.	**Schools:** **1. First of May .** **2. Somalia** **3. Gen. José Mariano. Monterde** **4. State of Querétaro.** *Invitation and instructions.* **January 29, 31 and February 2, 2024.** *Sending and receiving videos.* **From February 6 to March 1, 2024.** *Voting period for the best video.* *Winners publication.* **From April 8 to 12, 2024.** **Time:** Not applicable.	**Participants:** - Fourth grade girls and boys. - Fathers, mothers, guardians of fourth grade girls and boys. **Activities:** - Invitation to participate in the creation of a video focused on the identification of healthy alternatives that replace the consumption of sugary drinks and ultra-processed foods - Shipping instructions. - Sending and receiving videos from the 'Healthy Reporters' via WhatsApp - Publication of videos for voting by the school community via WhatsApp to select the best videos of the 'Healthy Reporters' - Publication of the winning children for the best video of 'Healthy Reporter'	The above activities will be carried out through the WhatsApp platform. This activity will be presented at the Launch and the invitation will be extended to fourth grade girls and boys and their guardians to participate.
Practical demonstration by the promoter of 'Movement Behaviors' on: -Physical activation before the start of classes. -Active breaks -Active recreation	**School: May Day.** December 4 and 6, 2023. **Time:** 8:00 a.m. to 12:30 p.m. **School: Somalia.** December 4 and 6, 2023. **Time:** 8:00 a.m. to 12:30 p.m. **School: General José Mariano Monterde.** December 5 and 7, 2023. **Time:** 8:00 a.m. to 12:30 p.m. **School: State of Querétaro.** December 5 and 7, 2023. **Time:** 8:00 a.m. to 12:30 p.m.	**Participants:** - Fourth grade girls and boys. **Activities:** Presentation and explanation to 4th grade teachers about physical activity practices: 1. Physical activation before the start of classes: For 15 minutes before classes, a short session of physical activity will take place. 2. Active Breaks: Active breaks will be encouraged, twice a day, which will include physical movements during classes to maintain energy and concentration. 3. Active Recess: During recess, at least 15 minutes of moderate to vigorous physical activities will be promoted in play areas adapted according to the “Workshop for the conditioning of school spaces” and/or using the sports equipment provided to the school. .	The promoter of 'Movement Behaviors' will gradually carry out the activities during the course of the day.

Promotion in the school environment of physical activation before the start of classes (led by teachers or Prof. EF)	**Schools:** **1. First of May .** **2. Somalia** **3. Gen. José Mariano. Monterde** **4. State of Querétaro.** Monday to Friday from December 1, 2023 to May 24, 2024. **Time:** 08:00 to 08:15 h.	**Participants:** - Fourth grade girls and boys. - Fourth grade primary school teachers. - Optional. Physical education teachers. **Activities:** Physical activation before the start of classes: For 15 minutes before classes, a short session of physical activity will take place. To know the recommended exercises, they can be consulted in the "Manual of physical activation, active breaks and active recesses within the school environment."	It is recommended that the other groups go to their respective classrooms; However, this strategy can be adjusted according to the needs of each school.
Promotion of active breaks in the classroom (led by teachers)	**Schools:** **1. First of May .** **2. Somalia** **3. Gen. José Mariano. Monterde** **4. State of Querétaro.** Monday to Friday from December 1, 2023 to May 24, 2024. **Active break time 1:** Between 09:00 a.m. and 09:30 a.m. **Active break time 2:** Between 11:30 a.m. and 12:00 p.m.	**Participants:** - Fourth grade girls and boys. - Fourth grade primary school teachers. **Activities:** Active breaks will be encouraged, twice a day, which will include physical movements during classes to maintain energy and concentration. **Example of exercises:** Games and dynamics, such as imitating animals, jumping, running, dancing, stretching, breathing movements, joint movements. **Frequency:** 2 times a day. Active break 1 is expected to be one hour after school starts while active break 2 is expected to be one hour after the school break ends. **duration** 5 to 6 minutes, up to 10 minutes (flexible by type of dynamic).	The schedules may vary depending on the dynamics of each school. To know the recommended exercises, they can be consulted in the "Manual of physical activation, active breaks and active recesses within the school environment."
Promotion of active recreation (ideally encouraged and supervised by teaching staff)	**Schools:** **1. First of May .** **2. Somalia** **3. Gen. José Mariano. Monterde** **4. State of Querétaro.** Monday to Friday from December 1, 2023 to May 24, 2024. **Time:** Ideally during 15 minutes of school recess.	**Participants:** - Fourth grade girls and boys. - Fourth grade primary school teachers. **Activities:** During recess, at least 15 minutes of moderate to vigorous physical activities will be promoted in play areas adapted according to the "Workshop for the conditioning of school spaces" and/or using the sports equipment provided to the school.	To know the recommended exercises, they can be consulted in the "Manual of physical activation, active breaks and active recesses within the school environment."

Supervision of the 'Movement Behaviors' promoter of: physical activation before the start of classes, active breaks and active recess	**School: May Day.** 1.December 11 and 13. 2.January 8, 10, 15, 17, 22, 24, 29, 31 3.February 6, 8, 12, 14, 19, 21, 26, 28 4.March 4, 6, 11, 13, 19, 21. 5.April 8, 10, 15, 17, 22, 24, 29. 6.May 2, 6, 8, 13, 16, 20, 22. **Time:** 8:00 a.m. to 12:30 p.m. **School: Somalia.** 1.December 11 and 13. 2.January 8, 10, 15, 17, 22, 24, 29, 31 3.February 6, 8, 12, 14, 19, 21, 26, 28 4.March 4, 6, 11, 13, 19, 21. 5.April 8, 10, 15, 17, 22, 24, 29. 6.May 2, 6, 8, 13, 16, 20, 22. **Time:** 8:00 a.m. to 12:30 p.m. **School: General José Mariano Monterde.** 1.December 12 and 14. 2.January 9, 11, 16, 18, 23, 25 and 30. 3.February 1, 7, 9, 13, 20, 22, 27 and 29. 4.March 5, 7, 12, 14, 20, 22. 5.April 9, 11, 16, 18, 23, 25. 6.May 3, 7, 9, 14, 17, 20, 22, 24. **Time:** 8:00 a.m. to 12:30 p.m. **School: State of Querétaro.** 1.December 12 and 14. 2.January 9, 11, 16, 18, 23, 25 and 30. 3.February 1, 7, 9, 13, 20, 22, 27 and 29. 4.March 5, 7, 12, 14, 20, 22. 5.April 9, 11, 16, 18, 23, 25. 6.May 3, 7, 9, 14, 17, 20, 22, 24. **Time:** 8:00 a.m. to 12:30 p.m.	**Participants:** - Fourth grade girls and boys. **Activities:** The promoter of 'Movement Behaviors' will supervise: 1. Physical activation before the start of classes: For 15 minutes before classes, a short session of physical activity will take place. 2. Active Breaks: Active breaks will be encouraged, twice a day, which will include physical movements during classes to maintain energy and concentration. 3. Active Recess: During recess, at least 15 minutes of moderate to vigorous physical activities will be promoted in play areas adapted according to the “Workshop for the conditioning of school spaces” and/or using the sports equipment provided to the school. "	The 'Movement Behaviors' promoter will gradually supervise the activities during the course of the day.

Workshop: Conditioning of school spaces.	**1. First of May .** **2. Somalia** **3. Gen. José Mariano. Monterde** **4. State of Querétaro.** Saturday December 2, 2023. **Time:** 9:00 – 12:00 h.	**Participants:** - Fathers, mothers, guardians of fourth grade girls and boys. - Fourth grade girls and boys. - Optional. Fourth grade primary school teachers. **Activity:** - Paint or recondition the school playground and fields. - The activity is directed by the promoter of 'Movement Behaviors'. - The Healthy Intervention team, represented by the promoters of 'Movement Behaviors', will be responsible for carrying and providing the necessary materials, such as paint and brushes, for the activity.	Ideally, this activity should be carried out when there are no classes and when fathers, mothers, guardians of fourth grade girls and boys have more time to go to school.
Workshop: Importance and benefits of promoting physical activity and limiting sedentary time in school girls and boys.	**1. May Day.** **2. Somalia** **3. Gen. José Mariano. Monterde** **4. State of Querétaro.** Monday, December 4, 2023 (virtual mode)[3] **Time:** 6:00 p.m. – 7:00 p.m.	**Participants:** - Fourth grade primary school teachers. **Activity:** - Paint or recondition the school playground and fields. - The activity is directed by the promoter of 'Movement Behaviors'. - The Healthy Intervention team, represented by the promoters of 'Movement Behaviors', will be responsible for carrying and providing the necessary materials, such as paint and brushes, for the activity.	This activity will be presented at the Launch and the invitation will be extended to fourth grade primary school teachers to participate.
Workshop: Healthy and sustainable eating and childhood obesity	**School: May Day** January 12, 2024 Time: 8:00 a.m. – 2:00 p.m. **School: Somalia** January 12, 2024 Time: 8:00 a.m. – 2:00 p.m. **School: General José Mariano Monterde** January 19, 2024	**Participants:** - Fourth grade girls and boys. **Activity:** - Playing videos on ' Let's eat more fresh vegetables and fruits', 'Let's avoid ultra-processed foods ', 'Let's drink more natural water every day and 'Let's do more physical activity'. - Through recreational activities, we will strengthen the understanding of fundamental messages that promote	The Workshop will last approximately 60 minutes per 4th grade group. The schedule has been planned in a way that allows for transitions between groups and waiting times without interfering with

[3] In the previous diagnosis carried out in schools in Campeche and Morelos, the teaching staff suggested that the workshops be carried out after the work day, preferably after 6:00 p.m.

	Time: 8:00 a.m. – 2:00 p.m. **School: State of Querétaro** January 19, 2024 Time: 8:00 a.m. – 2:00 p.m.	healthy and sustainable eating, thus contributing to preventing childhood obesity.	teaching activities.
Baseline measurement of participants (intervention schools).	**School: May Day** June 1 to 15, 2024 Time: 8:00 a.m. – 2:00 p.m. **School: Somalia** June 1 to 15, 2024 Time: 8:00 a.m. – 2:00 p.m. **School: General José Mariano Monterde** June 16-30, 2024 Time: 8:00 a.m. – 2:00 p.m. **School: State of Querétaro** June 16-30, 2024 Time: 8:00 a.m. – 2:00 p.m.	**Participants:** - Fourth grade girls and boys. **Activities:** - Signing of the informed consent addressed to parents or guardians of students - Assent addressed to 4th grade girls and boys. - Filling out questionnaires and anthropometric measurement for 4th grade girls and boys.	Review the document "Considerations prior to the final evaluation". Start date June 1st. End date July 31, 2024.
Baseline measurement of participants (control schools).	**School: Prof. José S. Benítez** June 1 to 22 Time: 8:00 a.m. – 2:00 p.m. **School: José Azueta** June 1 to 22, 2024 Time: 8:00 a.m. – 2:00 p.m. **School: Luis de la Brena** June 1 to 22, 2024 Time: 8:00 a.m. – 2:00 p.m. **School: Prof. Maximiliano Molina Fuente** June 1 to 22, 2024 Time: 8:00 a.m. – 2:00 p.m.	**Participants:** - Fourth grade girls and boys. **Activities:** - Signing of the informed consent addressed to parents or guardians of students - Assent addressed to 4th grade girls and boys. - Filling out questionnaires and anthropometric measurement for 4th grade girls and boys.	

Table 12. Morelos intervention project schedule , October 2023			
Activity	**Place, date and time**	**Participants and description of the activity**	**Observations**
Information session (INSP proposal).	October 31, 2023 Time: 10:00am – 11:00am	Directors Objective: To inform about the activities included in the IM. Virtual meeting	
Baseline measurement of participants (intervention schools).	**School: Lic. Benito Juárez García** November 6 to 10, 2023 Time: 8:00 a.m. – 2:00 p.m. **School: Narciso Mendoza** November 6 to 10, 2023 Time: 8:00 a.m. – 2:00 p.m. **School: November 20** November 6 to 10, 2023 Time: 8:00 a.m. – 2:00 p.m. **School: Aquiles Serdán. Lions Club 1** November 6 to 10, 2023 Time: 8:00 a.m. – 2:00 p.m. **School: Braulio Rodríguez** November 6 to 9, 2023 Time: 8:00 a.m. – 2:00 p.m. **School: Kids Heroes** November 6 to 9, 2023 Time: 8:00 a.m. – 2:00 p.m. **School: Mariano Matamoros** November 10 to 15, 2023 Time: 8:00 a.m. – 2:00 p.m. **School: Cuauhtémoc** November 10 to 15, 2023 Time: 8:00 a.m. – 2:00 p.m.	**Participants:** - Fourth grade girls and boys. **Activities:** - Signing of the informed consent addressed to parents or guardians of students - Assent addressed to 4th grade girls and boys. - Filling out questionnaires and anthropometric measurement girls and boys in 4th grade.	Review the document "Considerations prior to baseline assessment". Start date 23 October and term date 21 November (tentative)

Launching in each school intervention.	**School: Lic. Benito Juarez Garcia** 27 November **Hours:** 8:00 – 10:00 p.m. **School:** **Daffodil Mendoza** 28 November **Hours:** 8:00 – 10:00 p.m. **School: November 20th** 29 November **Hours:** 8:00 – 10:00 p.m. **School: Aquiles Serdan Lions Club** November 30, 2023. **Time:** 8:00 – 10:00 a.m.	**Participants:** Directors , teachers, fathers, mothers, tutors, food vendors, as well as fourth grade boys and girls. **Activities:** The purpose of the "Launch" is for the school community to be aware of the activities that will be carried out throughout the school year and, in this way, not only keep them informed, but also encourage their participation. The objective will be for the team to give an informative talk to the participants about the activities that will improve the nutrition and health of the girls and boys. 1. We will project a presentation detailing the activities that will take place during the rest of the school year. This presentation will describe the duration, objective and activities by component aimed at fourth grade boys and girls, fathers, mothers, tutors, teachers and food vendors. 2. We will show videos related to healthy and sustainable eating, as well as movement behaviors and psycho-emotional determinants. 3. We will invite mothers, fathers and caregivers, as well as school teachers, to register through the WhatsApp platform to receive messages about healthy and sustainable eating, movement behaviors and determinants psycho-emotional of girls and boys. 4. We will deliver printed communication material to mothers, fathers, people in charge of caring for girls and boys, as well as a Manual aimed at food vendors. This material will include magnets, infographics, brochures, among other information resources. 5. We will place printed communication material called " Pipimeter " in the girls' and boys' toilets, whose objective is that they can monitor whether the color of their urine meets the water consumption recommendations. 6. We will conclude the event with a Healthy Intervention question and answer session, aimed at clarifying any questions that attendees may have.	Two hours are contemplated due to any delays that may occur, but it is expected that the entire event will take a maximum duration of 90 minutes.

Table 12. Morelos intervention project schedule , October 2023			
Start of activities in the four implementation schools (November 2023 to June 2024).			
Virtual course 8 p.m.: Healthy intervention.	**Schools:** **1. Lic. Benito Juárez García** **2. Narciso Mendoza** **3. November 20** **4. Aquiles Serdán Lions Club 1**	**Participants:** - Fourth grade primary school teachers. - Optional. Fathers, mothers, guardians of fourth grade girls and boys. **Activity:** Self-managed 20-hour virtual course designed especially for teachers with the purpose of strengthening their understanding and mastery of the topics of healthy and sustainable eating and movement behaviors. Upon completing the course, participants will have the opportunity to receive a certificate with curricular validity issued by the School of Public Health of Mexico.	During the Launch, you will be informed how you can access the "Virtual Course: Healthy Intervention".
Receiving messaging via WhatsApp (Mobile Health).	**Schools:** **1. Lic. Benito Juárez García** **2. Narciso Mendoza** **3. November 20** **4. Aquiles Serdán Lions Club 1** From December 1, 2023 to May 24, 2024. Messages will be sent on Mondays, Wednesdays and Fridays. **Shipping time:** 18:00.	**Participants:** - Fathers, mothers, guardians of fourth grade girls and boys. - Physical education teachers. - Optional. Fourth grade primary school teachers. **Activity:** Messages will be sent via WhatsApp every third day throughout the school year, addressing topics related to healthy eating, movement behaviors and emotional health during childhood. The purpose of this activity is to consolidate the knowledge acquired in the other components of the program.	During the "Launch" you will be told how you can access WhatsApp messaging.
Promotion of the daily intake of vegetables and fruits in the school environment by promoting healthy snack options.	**Schools:** **1. Lic. Benito Juárez García** **2. Narciso Mendoza** **3. November 20** **4. Aquiles Serdán Lions Club 1** Monday to Friday from December 1, 2023 to May 24, 2024.	**Participants:** - Fourth grade girls and boys. **Activity:** The habit of bringing a healthy snack, which includes vegetables, fruits or both, from Monday to Friday by girls and boys, will be promoted.	Random supervisions will be carried out with the purpose of ensuring that the boys and girls bring their healthy snack, ideally on a daily basis.

Table 12. Morelos intervention project schedule , October 2023			
	Time: To eat them during the break.		
Promotion of the daily intake of natural water in the school environment with the support of the ' Pipometer '.	**It's Schools:** **1. Lic. Benito Juárez García** **2. Narciso Mendoza** **3. November 20** **4. Aquiles Serdán Lions Club 1** Monday to Friday from December 1, 2023 to May 24, 2024. **Time:** During the entire stay at school.	**Participants:** - Fourth grade girls and boys. **Activity:** Promotion of the habit of consuming natural water and reaching the recommendation of 5 to 8 glasses a day. During the supervisions, the color of the urine will be recorded. On a permanent basis, they will be able to use the ' Pipimeter ', available in all school bathrooms, as a visual reference.	Random supervisions will be carried out with the purpose of ensuring that children maintain the recommendations for natural water consumption.
Workshop: Emotional management of children about food.	**1. Lic. Benito Juárez García** **2. Narciso Mendoza** **3. November 20** **4. Aquiles Serdán Lions Club 1** November 8 or 9, 2023. Hours 8:00 a.m. – 9:00 a.m.	**Participants:** 4th grade girls and boys **Activity:** Theoretical-practical workshop for emotional management on topics related to food and nutrition **In-person**	
Workshop: Prevention of stigmatization with weight and body shape; and Risky Eating Behaviors.	**1. Lic. Benito Juárez García** **2. Narciso Mendoza** **3. November 20** **4. Aquiles Serdán Lions Club 1** November 15, 2023. Hours 8:00 a.m. – 9:00 a.m.	**Participants:** 4th grade girls and boys **Activity:** Theoretical-practical workshop for the definition, recognition, management and weight stigma, risky eating behaviors. **In-person**	
Workshop: Identification of hunger and satiety signals; and symptoms of anxiety and depression.	**1. Lic. Benito Juárez García** **2. Narciso Mendoza** **3. November 20** **4. Aquiles Serdán Lions Club 1** November 22 or 23, 2023. Hours 8:00 a.m. – 9:00 a.m.	**Participants:** 4th grade girls and boys **Activity:** Theoretical-practical workshop for the identification of signs of hunger, anxiety and depression. **In-person**	

Table 12. Morelos intervention project schedule , October 2023			
Workshop: Internalization of the aesthetic ideal of thin beauty	**1. Lic. Benito Juárez García** **2. Narciso Mendoza** **3. November 20** **4. Aquiles Serdán Lions Club 1** November 22 or 23, 2023. Hours 8:00 a.m. – 9:00 a.m.	**Participants:** 4th grade girls and boys **Activity:** Theoretical-practical workshop for the aesthetic identification and internalization of beauty. **In-person**	
Workshop: Prevention of stigmatization with weight and body shape; and Risky Eating Behaviors.	**1. Lic. Benito Juárez García** **2. Narciso Mendoza** **3. November 20** **4. Aquiles Serdán Lions Club 1** November 22 or 23, 2023. Schedule To be defined	Participants: Mothers and fathers or guardians Virtual, schedule to be defined with mothers and fathers or guardians.	
Workshop: Identification of hunger and satiety signals; and symptoms of anxiety and depression.	**1. Lic. Benito Juárez García** **2. Narciso Mendoza** **3. November 20** **4. Aquiles Serdán Lions Club 1** November 8 or 9, 2023. Schedule: To be defined	**Participants:** Mothers and fathers or guardians **Virtual,** schedule to be defined with mothers and fathers or guardians.	
Workshop: Prevention of stigmatization with weight and body shape; and Risky Eating Behaviors.	**1. Lic. Benito Juárez García** **2. Narciso Mendoza** **3. November 20** **4. Aquiles Serdán Lions Club 1** November 15, 2023. Schedule: To be defined	**Participants:** Mothers and fathers or guardians **Virtual,** schedule to be defined with mothers and fathers or guardians.	
Workshop: Limits, parenting and self-care.	**1. Lic. Benito Juárez García** **2. Narciso Mendoza** **3. November 20** **4. Aquiles Serdán Lions Club 1**	**Virtual,** schedule to be defined with mothers and fathers or guardians. Aimed at mothers and fathers or guardians	

Table 12. Morelos intervention project schedule , October 2023			
	November 22, 2023 Schedule: To be defined		
Workshop: Identification of hunger and satiety signals; and symptoms of anxiety and depression.	**1. Lic. Benito Juárez García** **2. Narciso Mendoza** **3. November 20** **4. Aquiles Serdán Lions Club 1** November 22, 2023. Schedule to be defined	**Participants:** Teaching staff. **Virtual,** schedule to be defined with the teaching staff	
Supervision of the promoter of the 'Healthy Intervention'.	**School Lic. Benito Juárez García** 7.December 4, 6, 12 and 14, 2023. 8.January 9, 11, 15, 17, 23, 25 and 29, 2024. 9.February 6, 7, 14, 15, 21, 22, 26 and 27, 2024. 10. March 6, 7, 13, 14 and 19, 2024. 11. April 9, 11, 15, 19, 23, 24 and 29, 2024. 12. 3, 7, 13, 17, 21, 23, May 2024. **Time:** 8:00 a.m. to 11:00 a.m. **School: Narcissus Mendoza** 7.December 4, 6, 12 and 14, 2023. 8.January 9, 11, 15, 17, 23, 25 and 30, 2024. 9.February 6, 7, 14, 15, 21, 22, 26 and 27, 2024. 10. March 6, 7, 13, 14 and 20, 2024. 11. April 9, 11, 15, 19, 23, 24 and 29, 2024. 12. May 3, 7, 13, 17, 21, 23, 2024. **Time:** 8:00 a.m. to 11:00 a.m.	**Participants:** - Fourth grade girls and boys. **Activities:** **1. Verify that they have a healthy snack.** The person in charge of the Healthy Intervention will go to each 4th grade classroom to verify that they bring it with them and, if they comply with this practice, they will be given a numbered ticket that will allow them to participate at the end of the school year in an incentive contest. . **2. Recording the color of the last urine.** During the visit to the classroom, the person in charge of this intervention will provide each girl and boy, at least twice a week, with a log-type recording sheet called 'My Pipimeter '. On this sheet, you can mark the color of your last urine observed in the bathroom. In addition, they will have the constant support of the ' Pipometer ', a visual resource that will be permanently installed in all school bathrooms as a reference.	Activities 1 and 2 will take approximately 20 minutes per 4th grade group, while interaction with food and beverage vendors will take 5 to 10 minutes per food and beverage outlet. The schedule has been planned in a way that allows for transitions between groups and waiting times without interfering with teaching activities.

Table 12. Morelos intervention project schedule , October 2023			
	November 20 7.December 5, 7, 11, 13, 2023. 8.January 8, 10, 16, 18, 22, 24 and 31, 2024. 9.February 8, 9, 12, 13, 19, 20, 28, 29, 2024. 10. March 4, 5, 11, 12, 21, 2024. 11. 8, 12, 16, 18, 22, 25, April 2024. 12. 2, 6, 9, 14, 16, 20, 24 May 2024. **Time:** 8:00 a.m. to 11:00 a.m.	**3. Make regular visits to food vendors in schools to encourage nutritious and healthy food and drink options.** During these visits, guidance and support will be provided to food and beverage vendors to promote more nutritious and healthy food options. The main focus is to ensure that the food options offered at school are balanced and beneficial to the health of students. The ultimate goal is to transform the food sales environment at school into a place that promotes the health and well-being of students, thus helping to prevent problems such as overweight and obesity, and allowing girls and boys to grow up healthily. .	
	School: 7. December 5, 7, 11, 13, 2023. 8.January 8, 10, 16, 18, 22, 24, 2024. 9.1, 8, 9, 12, 13, 19, 20, 28, 29 February 2024. 10. March 4, 5, 11, 12, 22, 2024. 11. 8, 10, 16, 18, 22, 25, April 2024. 12. 2, 6, 9, 14, 16, 20, 24 May 2024. **Time:** 8:00 a.m. to 11:00 a.m.		
Delivery of 'recognition of healthy perseverance' carried out by the promoter of the 'Healthy Intervention'.	**School: Lic. Benito Juárez García** January 29, 2024. **Time:** 8:00 a.m. to 11:00 a.m.	**Participants:** - Fourth grade girls and boys. **Activities:** Within the framework of supervisions for *"Verifying that they have a healthy snack"* and *"Recording the color of their last urine"* during visits to 4th grade classrooms will be carried out:	This activity will take approximately 5 minutes additional to those contemplated during the supervision of the promoter of the 'Healthy Intervention'.
	School: Narciso Mendoza January 30, 2024. **Time:** 8:00 a.m. to 11:00 a.m.		
	November 20 January 31, 2024. **Time:** 8:00 a.m. to 11:00 a.m.		

Table 12. Morelos intervention project schedule , October 2023			
	School: Aquiles Serdán Lions Club 1 February 1, 2024. **Time:** 8:00 a.m. to 11:00 a.m.	- Delivery of a Diploma for carrying a healthy snack. - Delivery of a Diploma for complying with the recommendations for natural water consumption.	
Promotion of the reduction of the consumption of sugary drinks and ultra-processed foods - two, promoting healthier alternatives through the "Healthy Reporter" activity.	**Schools:** **1. Lic. Benito Juárez García** **2. Narciso Mendoza** **3. November 20** **4. Aquiles Serdán Lions Club 1** *Invitation and instructions.* **January 29, 31 and February 2, 2024.** *Sending and receiving videos.* **From February 6 to March 1, 2024.** *Voting period for the best video.* *Winners publication.* **From April 8 to 12, 2024.** **Time:** Not applicable.	**Participants:** - Fourth grade girls and boys. - Fathers, mothers, guardians of fourth grade girls and boys. **Activities:** - Invitation to participate in the creation of a video focused on the identification of healthy alternatives that replace the consumption of sugary drinks and ultra-processed foods - Shipping instructions. - Sending and receiving videos from the 'Healthy Reporters' via WhatsApp - Publication of videos for voting by the school community via WhatsApp to select the best videos of the 'Healthy Reporters' - Publication of the winning children for the best video of 'Healthy Reporter'	The above activities will be carried out through the WhatsApp platform. This activity will be presented at the Launch and the invitation will be extended to fourth grade girls and boys and their guardians to participate.
Practical demonstration by the promoter of 'Movement Behaviors' on: -Physical activation before the start of classes. -Active breaks -Active recreation	**School: Lic. Benito Juárez** December 4 and 6, 2023. **Time:** 8:00 a.m. to 12:30 p.m. **School: Narciso Mendoza** December 4 and 6, 2023. **Time:** 8:00 a.m. to 12:30 p.m. **November 20** December 5 and 7, 2023. **Time:** 8:00 a.m. to 12:30 p.m. **School: Aquiles Serdán Lions Club 1** December 5 and 7, 2023. **Time:** 8:00 a.m. to 12:30 p.m.	**Participants:** - Fourth grade girls and boys. **Activities:** Presentation and explanation to 4th grade teachers about physical activity practices: 1. Physical activation before the start of classes: For 15 minutes before classes, a short session of physical activity will take place. 2. Active Breaks: Active breaks will be encouraged, twice a day, which will include physical movements during classes to maintain energy and concentration. 3. Active Recess: During recess, at least 15 minutes of moderate to vigorous physical activities will be promoted in play areas adapted according to the "Workshop for the conditioning of school spaces" and/or using the sports equipment provided to the school. .	The promoter of 'Movement Behaviors' will gradually carry out the activities during the course of the day.

Table 12. Morelos intervention project schedule , October 2023			
Promotion in the school environment of physical activation before the start of classes (led by teachers or Prof. EF)	**Schools:** **5. Lic. Benito Juárez García** **6. Narciso Mendoza** **7. November 20** 8. **Aquiles Serdán Lions Club 1** Monday to Friday from December 1, 2023 to May 24, 2024. **Time:** 08:00 to 08:15 h.	**Participants:** - Fourth grade girls and boys. - Fourth grade primary school teachers. - Optional. Physical education teachers. **Activities:** Physical activation before the start of classes: For 15 minutes before classes, a short session of physical activity will take place. To know the recommended exercises, they can be consulted in the "Manual of physical activation, active breaks and active recesses within the school environment."	It is recommended that the other groups go to their respective classrooms; However, this strategy can be adjusted according to the needs of each school.
Promotion of active breaks in the classroom (led by teachers)	**Schools:** **5. Lic. Benito Juárez García** **6. Narciso Mendoza** **7. November 20** **8. Aquiles Serdán Lions Club 1.** Monday to Friday from December 1, 2023 to May 24, 2024. **Active break time 1:** Between 09:00 a.m. and 09:30 a.m. **Active break time 2:** Between 11:30 a.m. and 12:00 p.m.	**Participants:** - Fourth grade girls and boys. - Fourth grade primary school teachers. **Activities:** Active breaks will be encouraged, twice a day, which will include physical movements during classes to maintain energy and concentration. **Example of exercises:** Games and dynamics, such as imitating animals, jumping, running, dancing, stretching, breathing movements, joint movements. **Frequency:** 2 times a day. Active break 1 is expected to be one hour after school starts while active break 2 is expected to be one hour after the school break ends. **duration** 5 to 6 minutes, up to 10 minutes (flexible by type of dynamic).	The schedules may vary depending on the dynamics of each school. To know the recommended exercises, they can be consulted in the "Manual of physical activation, active breaks and active recesses within the school environment."
Promotion of active recreation (ideally encouraged and supervised by teaching staff)	**Schools:** **5. Lic. Benito Juárez García** **6. Narciso Mendoza** **7. November 20** **8. Aquiles Serdán Lions Club 1.** Monday to Friday from December 1, 2023 to May 24, 2024. **Time:** Ideally during 15 minutes of school recess.	**Participants:** - Fourth grade girls and boys. - Fourth grade primary school teachers. **Activities:** During recess, at least 15 minutes of moderate to vigorous physical activities will be promoted in play areas adapted according to the "Workshop for the conditioning of school spaces" and/or using the sports equipment provided to the school.	To know the recommended exercises, they can be consulted in the "Manual of physical activation, active breaks and active recesses within the school environment."

Table 12. Morelos intervention project schedule , October 2023			
Supervision of the 'Movement Behaviors' promoter of: physical activation before the start of classes, active breaks and active recess	**School: Lic. Benito Juárez** 7.December 11 and 13. 8.January 8, 10, 15, 17, 22, 24, 29, 31 9.February 6, 8, 12, 14, 19, 21, 26, 28 10. March 4, 6, 11, 13, 19, 21. 11. April 8, 10, 15, 17, 22, 24, 29. 12. May 2, 6, 8, 13, 16, 20, 22. **Time:** 8:00 a.m. to 12:30 p.m. **School: Narciso Mendoza** 7.December 11 and 13. 8.January 8, 10, 15, 17, 22, 24, 29, 31 9.February 6, 8, 12, 14, 19, 21, 26, 28 10. March 4, 6, 11, 13, 19, 21. 11. April 8, 10, 15, 17, 22, 24, 29. 12. May 2, 6, 8, 13, 16, 20, 22. **Time:** 8:00 a.m. to 12:30 p.m. **November 20** 7.December 12 and 14. 8.January 9, 11, 16, 18, 23, 25 and 30. 9.February 1, 7, 9, 13, 20, 22, 27 and 29. 10. March 5, 7, 12, 14, 20, 22. 11. April 9, 11, 16, 18, 23, 25. 12. May 3, 7, 9, 14, 17, 20, 22, 24. **Time:** 8:00 a.m. to 12:30 p.m. **School: Aquiles Serdán Lions Club 1.** 7.December 12 and 14. 8.January 9, 11, 16, 18, 23, 25 and 30. 9.February 1, 7, 9, 13, 20, 22, 27 and 29. 10. March 5, 7, 12, 14, 20, 22. 11. April 9, 11, 16, 18, 23, 25. 12. May 3, 7, 9, 14, 17, 20, 22, 24. **Time:** 8:00 a.m. to 12:30 p.m.	**Participants:** - Fourth grade girls and boys. **Activities:** The promoter of 'Movement Behaviors' will supervise: 1. Physical activation before the start of classes: For 15 minutes before classes, a short session of physical activity will take place. 2. Active Breaks: Active breaks will be encouraged, twice a day, which will include physical movements during classes to maintain energy and concentration. 3. Active Recess: During recess, at least 15 minutes of moderate to vigorous physical activities will be promoted in play areas adapted according to the "Workshop for the conditioning of school spaces" and/or using the sports equipment provided to the school. "	The 'Movement Behaviors' promoter will gradually supervise the activities during the course of the day.

Table 12. Morelos intervention project schedule , October 2023			
Workshop: Conditioning of school spaces.	5. **Lic. Benito Juárez García** 6. **Narciso Mendoza** 7. **November 20** 8. **Aquiles Serdán Lions Club 1** Saturday December 2, 2023. **Time:** 9:00 – 12:00 h.	**Participants:** - Fathers, mothers, guardians of fourth grade girls and boys. - Fourth grade girls and boys. - Optional. Fourth grade primary school teachers. **Activity:** - Paint or recondition the school playground and fields. - The activity is directed by the promoter of 'Movement Behaviors'. - The Healthy Intervention team, represented by the promoters of 'Movement Behaviors', will be responsible for carrying and providing the necessary materials, such as paint and brushes, for the activity.	Ideally, this activity should be carried out when there are no classes and when fathers, mothers, guardians of fourth grade girls and boys have more time to go to school.
Workshop: Importance and benefits of promoting physical activity and limiting sedentary time in school girls and boys.	1. **Lic. Benito Juárez García** 2. **Narciso Mendoza** 3. **November 20** 4. **Aquiles Serdán Lions Club 1** Tuesday, December 5, 2023 (virtual mode)[4] **Time:** 6:00 p.m. – 7:00 p.m.	**Participants:** - Fourth grade primary school teachers. **Activity:** - Paint or recondition the school playground and fields. - The activity is directed by the promoter of 'Movement Behaviors'. - The Healthy Intervention team, represented by the promoters of 'Movement Behaviors', will be responsible for carrying and providing the necessary materials, such as paint and brushes, for the activity.	This activity will be presented at the Launch and the invitation will be extended to fourth grade primary school teachers to participate.
Workshop: Healthy and sustainable nutrition and childhood obesity	**School: Lic. Benito Juárez** January 12, 2024 Time: 8:00 a.m. – 2:00 p.m. **School: Narciso Mendoza** January 12, 2024 Time: 8:00 a.m. – 2:00 p.m. **November 20**	**Participants:** - Fourth grade girls and boys. **Activity:** - ultra-processed foods ', 'Let's drink more natural water every day and 'Let's do more physical activity'. - Through recreational activities, we will strengthen the understanding of fundamental messages that promote healthy and sustainable eating, thus contributing to preventing childhood obesity.	The Workshop will last approximately 60 minutes per 4th grade group. The schedule has been planned in a way that allows for transitions between groups and waiting times without

[4] In the previous diagnosis carried out in schools in Campeche and Morelos, the teaching staff suggested that the workshops be carried out after the work day, preferably after 6:00 p.m.

Table 12. Morelos intervention project schedule , October 2023			
	January 19, 2024 Time: 8:00 a.m. – 2:00 p.m. **School: Aquiles Serdán Lions Club 1** January 19, 2024 Time: 8:00 a.m. – 2:00 p.m.		interfering with teaching activities.
Baseline measurement of participants (intervention schools).	**School: Lic. Benito Juárez** June 1 to 15, 2024 Time: 8:00 a.m. – 2:00 p.m. **School: Narciso Mendoza** June 1 to 15, 2024 Time: 8:00 a.m. – 2:00 p.m. **School: November 20** June 16 to 30, 2024 Time: 8:00 a.m. – 2:00 p.m. **School: Aquiles Serdán Lions Club 1** June 16 to 30, 2024 Time: 8:00 a.m. – 2:00 p.m.	**Participants:** - Fourth grade girls and boys. **Activities:** - Signing of the informed consent addressed to parents or guardians of students - Assent addressed to 4th grade girls and boys. - Filling out questionnaires and anthropometric measurement for 4th grade girls and boys.	Review the document "Considerations prior to the final evaluation". Start date June 1. End date July 31, 2024
Baseline measurement of participants (control schools).	**School: Braulio Rodríguez** June 1 to 22, 2024 Time: 8:00 a.m. – 2:00 p.m. **School: Kids Heroes** June 1 to 22, 2024 Time: 8:00 a.m. – 2:00 p.m. **School: Mariano Matamoros** June 1 to 22, 2024 Time: 8:00 a.m. – 2:00 p.m. **School: Cuauhtémoc** June 1 to 22, 2024 Time: 8:00 a.m. – 2:00 p.m.	**Participants:** - Fourth grade girls and boys. **Activities:** - Signing of the informed consent addressed to parents or guardians of students - Assent addressed to 4th grade girls and boys. - Filling out questionnaires and anthropometric measurement for 4th grade girls and boys.	

Table 13. Intervention project schedule. Logwood.

Activity	Place, date and time	Participants and description of the activity	Observations
Information session (INSP proposal).	October 31, 2023 Time: 10:00am – 11:00am	Directors Objective: To inform about the activities included in the IM. Virtual Meeting	
Baseline measurement of participants (intervention schools).	**School: Justo Sierra Méndez** November 6 to 10, 2023 Time: 8:00 a.m. – 2:00 p.m. **School: Republic of Honduras** November 6 to 10, 2023 Time: 8:00 a.m. – 2:00 p.m. **School: Gunner boy** November 6 to 10 Time: 8:00 a.m. – 2:00 p.m. **School: Lucía Alayola Laura** November 6 to 10, 2023 Time: 8:00 a.m. – 2:00 p.m. **Presidente Ruiz Cortines School Center** November 6 and 7, 2023 Time: 8:00 a.m. – 2:00 p.m. **School: Josefa Ortiz de Domínguez** November 8 and 9, 2023 Time: 8:00 a.m. – 2:00 p.m. **School: CE Pdte. Avila Camacho** November 10 and 13, 2023 Time: 8:00 a.m. – 2:00 p.m. **School: Children of workers** November 14 and 15, 2023 Time: 8:00 a.m. – 2:00 p.m.	**Participants** : - Fourth grade girls and boys. **Activities:** - Signing of the informed consent addressed to parents or guardians of students - Assent addressed to 4th grade girls and boys. - Filling out questionnaires and anthropometric measurement for 4th grade girls and boys.	Review the document "Considerations prior to the baseline evaluation". Start date October 23 and end date November 21 (tentative)

Launch in each intervention school.	**School: Justo Sierra Méndez** November 27, 2023. **Time:** 8:00 – 10:00 a.m. **School: Republic of Honduras** November 28, 2023. **Time:** 8:00 – 10:00 a.m. **School: Gunner Boy** November 29, 2023. **Time:** 8:00 – 10:00 a.m. **School: Lucila Alayola Laura** November 30, 2023. **Time:** 8:00 – 10:00 a.m.	**Participants:** Directors , teachers, fathers, mothers, tutors, food vendors, as well as fourth grade boys and girls. **Activities:** The purpose of the "Launch" is for the school community to be aware of the activities that will be carried out throughout the school year and, in this way, not only keep them informed, but also encourage their participation. The objective will be for the team to give an informative talk to the participants about the activities that will improve the nutrition and health of the girls and boys. 1. We will project a presentation detailing the activities that will take place during the rest of the school year. This presentation will describe the duration, objective and activities by component aimed at fourth grade boys and girls, fathers, mothers, tutors, teachers and food vendors. 2. We will show videos related to healthy and sustainable eating, as well as movement behaviors and psycho-emotional determinants. 3. We will invite mothers, fathers and caregivers, as well as school teachers, to register through the WhatsApp platform to receive messages about healthy and sustainable eating, movement behaviors and determinants psycho-emotional of girls and boys. 4. We will deliver printed communication material to mothers, fathers, people in charge of caring for girls and boys, as well as a Manual aimed at food vendors. This material will include magnets, infographics, brochures, among other information resources. 5. We will place printed communication material called " Pipimeter " in the girls' and boys' toilets, whose objective is that they can monitor whether the color of their urine meets the water consumption recommendations. 6. We will conclude the event with a Healthy Intervention question and answer session, aimed at clarifying any questions that attendees may have.	Two hours are contemplated due to any delays that may occur, but it is expected that the entire event will take a maximum duration of 90 minutes.

Start of activities in the four implementation schools (November 2023 to June 2024).			
Virtual course 8 p.m.: Healthy intervention.	**Schools:** **1. Justo Sierra Méndez** **2. Republic of Honduras** **3. Gunner Boy** **4. Lucila Alayola Laura.** From December 1, 2023 to January 31, 2024. **Time:** Available 24 hours a day.	**Participants:** - Fourth grade primary school teachers. - Optional. Fathers, mothers, guardians of fourth grade girls and boys. **Activity:** Self-managed 20-hour virtual course designed especially for teachers with the purpose of strengthening their understanding and mastery of the topics of healthy and sustainable eating and movement behaviors. Upon completing the course, participants will have the opportunity to receive a certificate with curricular validity issued by the School of Public Health of Mexico.	During the Launch, you will be informed how you can access the "Virtual Course: Healthy Intervention".
Receiving messaging via WhatsApp (Mobile Health).	**Schools:** **1. Justo Sierra Méndez** **2. Republic of Honduras** **3. Gunner Boy** **4. Lucila Alayola Laura.** From December 1, 2023 to May 24, 2024. Messages will be sent on Mondays, Wednesdays and Fridays. **Shipping time:** 18:00.	**Participants:** - Fathers, mothers, guardians of fourth grade girls and boys. - Physical education teachers. - Optional. Fourth grade primary school teachers. **Activity:** Messages will be sent via WhatsApp every third day throughout the school year, addressing topics related to healthy eating, movement behaviors and emotional health during childhood. The purpose of this activity is to consolidate the knowledge acquired in the other components of the program.	During the "Launch" you will be told how you can access WhatsApp messaging.
Promotion of the daily intake of vegetables and fruits in the school environment by promoting healthy snack options.	**Schools:** **1. Justo Sierra Méndez** **2. Republic of Honduras** **3. Gunner Boy** **4. Lucila Alayola Laura.** Monday to Friday from December 1, 2023 to May 24, 2024.	**Participants:** - Fourth grade girls and boys. **Activity:** The habit of bringing a healthy snack, which includes vegetables, fruits or both, from Monday to Friday by girls and boys, will be promoted.	Random supervisions will be carried out with the purpose of ensuring that the boys and girls bring their healthy snack, ideally on a daily basis.

	Time: To eat them during the break.		
Promotion of the daily intake of natural water in the school environment with the support of the ' Pipometer '.	**Schools:** **1. Justo Sierra Méndez** **2. Republic of Honduras** **3. Gunner Boy** **4. Lucila Alayola Laura.** Monday to Friday from December 1, 2023 to May 24, 2024. **Time:** During the entire stay at school.	**Participants:** - Fourth grade girls and boys. **Activity:** Promotion of the habit of consuming natural water and reaching the recommendation of 5 to 8 glasses a day. During the supervisions, the color of the urine will be recorded. On a permanent basis, they will be able to use the ' Pipimeter ', available in all school bathrooms, as a visual reference.	Random supervisions will be carried out with the purpose of ensuring that children maintain the recommendations for natural water consumption.
Workshop: Emotional management of children about food.	**1. Justo Sierra Méndez** **2. Republic of Honduras** **3. Gunner Boy** **4. Lucila Alayola Laura.** November 8 or 9, 2023. Hours 8:00 a.m. – 9:00 a.m.	**Participants:** 4th grade girls and boys **Activity:** Theoretical-practical workshop for emotional management on topics related to food and nutrition **In-person**	
Workshop: Prevention of stigmatization with weight and body shape; and Risky Eating Behaviors.	**1. Justo Sierra Méndez** **2. Republic of Honduras** **3. Gunner Boy** **4. Lucila Alayola Laura.** November 15, 2023. Hours 8:00 a.m. – 9:00 a.m.	**Participants:** 4th grade girls and boys **Activity:** Theoretical-practical workshop for the definition, recognition, management and weight stigma, risky eating behaviors. **In-person**	
Workshop: Identification of hunger and satiety signals; and symptoms of anxiety and depression.	**1. Justo Sierra Méndez** **2. Republic of Honduras** **3. Gunner Boy** **4. Lucila Alayola Laura.** November 22 or 23, 2023. Hours 8:00 a.m. – 9:00 a.m.	**Participants:** 4th grade girls and boys **Activity:** Theoretical-practical workshop for the identification of signs of hunger, anxiety and depression. **In-person**	

Workshop: Internalization of the aesthetic ideal of thin beauty	**1. Justo Sierra Méndez** **2. Republic of Honduras** **3. Gunner Boy** **4. Lucila Alayola Laura.** November 22 or 23, 2023. Hours 8:00 a.m. – 9:00 a.m.	**Participants:** 4th grade girls and boys **Activity:** Theoretical-practical workshop for the aesthetic identification and internalization of beauty. **In-person**	
Workshop: Prevention of stigmatization with weight and body shape; and Risky Eating Behaviors.	**1. Justo Sierra Méndez** **2. Republic of Honduras** **3. Gunner Boy** **4. Lucila Alayola Laura.** November 22 or 23, 2023. Schedule To be defined	Participants: Mothers and fathers or guardians Virtual, schedule to be defined with mothers and fathers or guardians.	
Workshop: Identification of hunger and satiety signals; and symptoms of anxiety and depression.	**1. Justo Sierra Méndez** **2. Republic of Honduras** **3. Gunner Boy** **4. Lucila Alayola Laura.** November 8 or 9, 2023. Schedule: To be defined	**Participants:** Mothers and fathers or guardians **Virtual,** schedule to be defined with mothers and fathers or guardians.	
Workshop: Prevention of stigmatization with weight and body shape; and Risky Eating Behaviors.	**1. Justo Sierra Méndez** **2. Republic of Honduras** **3. Gunner Boy** **4. Lucila Alayola Laura.** November 15, 2023. Schedule: To be defined	**Participants:** Mothers and fathers or guardians **Virtual,** schedule to be defined with mothers and fathers or guardians.	
Workshop: Limits, parenting and self-care.	**1. Justo Sierra Méndez** **2. Republic of Honduras** **3. Gunner Boy** **4. Lucila Alayola Laura.** November 22, 2023 Schedule: To be defined	**Virtual,** schedule to be defined with mothers and fathers or guardians. Aimed at mothers and fathers or guardians	

Workshop: Identification of hunger and satiety signals; and symptoms of anxiety and depression.	**1. Justo Sierra Méndez** **2. Republic of Honduras** **3. Gunner Boy** **4. Lucila Alayola Laura.** November 22, 2023. Schedule to be defined	**Participants:** Teaching staff. **Virtual,** schedule to be defined with the teaching staff	
Supervision of the promoter of the 'Healthy Intervention'.	**School: Justo Sierra Méndez** 13. December 4, 6, 12 and 14, 2023. 14. January 9, 11, 15, 17, 23, 25 and 29, 2024. 15. February 6, 7, 14, 15, 21, 22, 26 and 27, 2024. 16. March 6, 7, 13, 14 and 19, 2024. 17. April 9, 11, 15, 19, 23, 24 and 29, 2024. 18. 3, 7, 13, 17, 21, 23, May 2024. **Time:** 8:00 a.m. to 11:00 a.m. **School:** **Republic of Honduras** 13. December 4, 6, 12 and 14, 2023. 14. January 9, 11, 15, 17, 23, 25 and 30, 2024. 15. February 6, 7, 14, 15, 21, 22, 26 and 27, 2024. 16. March 6, 7, 13, 14 and 20, 2024. 17. April 9, 11, 15, 19, 23, 24 and 29, 2024. 18. May 3, 7, 13, 17, 21, 23, 2024. **Time:** 8:00 a.m. to 11:00 a.m.	**Participants:** - Fourth grade girls and boys. **Activities:** **1. Verify that they have a healthy snack.** The person in charge of the Healthy Intervention will go to each 4th grade classroom to verify that they bring it with them and, if they comply with this practice, they will be given a numbered ticket that will allow them to participate at the end of the school year in an incentive contest. . **2. Recording the color of the last urine.** During the visit to the classroom, the person in charge of this intervention will provide each girl and boy, at least twice a week, with a log-type recording sheet called 'My Pipimeter '. On this sheet, you can mark the color of your last urine observed in the bathroom. In addition, they will have the constant support of the ' Pipometer ', a visual resource that will be permanently installed in all school bathrooms as a reference. **3. Make regular visits to food vendors in schools to encourage nutritious and healthy food and drink options.** During these visits, guidance and support will be provided to food and beverage vendors to promote more nutritious and healthy food options. The main focus is to ensure that the food options offered at	Activities 1 and 2 will take approximately 20 minutes per 4th grade group, while interaction with food and beverage vendors will take 5 to 10 minutes per food and beverage outlet. The schedule has been planned in a way that allows for transitions between groups and waiting times without interfering with teaching activities.

	School: **Gunner Boy** 13. December 5, 7, 11, 13, 2023. 14. January 8, 10, 16, 18, 22, 24 and 31, 2024. 15. February 8, 9, 12, 13, 19, 20, 28, 29, 2024. 16. March 4, 5, 11, 12, 21, 2024. 17. 8, 12, 16, 18, 22, 25, April 2024. 18. 2, 6, 9, 14, 16, 20, 24 May 2024. **Time:** 8:00 a.m. to 11:00 a.m.	school are balanced and beneficial to the health of students. The ultimate goal is to transform the food sales environment at school into a place that promotes the health and well-being of students, thus helping to prevent problems such as overweight and obesity, and allowing girls and boys to grow up healthily. .	
	School: Lucila Alayola Laura. 13. December 5, 7, 11, 13, 2023. 14. January 8, 10, 16, 18, 22, 24, 2024. 15. 1, 8, 9, 12, 13, 19, 20, 28, 29 February 2024. 16. March 4, 5, 11, 12, 22, 2024. 17. 8, 10, 16, 18, 22, 25, April 2024. 18. 2, 6, 9, 14, 16, 20, 24 May 2024. **Time:** 8:00 a.m. to 11:00 a.m.		
Delivery of 'recognition of healthy perseverance' carried out by the promoter of the 'Healthy Intervention'.	**School: Justo Sierra Méndez** January 29, 2024. **Time:** 8:00 a.m. to 11:00 a.m.	**Participants:** - Fourth grade girls and boys. **Activities:** Within the framework of supervisions for *"Verifying that they have a healthy snack"* and *"Recording the color of their last urine"* during visits to 4th grade classrooms will be carried out: - Delivery of a Diploma for carrying a healthy snack. - Delivery of a Diploma for complying with the recommendations for natural water consumption.	This activity will take approximately 5 minutes additional to those contemplated during the supervision of the promoter of the 'Healthy Intervention'.
	School: Republic of Honduras January 30, 2024. **Time:** 8:00 a.m. to 11:00 a.m.		
	School: **Gunner Boy** January 31, 2024. **Time:** 8:00 a.m. to 11:00 a.m.		

	School: Lucila Alayola Laura. February 1, 2024. **Time:** 8:00 a.m. to 11:00 a.m.		
Promotion of the reduction of the consumption of sugary drinks and ultra-processed foods - two, promoting healthier alternatives through the "Healthy Reporter" activity.	**Schools:** **1. Justo Sierra Méndez** **2. Republic of Honduras** **3. Gunner Boy** **4. Lucila Alayola Laura.** *Invitation and instructions.* **January 29, 31 and February 2, 2024.** *Sending and receiving videos.* **From February 6 to March 1, 2024.** *Voting period for the best video.* *Winners publication.* **From April 8 to 12, 2024.** **Time:** Not applicable.	**Participants:** - Fourth grade girls and boys. - Fathers, mothers, guardians of fourth grade girls and boys. **Activities:** - Invitation to participate in the creation of a video focused on the identification of healthy alternatives that replace the consumption of sugary drinks and ultra-processed foods - Shipping instructions. - Sending and receiving videos from the 'Healthy Reporters' via WhatsApp - Publication of videos for voting by the school community via WhatsApp to select the best videos of the 'Healthy Reporters' - Publication of the winning children for the best video of 'Healthy Reporter'	The above activities will be carried out through the WhatsApp platform. This activity will be presented at the Launch and the invitation will be extended to fourth grade girls and boys and their guardians to participate.
Practical demonstration by the promoter of 'Movement Behaviors' on: -Physical activation before the start of classes. -Active breaks -Active recreation	**School: Justo Sierra Méndez** December 4 and 6, 2023. **Time:** 8:00 a.m. to 12:30 p.m. **School: Republic of Honduras** December 4 and 6, 2023. **Time:** 8:00 a.m. to 12:30 p.m. **School: Gunner Boy** December 5 and 7, 2023. **Time:** 8:00 a.m. to 12:30 p.m. **School: Lucila Alayola Laura.** December 5 and 7, 2023. **Time:** 8:00 a.m. to 12:30 p.m.	**Participants:** - Fourth grade girls and boys. **Activities:** Presentation and explanation to 4th grade teachers about physical activity practices: 1. Physical activation before the start of classes: For 15 minutes before classes, a short session of physical activity will take place. 2. Active Breaks: Active breaks will be encouraged, twice a day, which will include physical movements during classes to maintain energy and concentration. 3. Active Recess: During recess, at least 15 minutes of moderate to vigorous physical activities will be promoted in play areas adapted according to the "Workshop for the conditioning of school spaces" and/or using the sports equipment provided to the school. .	The promoter of 'Movement Behaviors' will gradually carry out the activities during the course of the day.

Promotion in the school environment of physical activation before the start of classes (led by teachers or Prof. EF)	**Schools:** **1. Justo Sierra Méndez** **2. Republic of Honduras** **3. Gunner Boy** **4. Lucila Alayola Laura.** Monday to Friday from December 1, 2023 to May 24, 2024. **Time:** 08:00 to 08:15 h.	**Participants:** - Fourth grade girls and boys. - Fourth grade primary school teachers. - Optional. Physical education teachers. **Activities:** Physical activation before the start of classes: For 15 minutes before classes, a short session of physical activity will take place. To know the recommended exercises, they can be consulted in the "Manual of physical activation, active breaks and active recesses within the school environment."	It is recommended that the other groups go to their respective classrooms; However, this strategy can be adjusted according to the needs of each school.
Promotion of active breaks in the classroom (led by teachers)	**Schools:** **1. Justo Sierra Méndez** **2. Republic of Honduras** **3. Gunner Boy** **4. Lucila Alayola Laura.** Monday to Friday from December 1, 2023 to May 24, 2024. **Active break time 1:** Between 09:00 a.m. and 09:30 a.m. **Active break time 2:** Between 11:30 a.m. and 12:00 p.m.	**Participants:** - Fourth grade girls and boys. - Fourth grade primary school teachers. **Activities:** Active breaks will be encouraged, twice a day, which will include physical movements during classes to maintain energy and concentration. **Example of exercises:** Games and dynamics, such as imitating animals, jumping, running, dancing, stretching, breathing movements, joint movements. **Frequency:** 2 times a day. Active break 1 is expected to be one hour after school starts while active break 2 is expected to be one hour after the school break ends. **duration** 5 to 6 minutes, up to 10 minutes (flexible by type of dynamic).	The schedules may vary depending on the dynamics of each school. To know the recommended exercises, they can be consulted in the "Manual of physical activation, active breaks and active recesses within the school environment."
Promotion of active recreation (ideally encouraged and supervised by teaching staff)	**Schools:** **1. Justo Sierra Méndez** **2. Republic of Honduras** **3. Gunner Boy** **4. Lucila Alayola Laura.** Monday to Friday from December 1, 2023 to May 24, 2024. **Time:** Ideally during 15 minutes of school recess.	**Participants:** - Fourth grade girls and boys. - Fourth grade primary school teachers. **Activities:** During recess, at least 15 minutes of moderate to vigorous physical activities will be promoted in play areas adapted according to the "Workshop for the conditioning of school spaces" and/or using the sports equipment provided to the school.	To know the recommended exercises, they can be consulted in the "Manual of physical activation, active breaks and active recesses within the school environment."

Supervision of the 'Movement Behaviors' promoter of: physical activation before the start of classes, active breaks and active recess	**School: Justo Sierra Méndez** 13. December 11 and 13. 14. January 8, 10, 15, 17, 22, 24, 29, 31 15. February 6, 8, 12, 14, 19, 21, 26, 28 16. March 4, 6, 11, 13, 19, 21. 17. April 8, 10, 15, 17, 22, 24, 29. 18. May 2, 6, 8, 13, 16, 20, 22. **Time:** 8:00 a.m. to 12:30 p.m. **School: Republic of Honduras** 13. December 11 and 13. 14. January 8, 10, 15, 17, 22, 24, 29, 31 15. February 6, 8, 12, 14, 19, 21, 26, 28 16. March 4, 6, 11, 13, 19, 21. 17. April 8, 10, 15, 17, 22, 24, 29. 18. May 2, 6, 8, 13, 16, 20, 22. **Time:** 8:00 a.m. to 12:30 p.m. **School: Gunner Boy** 13. December 12 and 14. 14. January 9, 11, 16, 18, 23, 25 and 30. 15. February 1, 7, 9, 13, 20, 22, 27 and 29. 16. March 5, 7, 12, 14, 20, 22. 17. April 9, 11, 16, 18, 23, 25. 18. May 3, 7, 9, 14, 17, 20, 22, 24. **Time:** 8:00 a.m. to 12:30 p.m. **School: Lucila Alayola Laura.** 13. December 12 and 14. 14. January 9, 11, 16, 18, 23, 25 and 30. 15. February 1, 7, 9, 13, 20, 22, 27 and 29. 16. March 5, 7, 12, 14, 20, 22.	**Participants:** - Fourth grade girls and boys. **Activities:** The promoter of 'Movement Behaviors' will supervise: 1. Physical activation before the start of classes: For 15 minutes before classes, a short session of physical activity will take place. 2. Active Breaks: Active breaks will be encouraged, twice a day, which will include physical movements during classes to maintain energy and concentration. 3. Active Recess: During recess, at least 15 minutes of moderate to vigorous physical activities will be promoted in play areas adapted according to the "Workshop for the conditioning of school spaces" and/or using the sports equipment provided to the school. "	The 'Movement Behaviors' promoter will gradually supervise the activities during the course of the day.

	17. April 9, 11, 16, 18, 23, 25. 18. May 3, 7, 9, 14, 17, 20, 22, 24. **Time:** 8:00 a.m. to 12:30 p.m.		
Workshop: Conditioning of school spaces.	**1. Justo Sierra Méndez** **2. Republic of Honduras** **3. Gunner Boy** **4. Lucila Alayola Laura.** Saturday December 2, 2023. **Time:** 9:00 – 12:00 h.	**Participants:** - Fathers, mothers, guardians of fourth grade girls and boys. - Fourth grade girls and boys. - Optional. Fourth grade primary school teachers. **Activity:** - Paint or recondition the school playground and fields. - The activity is directed by the promoter of 'Movement Behaviors'. - The Healthy Intervention team, represented by the promoters of 'Movement Behaviors', will be responsible for carrying and providing the necessary materials, such as paint and brushes, for the activity.	Ideally, this activity should be carried out when there are no classes and when fathers, mothers, guardians of fourth grade girls and boys have more time to go to school.
Workshop: Importance and benefits of promoting physical activity and limiting sedentary time in school girls and boys.	**1. Justo Sierra Méndez** **2. Republic of Honduras** **3. Gunner Boy** **4. Lucila Alayola Laura.** Friday, December 1, 2023 (virtual mode)[5] **Time:** 6:00 p.m. – 7:00 p.m.	**Participants:** - Fourth grade primary school teachers. **Activity:** - Paint or recondition the school playground and fields. - The activity is directed by the promoter of 'Movement Behaviors'. - The Healthy Intervention team, represented by the promoters of 'Movement Behaviors', will be responsible for carrying and providing the necessary materials, such as paint and brushes, for the activity.	This activity will be presented at the Launch and the invitation will be extended to fourth grade primary school teachers to participate.
Workshop: Healthy and sustainable eating and childhood obesity	**School: Justo Sierra Méndez** January 12, 2024 Time: 8:00 a.m. – 2:00 p.m. **School: Republic of Honduras** January 12, 2024	**Participants:** - Fourth grade girls and boys. **Activity:** - ultra-processed foods ', 'Let's drink more natural water every day and 'Let's do more physical activity'. - Through recreational activities, we will strengthen the understanding of fundamental messages that promote	The Workshop will last approximately 60 minutes per 4th grade group. The schedule has been planned in a way that allows for transitions

[5] In the previous diagnosis carried out in schools in Campeche and Morelos, the teaching staff suggested that the workshops be carried out after the work day, preferably after 6:00 p.m.

	Time: 8:00 a.m. – 2:00 p.m. **School: Gunner Boy** January 19, 2024 Time: 8:00 a.m. – 2:00 p.m. **School: Lucila Alayola Laura.** January 19, 2024 Time: 8:00 a.m. – 2:00 p.m.	healthy and sustainable eating, thus contributing to preventing childhood obesity.	between groups and waiting times without interfering with teaching activities.
Baseline measurement of participants (intervention schools).	**School: Justo Sierra Méndez** June 1 to 15, 2024 Time: 8:00 a.m. – 2:00 p.m. **School: Republic of Honduras** June 1 to 15, 2024 Time: 8:00 a.m. – 2:00 p.m. **School:** **Gunner Boy** June 16 to 30, 2024 Time: 8:00 a.m. – 2:00 p.m. **School: Lucila Alayola Laura.** June 16 to 30, 2024 Time: 8:00 a.m. – 2:00 p.m.	**Participants:** - Fourth grade girls and boys. **Activities:** - Signing of the informed consent addressed to parents or guardians of students - Assent addressed to 4th grade girls and boys. - Filling out questionnaires and anthropometric measurement for 4th grade girls and boys.	Review the document "Considerations prior to the final evaluation". Start date: June 1. End date July 31, 2024.
Baseline measurement of participants (control schools).	**Presidente Ruiz Cortines School Center** June 1 to 22, 2024 Time: 8:00 a.m. – 2:00 p.m. **School: Josefa Ortiz de Domínguez** June 1 to 22, 2024 Time: 8:00 a.m. – 2:00 p.m. **School: CE Pdte. Avila Camacho**	**Participants:** - Fourth grade girls and boys. **Activities:** - Signing of the informed consent addressed to parents or guardians of students - Assent addressed to 4th grade girls and boys. - Filling out questionnaires and anthropometric measurement for 4th grade girls and boys.	

	June 1 to 22, 2024 Time: 8:00 a.m. – 2:00 p.m. **School: Children of workers** June 1 to 22 2024 Time: 8:00 a.m. – 2:00 p.m.		

4. Stage 4. Institutionalization of the intervention

Analysis and formulation of recommendations for scaling and incorporating the intervention into the SEP. Meetings with decision makers to seek scaling up of the program to other schools and dissemination activities of the educational materials developed (Apps and printed material) aimed at various population groups.

Ethical and biosafety aspects

The research proposal will be reviewed by the Research, Biosafety and Ethics Committees of the National Institute of Public Health, the institution that will coordinate the project. Only after being approved by these committees will the work begin. Participants will be asked to sign a letter of informed consent. In the case of schoolchildren, the parents or person responsible for the minor will be the ones to sign this document. In addition, schoolchildren will be asked for their consent through the letter of informed consent. All participants will have complete freedom to withdraw from the study at any time they wish. Schoolchildren who participate in the randomized clinical trial will receive an incentive.

Problems and limitations

One of the first risks we face when carrying out this project is the refusal of people to participate in a long-term project and/or abandoning the project, however, for this reason a series of strategies have been designed to minimize these risks, for example, seeking the support of local authorities to facilitate entry into schools and the provision of meaningful incentives to motivate participation; as well as the delivery of results of laboratory studies.

Mechanisms for transferring results and their feasibility

The results of this investigation will be made known through different means:

1. In the schools in which they participated, the results will be delivered and an oral presentation will be made.
2. Meeting with decision makers to present results.
3. Participation in conferences, research reports, scientific articles.
4. The prevention model can be taught by students of health-related careers, after receiving training. This makes it easier for the program to be replicable, that is, it does not require specialists or prolonged training. It is an intervention of four sessions of 45 minutes each, brief enough to be accepted by school institutions to be taught during the school year during class hours. Involves parents through assigned tasks to be completed between sessions, so parents do not have to modify their daily activities to attend a workshop.

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