



## Importance of school gardens. As a strategy for the consumption of healthy food in an early childhood home in Bogota-Colombia

### Importancia de las huertas escolares. Como una estrategia para el consumo de alimentos saludables en un hogar infantil de la primera infancia de Bogotá-Colombia

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#### Abstract

The objective was to implement a school garden (HE) as a strategy to promote the consumption of healthy foods (HF) in a children's home (HI) for early childhood (PI) in Bogota-Colombia. The methodology was mixed (qualitative, quantitative), and longitudinal. Two instruments were designed: 1 for the classification of food consumption frequency of 116 children (NN) and 2 for the measurement of post-consumption waste before and after the application of pedagogical activities. With the initial data (DI) obtained from the 2 instruments, the strategies for the implementation of the HE were designed, and after 9 months the measurement was done again. At least 116 children participated in the intervention, with at least 1 monthly educational session in each group, on healthy eating habits and 1 week of care of the vegetable garden, starting with its planning and implementation. The results at 9 months showed the NN had an impact mostly with the improvement of eating habits, when performing the statistical tests, a p-value of < 0.05 was obtained. As for food waste decreased by 64% after the implementation of the vegetable garden, together with the interest in caring for the environment on the part of 80% of all the children. For the promotion of healthy eating and the lasting change in eating behaviors, it is essential to implement food and nutrition education strategies that promote participatory and collaborative learning.

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#### Resumen

El objetivo fue, implementar una huerta escolar (HE) como estrategia para promover el consumo de alimentos saludables (AS) en un hogar infantil (HI) de la primera infancia (PI) de Bogotá-Colombia. La metodología fue mixta (cualitativa, cuantitativa), longitudinal. Se diseñaron 2 instrumentos: 1 para la clasificación de frecuencia de consumo de alimentos de 116 niños y niñas (NN) y 2 para la medición de desperdicios pos consumo antes y después de la aplicación de actividades pedagógicas. Con los datos iniciales (DI) obtenidos de los 2 instrumentos se diseñaron las estrategias para la implementación del HE, posteriormente a los 9 meses se hizo otra vez la medición. En la intervención participaron 116 NN, con mínimo 1 sesión pedagógica mensual en cada grupo, en temas de hábitos de alimentación saludable y 1 semana de cuidados de la huerta, iniciando con su planificación e implementación. Los resultados a los 9 meses los NN tuvieron un impacto en su mayoría con la mejoría de los hábitos de alimentación, al realizar las pruebas estadísticas se obtuvo un p valor de < 0.05. En cuanto a los desperdicios de alimentos, disminuyó en 64 % después de la implementación de la huerta, aunado por el interés del cuidado del ambiente por parte del 80 % de la totalidad de NN. Para la promoción de la alimentación saludable y el cambio duradero de conductas alimentarias, es fundamental implementar estrategias de educación alimentaria y nutricional que promuevan el aprendizaje participativo y colaborativo.

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## Introduction

Food security (FS), according to the World Food Summit (1996), is achieved when all people at all times have physical, economic access to sufficient, safe and nutritious food to meet their dietary needs and preferences for an active and healthy life<sup>1</sup>. The HE integrated in the curriculum, contribute to its achievement, since they improve the availability of food at school and family level, facilitate access, are part of the educational material in the institutions, encourage the consumption of fruits and vegetables as part of a healthy diet, while stimulating good food handling practices, from planting to consumption<sup>2</sup>.

Food and nutritional insecurity is a problem that afflicts millions of people around the world and it continues to increase<sup>3</sup>. Data issued by the United Nations (UN) report that the number of people suffering from hunger has increased, reaching 828 million in 2021, which shows that it is increasingly difficult to meet the goal of eradicating hunger by 2030<sup>4</sup>.

The Food and Agriculture Organization of the United Nations (FAO) has recognized that for agriculture to feed the world in a way that ensures sustainable rural development<sup>5</sup>, it must be climate-smart, since this approach makes it possible to develop the technical, political and financial conditions needed to achieve agricultural development for the sake of FS in a context of climate change<sup>4,5</sup>.

FAO has extensive experience in the implementation of projects to strengthen the social fabric, the well-being of the population and the development of the individual in his or her context<sup>5</sup>. In this sense, the HE were an important tool for contributing to sustainable development, starting with environmental and food education from the earliest stages of life, in addition to the fact that they can involve teachers, students and heads of family<sup>2</sup>.

In the search for successful cases of HE, there are countless experiences that strengthen the intention of implementing this strategy in IP teaching environments, as they empower the individual and his or her family about their health. The following are some of them: i) Banareng Primary School in Pretoria, South Africa, has transformed an urban desert into a flourishing vegetable garden, which promotes food availability and access. ii) The Edible School Yard in Berkeley, California, introduces children to healthy eating. They grow food organically, raise chickens, taste and compare food, prepare it and eat it. This makes evident the approach to food handling practices<sup>6</sup>. iii) The HE of the Juan Pablo II Educational Institution in Palmira, Colombia, allowed the construction of a pedagogical scenario that favors the strengthening of intellectual and multidisciplinary capacities, which encourages the conservation of the environment, the SA, the autonomy of the children and the intervention of the parents in the educational scenario<sup>7</sup>. iv) The HE of the Juan Pablo II Educational Institution in Palmira, Colombia, allowed the construction of a pedagogical scenario that favors the strengthening of intellectual and multidisciplinary capacities, which encourages the conservation of the environment, the SA, the autonomy of the children and the intervention of the parents in the educational scenario<sup>7</sup>. iv) The HE of the La Laguna Dinde Educational Institution, Cajibío Corregimiento, Municipality of Popayán Cauca, strengthened the ES of students in grade 9<sup>8</sup>.

The HE are a learning opportunity in a sustainable and healthy environment for the children in the schools, who in turn play a fundamental role in the education of their families, who will also begin to share their knowledge with the community<sup>2</sup>. This

learning strategy allows the understanding of the importance of healthy eating, the development of skills to grow local food, the recovery of ancestral knowledge and the promotion of local solidarity economies<sup>10</sup>, which in practice also implies the integration of a variety of sensory stimuli that favor the motivation to learn and share new knowledge<sup>11</sup>. At the same time, it sheds light on the recovery of the roots of food culture and sows the seed for the reconstruction of the social fabric, the conservation of biodiversity, and the practice of agriculture as our ancestors did<sup>12</sup>.

Agriculture emerged as a response to the need for societies to organize themselves and create models of social and economic development<sup>13</sup>. It was the most important economic activity in the history of mankind, because in addition to providing goods, it is responsible for supplying most of the food consumed and plays a fundamental role in strengthening the social fabric<sup>12</sup>.

According to the World Bank, agriculture is fundamental in the economic development of each of the countries, only in 2018 the gross domestic product (GDP) represented 4 %, but in some developing countries it reaches 25 % of their GDP<sup>14</sup>. That is why it is considered as an economic activity of great relevance, one way to promote agriculture is the implementation of HE, as they can somehow respond to the needs of food insecurity, through the promotion and harmonious interaction with the environment, food from nutritional education, and promote livelihood techniques, through forms of practical learning in school, to contribute to long-term health and FS<sup>15</sup>. The history of the HE dates back to the end of the 19<sup>th</sup> century, when gardens were incorporated into American and European schoolyards for two main purposes: one related to children acquiring skills for

their development, and the other to develop the economic benefits of agriculture<sup>13</sup>.

However, around 1930, with the technological advances in agriculture, the development of commerce and the change of curriculum, the HE became obsolete. Years later, the HEs were once again gaining importance in educational projects, allowing children to learn nature-related content through experience<sup>6,13</sup>. Family farming and small-scale agriculture was the objective of the International Year of Family Farming in 2014, which made it possible to value vegetable gardens worldwide, given their important role in alleviating hunger and poverty, improving living habits, and managing and protecting natural resources, in order to propose sustainable development<sup>16</sup>.

Concern for the inadequate eating habits of the population<sup>17</sup> greatly increases the prevalence of malnutrition in all senses, which is why they are listed among the main risk factors for global health<sup>18</sup>. In addition, it is important to recognize that, despite the diversity of food in the country, much of it is lost. One third of the production for human consumption is wasted or squandered throughout the world<sup>17</sup>, affecting the environment as it requires 70 % of the world's water<sup>18</sup>. In addition, the report on malnutrition in children under 5 years of age shows chronic malnutrition figures of 10.8 %, global malnutrition of 3.7 % and overweight and obesity of 6.3 %, which is on the rise in 2015<sup>19</sup>.

In professional practice, it has been evidenced through multiple nutritional counseling of the population served, what is mostly consumed are ultra-processed products with high fat, sugar and sodium content<sup>20</sup>. In addition, several databases were consulted that reported increasing trends in the consumption of ready-to-drink beverages and foods high in calories, fat and sugar<sup>20</sup>. Therefore, the problem is defined as

the high consumption of ultra-processed foods with high fat, sugar and sodium content in the PI of an HI, located in the middle-stratum urban area of Bogota-Colombia.

The HE allow us to recognize how the time invested in the cultivation and preparation of food affects consumption habits and give rise to reflection on current patterns and behaviors in relation to greater consumption of unhealthy or unhealthy AS<sup>21</sup>.

Considering the consumption of ultra-processed foods, and their participation as a trigger of imbalance for the health of the individual<sup>22</sup>, the sustainability of the ecosystem and therefore the ES, it became urgent to answer the question: How to reduce the high consumption of ultra-processed foods with high fat, sugar and sodium content in the IP of a HI in the middle stratum urban area of Bogota-Colombia?

The implementation of FS was proposed as a strategy to achieve the objective of promoting the consumption of FS, encouraging consumer awareness and a critical attitude towards their well-being, to reduce malnutrition, food losses and waste that impact agrifood systems, to revalue the role of producers and to promote the sustainable use of natural resources<sup>23</sup>.

The project is developed in an HI located in the locality of Fontibón in Bogotá-Colombia and arises from the idea of promoting the consumption of native foods, as part of the promotion of healthy life habits, the protection and revaluation of the internal producer and the incentive towards ecologically sustainable practices, to contribute to the FS of the population. The HI is an institutional service that seeks to provide initial education, care and nutrition for children under 5 years of age, of working parents, during an 8-hour day from Monday to Friday.

The feeding processes of the children at the beginning of the HI are framed by the rejection of foods such as fruits and vegetables and preference for ultra-processed foods with high fat, sugar and sodium content, a behavior that has its origin in family life habits. However, it has been shown that the response to the motivation for healthy eating generates a positive effect and this is even greater when the family is involved in the process.

The proposed solution aims to take advantage of "maximum brain plasticity, which occurs in the early years of neurodevelopment, when the essential learning for adaptation to the environment is acquired"<sup>24</sup>, as a pedagogical window of opportunity to implement an intervention called HE in IP, based on participatory and active education<sup>25</sup>, which aims to encourage food awareness and interest in health from the early stages of human development.

## Materials and methods

The approach of the intervention project is mixed, descriptive, longitudinal, correlational and the design is pre-experimental, a basis for the implementation of the vegetable garden in the IP is proposed and there is a low control in the course of each of the stages of its development. The intervention is semi-structured, for the beginning of the project implementation, to finalize its structuring through a participatory construction process, with the educational agents of each of the classrooms<sup>26</sup>.

Secondary documentary sources were also used to obtain support for the development of educational and participatory strategies with the children. This information corresponded to successful and unsuccessful cases of garden implementation in different contexts.

Population. Children under 6 years of age and their corresponding guardians, who are linked to the Service Unit of the Children's Homes of the Colombian

Institute of Family Welfare (ICBF) located in Fontibón Bogotá-Colombia.

**Table 1 Data collection instruments and techniques**

Instrument	Utility	Application
Semi-structured survey	For the food consumption frequency classification of the 116 NN.	At the beginning (February) and at the end (November) of the service at the HI. The HI nutritionist designed the survey using the Google form and provided practical training on its implementation through a video-conference via Meet, with all the educational agents (8 classroom agents and 3 assistants), who were responsible for applying it by telephone with the guardian of each NN in their classroom.
Post-consumer waste registration form	Established within HI protocols for waste quantification.	The food not consumed by the children was weighed before and after the application of educational activities on the subject. A previously calibrated weight scale was used for the measurement <sup>28</sup> .

**Table 2 Project stages**

Stage	Description
1. Inter-institutional coordination.	Inter-institutional coordination was carried out with different public entities to establish strategic alliances to promote the consumption of AS in the HI, through different educational sessions.
2. We learn a little about the garden.	i) The HI invites the parents of the children to participate in the "Urban Agriculture Course" given by the Botanical Garden. ii) The entire human talent of the HI (20 people) participates in the "Urban Agriculture Course".
3. Creation of baseline:	i) Frequency of food consumption of 116 HI NN. ii) Post-consumption food wastage in 1 group of 25 NN: 1 month before the end of the project and at the end of the project. Overall record of HI post-consumer food wastage at the beginning of the year.
4. Planning and implementation.	The planning of the vegetable garden is carried out with all the human talent: 11 educational agents, 1 psychologist, 1 nutritionist, 3 cooks, 2 general services personnel, 1 director and 1 administrative assistant. The implementation counts with the participation of the human talent, the NN and the volunteer parents.

*Sample.* A simple stratified random sampling without replacement was performed<sup>26,27</sup>. Initially, there were 160 children participating in the intervention project; however, 116 of them completed the year at the HI, the rest left for health and personal reasons.

*Criteria for inclusion in the project.* i) Children under 6 years of age at the HI. ii) HI staff. iii) Children's relatives of children at the HI.

*Exclusion criteria in the project.* i) Children over 6 years of age or with a diagnosed learning disorder. ii) Temporary educational personnel. iii) Temporary worker. iv) Temporary children's caretakers.

*Instruments and techniques for data collection.* Two measurement instruments were implemented accord-

ing to Table 1.

The stages of the project were Table 2.

*Pedagogical strategies.* They were aimed at human talent (through the activities developed by the nutritionist), parents of children (activities developed by the nutritionist and educational agents) and children (activities developed by the educational agents). The strengthening of this knowledge will be transmitted to the children of the HI, who will learn through pedagogical activities in the garden over a period of 9 months. At least 1 monthly pedagogical session was developed in each classroom (8 classrooms), on healthy eating habits and 1 week per month on the care of the vegetable garden, starting with its plan

ning and implementation.

Evaluation. The variables evaluated Table 3.

**Table 3 Evaluation**

Variable	Description
i)	Frequency of food consumption.
ii)	Post-consumer waste variation.
iii)	Field diary.
iv)	Perception of successful pedagogical experiences.
v)	Interest in the care of the environment demonstrated at the end of the project.

## Results

For the implementation of HE in the HI, DI were obtained on the frequency of food consumption and post-consumption food wastage. With the DI obtained, strategies were designed to implement HE in the HI, which included all 116 children.

The results obtained from the implementation of the HE at 9 months show:

*1 Frequency of food consumption.* In the food consumption frequency survey of the 116 HI NNs, they were asked about the foods they most frequently rejected. Table 4 shows data from the first survey compared to the second.

**Table 4 Refusal of food by the user of the HI**

What foods does the NN reject?	February	November
Fruits	16	9
Vegetables	51	53
Fruits and Vegetables	1	3
Other	48	51

The Wilcoxon statistic was performed, given that the data do not follow a normal distribution, but are related data, since they measure before and after the same population. Table 5 obtained a p value of 0.267,

which indicates that it is greater than 0.05, therefore, there is no significant change in the NN of the HI, since it was not possible to reduce the rejection of vegetables and it was partially achieved in fruits.

**Table 5 Contrast statistics<sup>a</sup>**

	DI - A1
Z	-1.109 <sup>b</sup>
Sig. asymptot (bilateral)	.267

a Wilcoxon signed rank test

b Based in the positives ranks

Table 6, consumption of raw vegetables (salad type), before and after the creation of the garden. Regarding its consumption in the NN, although at the beginning the consumption is low, the results after 9 months show a modification, which corresponds to the increase in the frequency of consumption (1 to 2 v/d, 3 to 4 v/d, 5 or more v/d).

**Table 6 Consumption of raw vegetables**

Raw vegetables	February	November
5 or more times a day	0	5
3 to 4 times a day	2	9
1 to 2 times a day	20	36
3 to 4 times a week	27	9
1 to 2 times a week	23	31
Each 15 days	6	4
1 time a month	8	3
Never or almost never	30	19

Table 7, Wilcoxon statistics performed on raw vegetable consumption data by the NN and the HI, the value obtained is 0.000, it is less than the p value of 0.05, so the data are statistically significant and there is a change in the consumption of raw vegetables after the implementation of the garden.

Regarding the consumption of cooked vegetables by the NN of the HI, very few of them almost never consume.

**Table 7 Contrast statistics<sup>a</sup>**

	D22 - A2
Z	-7.986 <sup>b</sup>
Sig. asymptot (bilateral)	.000

a Wilcoxon signed rank test  
b Based in the positives ranks

Table 8. After the implementation of the garden, the frequency was favorably modified from 1 to 2v/d, 3 to 4 v/d, 5 or more v/d. It could be thought that the children who consumed them 1 to 2 times or 3 to 4 times increased their consumption and those who consumed them every 15 days, once a month, never or almost did not consume them, continued in these last 3 categories to the November survey.

**Table 8 Consumption of cooked vegetables**

Cooked vegetables	February	November
5 or more times a day	0	9
3 to 4 times a day	4	8
1 to 2 times a day	33	43
3 to 4 times a week	29	21
1 to 2 times a week	38	24
Each 15 days	5	4
1 time a month	4	1
Never or almost never	3	6

The Wilcoxon test carried out on the data Table 9, on the consumption of cooked vegetables by the NN of the HI, obtained a value of 0.000 which is less than the p value of 0.05, demonstrating that there is a difference between before and after the implementation of the garden.

**Table 9 Contrast statistics<sup>a</sup>**

	D32 - A3
Z	-6.718 <sup>b</sup>
Sig. asymptot (bilateral)	.000

a Wilcoxon signed rank test  
b Based in the positives ranks

Table 10 regarding fruit consumption, the highest frequencies of consumption increased compared to the initial data. The children who already consumed them 1 to 2 times a day and 3 to 4 times a week, in November consume them more times a day.

**Table 10 Fruit consumption**

Fruit	February	November
5 or more times a day	1	7
3 to 4 times a day	13	21
1 to 2 times a day	84	76
3 to 4 times a week	15	10
1 to 2 times a week	2	2
Each 15 days	0	0
1 time a month	0	0
Never or almost never	1	0

Table 11 Wilcoxon statistics applied to the fruit consumption data, obtaining a p value of 0.000, this being less than the p value of 0.05, indicating that there is a significant difference in consumption before and after.

**Table 11 Contrast statistics<sup>a</sup>**

	D42 - A4
Z	-5.209 <sup>b</sup>
Sig. asymptot (bilateral)	.000

a Wilcoxon signed rank test  
b Based in the positives ranks

Regarding the consumption of sauces such as soy, tomato, tartar, mayonnaise among other similar products, the NN of the HI increased their frequency of consumption at the end of the year Table 12.

**Table 12 Consumption of sauces**

Sauces	February	November
5 or more times a day	0	1
3 to 4 times a day	0	0
1 to 2 times a day	1	17
3 to 4 times a week	8	3
1 to 2 times a week	18	24
Each 15 days	22	18
1 time a month	22	13
Never or almost never	45	40

The statistics carried out on the consumption of sauces, Table 13, the Wilcoxon test obtained a value of 0.000, this is less than the p value of 0.005, so the consumption of sauce before and after the implementation of the garden is different.

**Table 13 Contrast statistics<sup>a</sup>**

	D52 - A5
Z	-7.139 <sup>b</sup>
Sig. asymptot (bilateral)	.000

a Wilcoxon signed rank test  
b Based in the positives ranks

The consumption of industrialized beverages (bottle or box juices, H<sub>2</sub>O, ponymalta, sodas and soft drinks) in the NN of the HI, had an increase at the end of the year from the frequency of 1 to 2 times a week or more. Confusion could have arisen in this question, because when the drink H<sub>2</sub>O was mentioned, reference was not made to water but to a drink with this name, similar to soda, but with lower sugar content. This information was not explained to the NN's caregivers, Table 14.

**Table 14 Consumption of industrialized beverages**

Industrialized drinks	February	November
5 or more times a day	0	1
3 to 4 times a day	0	1
1 to 2 times a day	0	15
3 to 4 times a week	4	5
1 to 2 times a week	22	29
Each 15 days	20	20
1 time a month	30	17
Never or almost never	40	28

The Wilcoxon statistic applied to the data on the consumption of industrialized beverages, Table 15, a value of 0.000 is a p value less than 0.05, indicating that there is a difference between before and after the consumption of industrialized beverages.

**Table 15 Contrast statistics<sup>a</sup>**

	D62 - A6
Z	-8.165 <sup>b</sup>
Sig. asymptot (bilateral)	.000

a Wilcoxon signed rank test  
b Based in the positives ranks

Table 16, the frequency of consumption of sausages such as sausage, mortadella, ham and chorizo, by the NN of the HI. The caregivers mentioned that

this type of food represented an option to vary the family's diet.

**Table 16 Consumption of sausages**

Sausages	February	November
5 or more times a day	0	1
3 to 4 times a day	0	1
1 to 2 times a day	7	18
3 to 4 times a week	18	7
1 to 2 times a week	39	29
Each 15 days	14	22
1 time a month	19	19
Never or almost never	19	19

Table 17, the Wilcoxon statistic data, a value of 0.059 is observed, this is greater than the p value of 0.05, indicating that there is no significant difference between before and after the consumption of the sausages.

**Table 17 Contrast statistics<sup>a</sup>**

	D72 - A7
Z	-1.890 <sup>b</sup>
Sig. asymptot (bilateral)	.059

a Wilcoxon signed rank test  
b Based on positive ranges

2. *Food waste: Beginning and end.* With 1 month left until the end of the service at the HI, the measurement of post-consumer waste was carried out in 1 of the classrooms, which 25 NN attended. The meal times offered were breakfast, lunch and snack, the portions served were standardized for each component of the dish at each meal time: i) Breakfast: Fruit (70 g), milk drink (200 mL), protein (50 g), derived from cereal (30 g). ii) Lunch: Protein (30 g), vegetables (60), fruit (60), cereal (40 g) and tuber (40 g). iii) Snack: Fruit (70 g), cereal derivative (30 g) and dairy (150 mL).

The measurement of waste was carried out again on 1 of the last days of providing the service, after having applied 2 pedagogical experiences: i) Using a



scale, the waste of each boy and girl was measured in the presence of the caregiver who did it. collected at the end of the day. 1 transparent collection bag had been allocated for each boy and girl. Reflection is made regarding the waste of food and the resources used in its production. 6 strategies were socialized to reduce food waste at home: 1. Healthy eating (5 fruits and vegetables a day), 2. Buy and prepare only what you need, 3. Choose ugly fruits and vegetables (Not rotten. Many are discarded for not having perfect shapes or looking shiny), 4. Store food properly, 5. Read expiration dates, 6. Prefer to eat fresh, but if there is leftover food at home, it is frozen for later.

**Figure 1 Reflection of post-consumption waste between caregiver and child of the HI, after weighing at the end of the day**

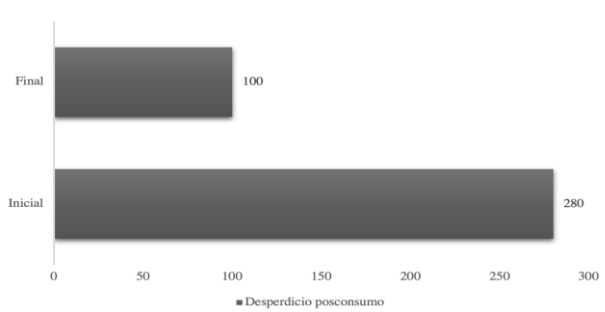


ii) By groups of 5 to 8 NN attendants, the total food waste (in g) generated in the HI in one day was socialized. Next, bills were distributed (imitation), the following was investigated and reflected: Who would like to throw away the money? How much money is 8 kg of discarded (post-consumer) food worth? What would you do as a family with the money that is thrown away every day at the HI due to post-consumer food loss?

The results obtained in post-consumer waste in grams, 1 month prior to the end of the service and at

its end were the following:

**Figure 2 Post-consumer food waste**



The final measurement shows a 64 % reduction in post-consumer food waste. The 2 pedagogical experiences were very well received by the children and caregivers, who shared with the educational agent of the level in subsequent days: “The boy/girl came home to consume the food collected in the bag, to avoid throw them in the trash.” In the second experience, they mentioned: “At home we no longer throw away (waste) food so much.”

3. *Field diary*: The most representative. The 11 educational agents participating in the implementation and care of the garden stated that the fastest germinating and growing seeds/seedlings were: Celery, peas, beans and lettuce. On the other hand, the slowest germinating and growing seeds/seedlings were: radish, broccoli, cilantro, beet, cauliflower, carrot, pumpkin, green cabbage and quinoa.

They reported that the care experiences in the garden with the boys and girls were significant, because seeing progress in the growth of the plants generated motivation, while waiting for a long period for germination and subsequent growth, in some cases produced demotivation. and lack of participation in garden activities. Likewise, they reported that caring for the garden generated greater resilience, patience in the boys and girls, and contributed to collaborative work.

**Figure 3 Collaborative work of boys and girls**

The activities rated by the educational agents as pleasant experiences in the HE due to the participation of the boys and girls were: adaptation of the space for the garden, planting, transplanting, watering and fertilizing. On the contrary, the activities with low adherence were: pruning, receipt of inputs for the garden, management of pests and “weeds” (weeds).

4. Perception of successful experiences. The pedagogical experiences most liked by the NN, as stated by the educational agents, were: i) Implementation of the HE and collaborative work between NN and human talent from the HI. ii) Home laboratory: Invitation of a chef to the HI, to prepare a recipe with food from the garden. Live broadcast on Meet. iii) What do we do with the food produced in the HE?:

Preparation of salad by the NN, with the guidance of the educational agents. iv) Peasant markets: Organization of tables with the sale of fruits and vegetables (models) and money (imitation), for the purchase of the same, by the NN. The role of the farmer in food production was identified. v) School store: Children

were guided to purchase SA, instead of ultra-processed foods with high content of saturated fat, sodium and sugar, in a supermarket simulation at the HI. vi) Gastronomic fair: 10 of the families of the NN of the HI, were organized by regions, prepared and offered in the HI to the other families and human talent, the typical dishes of each region. vii) Technical assistance from the Botanical Garden: Longitudinal. A professional from the Bogotá Botanical Garden provided bimonthly technical assistance in the HI to the NN, in support of the pedagogical experiences developed by the educational agents in the garden. viii) Visit to the Botanical Garden: Children over 4 years old, from 3 HI classrooms, visit the Tropicario of the Botanical Garden of Bogotá, accompanied by 1 professional from this and 3 educational agents from the HI.

To encourage care for the environment, during the year on a monthly basis, various pedagogical strategies were developed, among which the NN highlighted as “the best”: visit to the Botanical Garden of

Bogotá, a Farmer's Market in the HI and personification and dance of food. At the end of the year, the HI educational agents mentioned that 80 % of the NN were interested in caring for the environment.

## Discussion

The HE have been proposed for many years, but it was in 2006 that the FAO, in its manual on creating and managing a vegetable garden, mentions that these crops will be under the care of students and teachers, with the main objective of involving pedagogical activities for meaningful, interdisciplinary, collective and social learning<sup>29</sup>.

However, it has been found that vegetable gardens are not always institutionalized within pedagogical practices, possibly due to the lack of knowledge of the directors of educational institutions, which makes their implementation become an additional task for teachers and is considered an overload, since it is not integrated into educational programs<sup>30</sup>.

This finding took place at the HI, where the educational agencies initially expressed their displeasure with the proposal to implement the vegetable garden, because of the interpretation of additional activities to be developed during their working day. However, this information was denied since the garden was part of the educational program.

The NNs, being familiar with the food production process (from the seed to obtaining the food ready for consumption), identified the importance of the producer's work in the field in order to be able to eat, likewise, incorporating the children's guardians and human talent<sup>31</sup> awakened their interest in generating self-sufficiency in the production of food for family consumption.

With respect to the results mentioned in the previous section, there was an increase in the rejection of vegetables, while there was greater acceptance of fruits, in accordance with the end-of-year results. The pedagogical activities with greater adherence on the part of the children were those that had fruits as part of the materials; their characteristic sweet taste generated less resistance to reduce their rejection and increase their consumption.

As the activities in the garden developed, vegetables began to be considered part of a snack or refreshment at different times of the day. Some of the most commonly used presentations that contributed to this were: carrot sticks, sliced cucumbers, broccoli cuttings called "arbolitos" by the children, curly lettuce leaves and beet squares.

Fruit consumption started to become more frequent and fruit began to be part of the NNs' snacks outside the home. It was recognized that industrialized beverages, such as "boxed juices", are more expensive than a fruit from a sewing machine, as well as being less healthy. In spite of this, their consumption increased for the month of November, the main reason, according to the children's guardians, was the lack of time to prepare food at home (e.g., boxed juices).

Another of the changes evidenced was the use of water in the celebration of the birthdays of the NNs, as a replacement for soft drinks. This was due to the HI nutritionist's demand that this type of beverages not be brought into the facilities. In spite of this, the request was well received by the children's guardians and the human resources and was replicated in the families.

Regarding the consumption of sauces and its increase in November, it is identified that there is still a lack

of education on alternatives for home preparations that can replace them. Although a workshop on this topic was developed with the human talent of the HI (guacamole, tomato paste, garlic homemade garlic sauce), this was not replicated to the parents of the children. A third of the human talent began to replicate these homemade preparations with their families.

Sausages such as sausage, mortadella, ham and chorizo continue to be a food option, due to their easy preparation that allows almost immediate consumption.

In terms of social skills, the implementation and continuity of the vegetable garden led to the creation of meaningful experiences in the IP, promoting the creation of healthy eating behaviors based on self-empowerment. In addition, it favored interest in caring for the environment as a continuous process within which individuals and populations can become aware of the reality of their context, as happened in the work carried out by Morón Monge et al.<sup>32</sup>, where more than 80 % of the students became aware of the implementation and importance of the gardens, of the community's own set of knowledge, their hierarchies of values, levels of competence, life experiences, commitment to the transformations of the current reality and their capacity to carry them out<sup>33</sup>.

Similar results were observed in the implementation of an HE in an educational community in Bogota<sup>34</sup>, where teamwork among students, teachers and parents improved relations of mutual affection and developed competencies that ensured constructive harmony in the educational community. It also showed a change in attitudes regarding the need to assume

personal and social commitments to protect the environment and enable social development. It also<sup>35</sup> identified that learning practices based on the motivation for the vegetable garden generated favorable differences in the attitudes of the students, allowing them to participate and make proposals in the classroom<sup>36</sup>.

The questions focused on healthy eating in the IP and the analysis for assertive decision making, allowed to generate a collective learning, replicable and applicable over time. There is clear and growing evidence that nutrition education provided from the implementation of school gardens is an opportunity that offers ample opportunities to generate voluntary changes in food, as a result of food cultivation. In addition, considering the organic approach for its implementation, improves and strengthens the relationship of the individual with the environment from the early stages of life<sup>37</sup>.

The transforming role of the NNs in their families was evident after their learning, as they were intentional and persistent applicants at home for the purchase of foods such as fruits and vegetables. The implementation of the vegetable garden empowered the individual and his or her family about the importance of their health and it has been observed that<sup>37</sup>. i) It increases the children's preference for vegetables and fruits, thus favoring their consumption. ii) It increases awareness of the need to protect the environment and conserve the soil.

It was identified that, in order to strengthen autonomy in the formation of healthy eating habits, a multidisciplinary approach is necessary in the implementation and continuity of the garden and in the generation of successful and transcendental experiences

for children. Learning in the school garden is the way to promote the consumption of AS, it is an innovative proposal to learning programs, it is multisectoral, multidisciplinary and generates surprising results in eating habits, derived from the motivation of learning by doing<sup>34</sup>. It is therefore advisable to integrate learning in the garden into all curricula, as mentioned by the FAO in its new HE policy document<sup>37</sup>:

Problem, the high consumption of ultra-processed foods with high fat, sugar and sodium content, in the IP of an HI, located in the middle stratum urban area of Bogotá-Colombia. The objective was to implement a garden as a strategy to promote the consumption of SA in an HI of the IP of Bogotá-Colombia.

*Learned lessons.* i) The preparation of this intervention project left greater clarity regarding the strategies that can be implemented in food and nutritional education, from the first stages of human development, to promote the consumption of SA and favor the participatory learning process. ii) The scope of this project is to serve as a model to be implemented in other IP care units, both nationally and internationally, since it is clear that HEs offer the individual a variety of opportunities for the creation of experiences, highly influential in the formation of their eating habits. iii) According to the results obtained, it was identified that healthy eating habits (low consumption of industrialized drinks, sausages and sauces, added to the daily consumption of fruits and vegetables) were accentuated after the implementation of the garden. At the same time, obesogenic habits (understood in this context as high consumption of industrialized drinks, sausages and sauces, coupled with low or no consumption of fruits and vegetables), also increased. iv) Implementing cooking workshops that link children, caregivers and human

talent, and provide healthy alternatives for food preparation, are an option that can reduce resistance to change towards healthy lifestyle habits, as they respond to the lack of not knowing how to replace ultra-processed foods high in sugar and fat, in a simple and easily applicable way. v) School gardens offer humanity a range of possibilities to interact safely with their environment, build and strengthen through collective learning, the social fabric and healthy habits, based on environmental sustainability. vi) With the implementation of the HE that was carried out in the HI, it is important to consider the option of transcending it to family gardens during vacation periods, so as not to stop the continuity of the progress that occurred with the intervention.

It is proposed that educational institutions promote HE among their communities, to open opportunities and remake the dynamics of interaction between neighbors, educational agents, managers, families and NN, as well as with other actors internal and external to the HI, to overcome with greater assertiveness the limitations (economic, location, among others) and difficulties that arise during its implementation and trajectory, since HE is a relevant strategy that allows mitigating hunger and reducing food insecurity<sup>30</sup>.

### Source of funding

Own resources were used to execute the program.

### Conflicts of interest

The collaborators in this research project declare that there is no conflict of interest related to the planning, implementation and results derived from it. The results obtained have the purpose of generating

knowledge that serves as a basis for future interventions.

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### Ethical considerations

In accordance with Colombian regulations regarding scientific, technical and administrative standards for health research: Resolution 8430 of 93, and with the objective of contributing to safeguarding the dignity, safety and well-being of all participants, and in accordance with the Considering this research, whose risks are minimal or null for the participants, informed consent was considered<sup>38</sup>.

### Research limitations

Yes, due to the situation of the COVID-19 pandemic, but alternatives were sought for its implementation.

### Authors' contributions

*Claudia Catalina Piñarete Jiménez*, for the support of research in the formulation, design and implementation of school gardens, data capture, participation in the experimental phase, analysis of results, discussion and search for information. *Patricia Yazmín Figueroa Chávez*, evaluation of the intervention design, research analysis, statistical analysis, results, information search, discussion and final article.

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