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“Jugando a Ganar Salud” (“Playing to Gain Health”): A Summer-Vacation Physical Activity and Correct Eating Workshop for School-Aged Children – A Pilot Study

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1. Introduction

According to the most recent data on nutritional evaluation in Mexican population, one of every four children between 5 and 11 years of age (26%) presents overweight or obesity, dramatically surpassing the estimate calculated for 2010 for childhood obesity at the worldwide level of 6.7% (Olaiz-Fernández G, 2006). This problem acquires great relevance not only because of the prevalence of obesity, but also due to the consequences associated with this condition, such as high risk of adult-age obesity and chronic diseases such as diabetes mellitus, high blood pressure, dyslipidemias, obstructive apnea sleep disorder syndrome, and non-alcoholic steatosis (Pimenta AM, 2010; Elizondo-Montemayor L, 2010). Conclusive evidence has been established that physical activity is a promoter of healthy lifestyle promoter and a preventer of excessive weight gain (Summerbell CD, 2005) and other diseases. In particular, habitual physical activity at early ages increases the probability of exerting an impact on the mortality and longevity of persons, as well as improving some cardiovascular risk indicators (Hills AP, 2007; Balas-Nakaxh M, 2010). Generality in existing consensuses for the prevention and treatment of childhood obesity cites the promotion of physical activity as an imperative strategy. The different guidelines that exist on physical activity in children recommend 60 min of physical activity daily of at least moderate intensity, including vigorous aerobic activity at least 3 days a week (Jasen I, 2010; O'Donovan G, 2010). Unfortunately, in Mexico, the reality concerning the time devoted to physical activity in children lies very far from these recommendations. An observational study conducted in Mexico quantified the physical activity engaged in within the school environment, identifying that children have few opportunities to participate in moderate- and vigorous-intensity physical activity, scarcely achieving one half of the time recommended by international guidelines for this age group (Jennings-Aburto N, 2009). A large proportion of the reports on studies examining the promotion of physical activity in this age group are hardly encouraging in terms of the results obtained regarding body weight modification, eating habits, and a sedentary lifestyle at the

long term (Jennings-Aburto N, 2009). The lack of available physical and environmental spaces that promote physical activity within the inter- as well as the extra-academic environment could also contribute to the problem. In addition, the amount of physical activity carried out by children in the school environment is diminishing over time; a study conducted with Mexican children reported that moderate-to-vigorous physical activity decreased 40% from kindergarten to second grade of primary school (Jáuregui A, 2011).

The increase of overweight and obesity has been associated with multiple factors such as the genetic factor, the social factor, and those of behavior and ecology (Jennings-Aburto N, 2009). Only some of these factors can be modified at a certain percentage; the development of overweight and obesity are the consequence of changes in dietary patterns: the increase of the availability of food; the consumption of foods with greater energetic density, and less consumption of fruits and vegetables. In Mexico, in the last 14 years, the purchase of vegetables and fruits has diminished by 29.3%. The consumption of vegetables and fruits in Mexican children stands at one portion (100 g) (Ramírez-Silva I, 2009); this is considered insufficient for maintaining a healthy diet and for preventing chronic degenerative diseases. The purchase of high-energetic-density industrialized foods has increased by 6.3% and the purchase of sweetened beverages has increased by 37.2% (Bonvecchio A, 2009). This demonstrated numerically the changes undergone by dietary patterns. The role of child-directed advertising, the constant bombardment of information on high-energy-value drinks, and the broad array of offers for this type of food has induced an important change in the childhood feeding pattern. Many interesting efforts have been made in applying marketing techniques to promote the consumption of fruits and vegetables and to revert in this manner the effects of the food-consumption behavior adopted over the last 40 years (Domínguez-Vázquez P, 2008).

2. Materials and methods

Considering the previously cited findings, the Health Department of the Mexico City-based Universidad Iberoamericana (UIA) took on the task of developing the Summer Course entitled “Playing to Gain Health”, a model for the promotion of a healthy lifestyle for school-aged children, focused on the skills, attitudes, and knowledge concerning correct diet and the practice of physical activity in a playful, carefree, and non-violent atmosphere to promote the consumption of three servings of fruits and vegetables, water, and skin milk and practicing 30 min of moderate and 15 min of light physical activity and fruits during 3 weeks of morning sessions at schools of community centers during the summer vacation period. The strategy can be adapted for utilization in children’s free time during the week or even on weekends in parks and schoolyards or open spaces in the community.

Eating habits that are acquired during childhood may persist into adulthood (Brannen L, Fletcher J, 1999); thus, factors that influence food consumption should be identified in order to carry out more effective interventions that will promote a healthy diet throughout the entire lifespan (Pérez, 2004). Also, the physical-activity level tends to decline and sedentary behavior tends to increase prior to adolescence (Basterfield L, 2011); reinforcement of an active lifestyle is crucial at this age.

A number of behavioral theories are applied to eating habits research to describe the mechanisms by which attitudes and beliefs exert their influence on eating behavior (Jack I, 2010). It is expected that the efficiency and efficacy of individual and community interventions in the form of health programs, particularly food programs, would increase as our understanding of basic behavioral mechanisms through these theories also increases. The

Social Cognitive Theory (Bandura, 1977) proposes that an individual's behavioral and environmental conduct and personal characteristics interact in reciprocal relationship (reciprocal determination), explaining the subject's behavior. These characteristics are defined as the following: accessibility (the ease with which students were able to find ready-to-eat vegetables and fruits [VF]); expectancy (the value that the person places on a given outcome); self-efficacy (the person's confidence in engaging in a particular behavior and in overcoming barriers to that behavior); preference (what the child likes to eat), and knowledge (what the child knows about the function of VF in the body) (Baranowski T, 2002). Applying this theory to nutritional education has been successfully employed as the foundation in health education interventions in schools (Yngve A, 2005). Our model summer program and intervention were designed based on the social learning theory (Pérez-Lizaur AB, 2008) and constructivist pedagogy whereby summer-course participants construct their learning curve on the attitudes that they develop during the 3 weeks that the workshop lasts. The activities facilitate the knowledge and promote the skills and attitudes to comply with the program's objectives written in terms of didactic strategies that define the following: name of the activity; session number; objective of the activity; purpose or principle of the strategy; theme, subtheme; duration; procedure; sponsorship; resources, and time.

“Playing to Gain Health” summer course has its pedagogical foundation on the constructivist teaching trend in which participants guide their learning process based on the activities that they develop during the workshop's 3-week duration. We developed a manual in which the activities are described that facilitate knowledge and that promote skills and attitudes to comply with the objectives of the program and that are described by means of didactic strategies that define:

- Name of the activity
- Session number
- Objective of the activity
- Purpose or principle of the activity
- Theme, subtheme
- Duration, procedure, sponsorship, resources, time.

The content of the Summer Course Manual was validated by a group of experts and the strategy has been evaluated on two occasions with respect to the eating habits and physical activity of the children.

The program is designed to be carried out during 3 weeks in a period of 4½ h daily, including breakfast and a snack for the children to have access to correct eating (especially tasting and consumption of vegetables, fruits, plain water, and skin milk). The games are focused on developing light- and moderate-intensity physical activity as well as some minutes of vigorously intense activity in a playful and non-violent environment.

In complementary fashion, we designed menus for the breakfasts and the snacks (refreshments) that were focused on compliance with the general guidelines established by the Ministry of Health and the Ministry of Public Education in Mexico for the sale or distribution of food and beverages in the school consumption establishments of basic-education centers (Secretaría de Educación Pública, 2010). With the purpose of providing access to a great variety of fruits and vegetables, we prepared and served raw and/or cooked vegetables and fruits, whether as an ingredient in a some typical dish (with zucchini squash “sopes”, and purslane and cheese “tacos”), or as the main ingredient of some snack (frozen pineapple popsicle). In order to draw the children near to vegetables and fruits and to familiarize the children with

these as part of the workshop’s activities, the children prepared some recipes such as fruit kabobs, vegetarian robots, and diverse figures such as a ship with vegetables; similarly, they prepared a certain recipe such as a fruit and veggie rainbow (Figures 1-3).



Fig. 1. Fruit kabob



Fig. 2. Vegetarian robot



Fig. 3. Fruit and veggie rainbow

2.1 Subjects

The physical-activity education program was piloted in 45 boys and girls aged 6-13 years, belonging to a low socioeconomic level (classification D¹)(AMAI 200)(A.C., 2009), who regularly attend public schools in Mexico's Federal District. We received informed consent from the children's parents and the consent of the children themselves. For study participation, we requested a medical certificate as proof of the child's good health. We utilized convenience sampling, selecting all children who accepted the invitation to participate in the program. For recruitment, the invitation was issued by means of posters distributed in the neighborhood where the study was carried out. Interested parents attended an informative meeting in which we explained the program procedures and requested their written consent concerning the participation of their children. An additional population ($n = 21$) with characteristics equivalent to those of the summer-course attendee population was selected to make comparisons (age- and Body mass index [BMI]-paired) of the physical activity carried out in an environment designed for its promotion as a summer workshop, in contrast with the physical activity quantified in a common school environment. For selection of this population, we also had written informed consent from the children's parents.

For determination of the total vegetable and fruit consumption, we weighed the daily production of all fruits, vegetables, and prepared dishes, we weighed the leftovers of these dishes and the waste on the children's plates). We determined the percentage of leftovers/waste and the total percentage of fruits and vegetables consumed.

Water consumption was measured by the amount of large, plastic water containers consumed every day; this comprised free access and was offered at breakfast, during the practice of physical activity, and during snack time.

2.2 Instruments and procedures

The “Playing to Gain Health” program was carried out at the *Santa María Comedores* AC communal dining rooms and at public courts of the Colonia Tlapechico neighborhood in the Álvaro Obregón Delegation in Mexico's Federal District; these sites complied with the requirements of being a physical space with a kitchen, a dining room, and public space for outdoor activities and to conduct the activities planned.

A group of young people (cheerleaders (*animadores*) aged 18-22 years, at a 1:8 ratio of one youth per 8 children) trained in didactic strategies and coordinated by the program supervisor (see Figure 5) provided an emotionally and physically safe ambiance for development of the program. This tactic allowed for a dual function on providing activities for the youth population in contact with the children and the promotion of good health practices.

¹Lower middle class (D+) – The head-of-household profile in these homes is one of individuals with a complete primary or secondary school academic level. The living spaces of this segment are, in the majority, owned by the family, while some persons rent their homes and some are social-interest dwellings.

Lower Class (D) – This is the mid-section of the lower classes. The profile of the head of household in these homes is one of individuals with an average primary-school educative level (complete in the majority of cases). The dwellings of those belonging to this sector are owned or rented (it is easy to find typical tenement houses), which are in their majority social-interest or fixed/controlled-rent housing. Source: AMAI¹⁶.



Fig. 4. Cheerleader Group 1.

The main strategy for complying with the objectives was the involvement of the children in a non-violent environment, in traditional games (children’s songs and rounds, hoops, jump rope) and in sports such as soccer, basketball, volleyball, races, and rallies, which took place on the site’s public sports courts and playing fields (Figures 5 and 6).



Fig. 5. Basketball.



Fig. 6. Children’s games and rounds.

Additionally, we included activities with basic healthy-eating Concepts, including knowledge of the Healthy Eating Dish, the practical concepts of the complete and varied diet, as well as the importance of the consumption of fruits, vegetables, and water (Figures 7 and 8).



Fig. 7. Coloring “The Healthy Eating Dish”.



Fig. 8. Identifying foods on the “The Healthy Eating Dish”.

The children ate their breakfast and snack in the workshops; the menus were designed based on Correct Diet characteristics (Salud, 2005) (Bandura, 1977) and following the general guidelines for the sale or distribution of foods and beverages in establishments catering to school consumption at basic-education centers (Ministry of Public Education, 2010). In Table 1, we are able to observe a nutrient-evaluation example of a breakfast and a snack. The requirement is that referred for children of Mexican population (Bourges et al., 2009), such as simple carbohydrates including lactose and sucrose (15 g); the remaining nutrients are covered on average at between 90 and 110% in all menus.

	Kcal	Simple carbo- hydrates	Protein	Lipids	Carbo- hydrates	Sodium	Calcium
Requirement	760.00	29.00	28.50	21.00	114.00	927.20	400.00
Water	0.00	0.00	0.00	0.00	0.00	7.20	0.00
Fruit kabob	120.82	24.05	1.39	0.54	31.26	4.94	0.00
Egg with corn tortilla	277.76	1.37	12.39	14.31	24.53	896.11	90
Milk	84.24	0.00	8.23	0.39	11.66	123.43	295.84
Watermelon with yogurt	229.79	13.02	6.20	7.46	38.09	36.51	54.32
	712.61	38.44	28.20	22.70	105.54	1,068.19	440.15
% of daily requirement	93.76	132.55	98.95	108.09	92.58	115.21	110.54

Table 1. Evaluation example of the nutrient composition of a menu

To evaluate the results of the program, we performed evaluations in week 1 and 3 (first and last weeks) of the workshop, including anthropometric variables (weight, height, BMI, waist circumference according to the technique proposed by Lohman) (Lohman TG, 1988), blood pressure, and physical activity measurement with accelerometers (ActiGraph GT3X). Anthropometric measurements of physical activity and blood pressure were carried out by nutritionists standardized for these measurements. Evaluations with accelerometers were performed in duplicate for each child, with measurement at the workshop’s beginning and end. Measurements were considered valid if they had at least a 4-h duration. The main success indicator explored was the achievement of performing at least 30 min of moderate and 15 min of light physical activity. We performed a descriptive analysis of baseline (initial) and endline (final) conditions through calculation of central trend measurements and appropriate spread of variable type and distribution. Baseline-endline comparison of the workshop was conducted by means of analysis with the Wilcoxon test. In addition, we employed, by means of multiple regression analysis, the variables that could explain the physical activity carried out in the two measurements as well as the change between the first and second measurement. For comparison of physical activity performed by pilot-workshop participants, we paired them with a control group of 21 children (age- and BMI-matched) (Wilcoxon test).

3. Results

We studied 45 children, 60% ($n = 27$) were girls attending between 1st and 6th grade of primary school, with ages between 6 and 13 years. Comparison between baseline physical-activity measurements vs. those performed at endline show that there were no changes in anthropometric variables nor in blood pressure (Table 2).

	FIRST WEEK Med (min-max)	LAST WEEK Med (min-max)	Signifi-cance* ($p =$)
Weight (kg)	31.00 (18.00-54.00)	30.00 (18.00-48.00)	0.414
BMI	17.00 (14.00-25.00)	-17.00 (14.00-25.00)	0.317
Waist circumference (cm)	59.00 (48.00-76.00)	57.00 (49.00-76.00)	0.323
Systolic blood pressure	99.00 (77.00-142.00)	92.00 (77.00-133.00)	0.170
Diastolic blood pressure	62.00 (43.00-110.00)	59.50 (36.00-85.00)	0.26

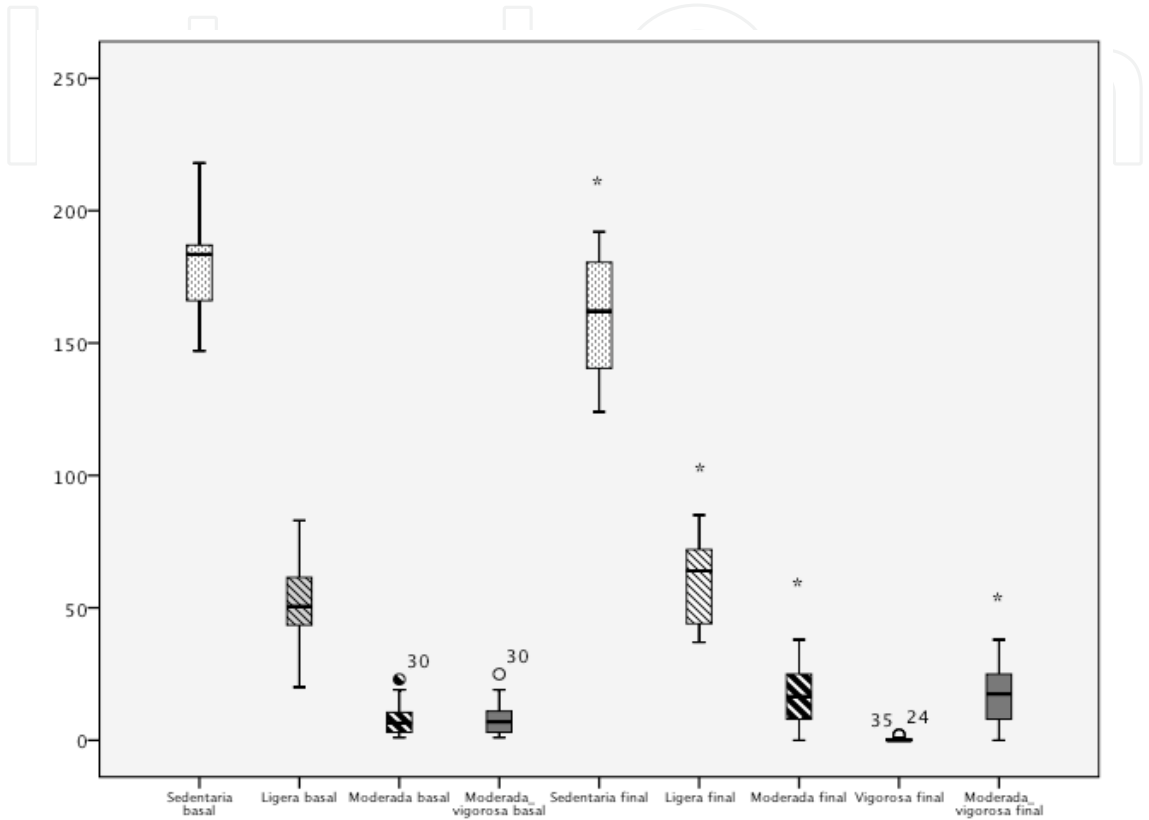
*Wilcoxon test. Med = Media ; min = minimun ; max = maximun .

Table 2. Changes in anthropometric variables and blood pressure

With regard to observations on physical activity, there was a global increase in the physical activity engaged in by the children, which we evaluated with total counts registered by accelerometer (Wilcoxon test; $p = 0.000$). Specifically, changes in the intensity of the activity carried out showed a significant reduction in sedentary-type physical activity, while activities of light and moderate intensity increased (Figure 9).

Once the modifications were explored of the physical-activity amount and type carried out by the children, we evaluated the achievement of the main objectives of the study, which corresponded to engaging in at least 30 min of moderate- and 15 min of light-type physical activity. In terms of light physical activity, 95.5% ($n = 43$) of the participants had already covered the expected time in the baseline measurement and there was no modification under this heading in the final quantification, in contrast with moderate-type activity, which no child carried out for 30 min or more at the beginning of the program and which only 9.5% achieved at the end of the workshop. We identified, by means of multiple linear regression analysis (Stepwise), which of the variables collected (age, weight, height, BMI, waist circumference, and systolic and diastolic blood pressure) explained the physical-activity counts at the end of the workshop. We identified age as the sole predictor variable of the total counts registered for each child ($p = 0.011$).. On its part, change in physical activity at both dates (week 1 counts – week 3 counts) were not predicted in regression analysis by any of the variables analyzed ($p = 0.983$).

With respect to comparison of the physical activity engaged in by the workshop children vs. that carried out by the children during a school day, we observed that from week 1, the energy expenditure was significantly greater in the former ($p < 0.05$), because these children initiated their games and activities from day 1 of the intervention (Table 3).



Baseline vs. endline activity comparison; Wilcoxon test; $p < 0.05$.

Sedentaria base = Baseline sedentary

Ligera base = Baseline light

Moderada base = Baseline moderate

Moderada, vigorosa base = Baseline moderate-to-vigorous

Sedentaria final = Endline sedentary

Ligera final = Endline light

Moderada final = Endline moderate

Vigorosa final = Endline vigorous

Moderada, vigorosa final = Endline moderate-to-vigorous

Fig. 9. Baseline and endline comparison of physical activity.

VARIA- BLE Minutes (mins)	SUMMER PROGRAM GROUP		GROUP IN SCHOOL Med (min-max)	SIGNIFI- CANCE* (Intervention, baseline vs. control)	SIGNIFI- CANCE* (Intervention, endline vs. control)
	Initial week Med (min-max)	Final week Med (min-max)			
Sedentary activity (mins)	183.50 (147.00-218.00)	162.00 (124.00-192.00)	213.00 (150.00- 240.00)	0.000	0.000
Light activity (mins)	50.50 (20.00-83.00)	64.00 (37.00-85.00)	27.00 (0.00-77.00)	0.000	0.000
Moderate activity (mins)	5.00 (00-23.00)	16.50 (0.00-38.00)	1.00 (0.00-13.00)	0.007	0.000
Vigorous activity (mins)	0.00 (0.00-2.00)	0.00 (0.00-2.00)	0.00 (0.00-0.00)	0.102	0.038
Moderate + vigorous activity (mins)	7.00 (1.00-25.00)	17.50 (0.00-38.00)	1.00 (0.00-13.00)	0.004	0.000

*Wilcoxon test. Med = Media ; min = minimun ; max = maximun .

Table 3. Change of physical activity in workshop children vs. children in school

To determine vegetable and fruit consumption, we weighed the total production of each dish or food programmed, and the waste (what was no longer good and that remained in the casseroles in the kitchen) and we additionally weighed everything left on the children’s plates (waste), separating vegetables and fruits from the remaining ingredients. Consumption of vegetables and fruits was determined by means of an average, which was 91.69%; it is noteworthy that the children accepted fruits better than vegetables and that in general, they consumed more raw than cooked fruits and vegetables. It is interesting to observe, in Table 4, the increase of fruit consumption from week 1 to week 3, and that during the morning, the children reached a consumption during of >60% of the World Health Organization (WHO) recommendation.

Consumption of vegetables and fruit (g/ child)	Week 1	Week 3
Monday	90	363
Tuesday	313	221
Wednesday	248	218
Thursday	333	376
Friday	207	390

Table 4. Consumption of vegetables and fruits, total in grams (g) per child per day

Regarding water consumption, this was 52.66 l each day, which is equivalent to 0.612 l per child. It is important to remember that children had free access.

It is important to mention some of the barriers that presented themselves for the correct development of the workshop. Some members of the community did not respect the space in which the activities were developed and they met every day from 10 a.m. to smoke marijuana next to the soccer field, little by little impinging upon the space for the development of the programmed activities (Figure 10). This is a real example of what occurs in the few spaces designed for the practice of physical activity.



Fig. 10. Onlooking community members smoking marijuana.

On the other hand, eating behavior is a set of actions that establish the relationship of humans with food. Eating behaviors are acquired through direct experience with food, by imitating models, food availability, social status, affective symbolisms, and cultural traditions. It has been found that the most direct familial group, especially mothers, exerts an important influence on the way in which the child behaves in relation to eating; regrettably and although mothers and/or those charged with feeding children were invited to attend three, 2-4-h sessions at the installations where the workshop was offered, with the objective of their engaging in physical activity (dance, yoga) and diverse activities focused on food orientation, attendance of the mothers was very low (four mothers for 75 children); thus, lack of interest is considered a scarcely modifiable factor and impedes the prevention of childhood obesity and the change to a healthy individual and familial lifestyle.

During the workshop's 3-week duration, the children remain in direct contact with fruits and vegetables in diverse presentations, forming part of typical dishes, new, flavorful, and fun dishes. The children can touch textures and observe colors. At the same time, consumption of food in a non-violent, hygienic, and warm environment surely exerts a positive impact on the experience of the children with the foods prepared at the workshop. Availability of and accessibility to foods were factors that facilitated the consumption and acceptance of fruits and vegetables.

4. Discussion

Diverse evidence-based reports have cited the benefits of physical activity for school-aged children. These data deal with considerations of the impact on musculoskeletal and cardiovascular health as well as details on the conditions related with the metabolic syndrome, such as overweight, high blood pressure, and dyslipidemias (Jasen I, 2010; Hills AP, 2007; Lohman TG, 1988; Strong WB, 2005). In general terms, the majority of these benefits are visualized as long-term consequences and, in brief observations such as that which we report, they are hardly evaluable. In our study, the modifications in physical-activity type and amount achieved by the children during the summer workshop were unable to be associated statistically with changes in clinical and anthropometric markers such as blood pressure, weight, or waist circumference, which is very probably due to that the follow-up time was very short for verifying this. However, weight, waist circumference, and systolic and diastolic blood pressure exhibited changes of -3.2, -3.3, -7.07, and -4.03%, respectively, which could have positive clinical repercussions if these were conserved at the long term.

Other known benefits of physical activity can exert an impact on the everyday characteristics of perception in the child, such as those that affect self-perception, feelings associated with anxiety and depression, non-violence, as well as success in academic performance; thus, it is important to explore this in future implementations of the program (Strong WB, 2005).

International recommendations on physical activity tend to suggest that from the age of beginning school, children accumulate, on average, at least 60 min daily of moderate or more intense physical activity, although these recognize that certain benefits can be obtained from activities engaged in for 30 min daily (Jasen I, 2010; Services, 2008). In our study, we established as success parameter the achievement of 50% of this goal; despite that the children were involved for >4 h in an ambiance devoted predominantly to the promotion of physical activity, this was unable to be achieved in the majority of the children. It was expected that in the short term -3 weeks-, the children would achieve engaging in least 30 min of moderately intense and 15 min of slightly intense physical activity. Additionally, we sought to evaluate whether the workshop's activities achieved increasing physical activity performed under habitual conditions, taking as reference for this the physical activity engaged in within a school ambiance. These findings oblige us to reflect upon the difficulty of achieving physical-activity recommendations in daily surroundings, rendering it imperative to establish a very well-structured plan and with highly enthusiastic executors for its application in more daily ambits such as school. Examples of successes in Mexico have been reported; however, application at the long term appears to be a great challenge (Balas-Nakaxh M, 2010). Our comparative observations between children in a high-stimulus physical-activity environment and children in a daily school environment agree with other reports, evidencing the gravity of sedentariness in a large proportion of school-aged population in Mexico (Ciampa PJ, 2010).

Another serious problem confronting similar populations to that studied here is the lack of spaces adapted for the practice of physical activity, as well as the lack of friendly spaces or physically active communities of neighborhoods, which taken together impede children from carrying out some type of physical activity safely. In the Summer-vacation Workshop, although the spaces and all of the equipment were focused on the children's safety, the community did not offer an environment that adequately protected the children as team members.

Authors who are expert in fruit and vegetable consumption in children (Baranowski, 2002) conclude that in order to improve fruit and vegetable consumption, direct contact is important in diverse presentations, forming part of typical dishes, novel, tasty, and fun dishes that permit children to touch textures and to observe colors. At the same time, food consumption in a non-violent, hygienic, and emotionally warm environment surely exerts a positive impact on the experience of the children with the foods prepared in the workshop. Availability and accessibility were factors that facilitated consumption and acceptance of fruits and vegetables during the workshop, as witnessed by the increased consumption of these between weeks 1 and 3.

We consider that conducting the workshop in a playful ambiance promotes greater long-term adherence to better eating and physical-activity habits, because the children consumed adequate quantities of plain water, fruits, and vegetables and increased physical activity. The challenge for an intervention of this type is for the population in its milieu to maintain these habits and to adopt them as their own. The participation of parents and the community is basic for maintaining foods within the reach of the children and safe installations to encourage the practice of physical activity.

5. Declaration on conflict of interests

We declare that in the development of the present work, there was no conflict of interests for any of the authors.

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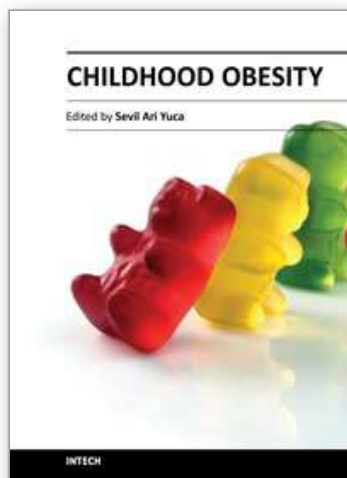
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This book aims to provide readers with a general as well as an advanced overview of the key trends in childhood obesity. Obesity is an illness that occurs due to a combination of genetic, environmental, psychosocial, metabolic and hormonal factors. The prevalence of obesity has shown a great rise both in adults and children in the last 30 years. It is known that one third of children who are obese in childhood and 80% of adolescents who are obese in their adolescent years continue to be obese later in life. Obesity is an important risk factor in serious illnesses such as heart disease, hyperlipidemia, hyperinsulinemia, hypertension and early atherosclerosis.

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