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Developing Educational Games for Preschool Children to Improve Dietary Choices and Exercise Capacity

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Abstract: This article describes the processes used to develop two different types of games used to improve the consumption of healthful foods and increase exercise in preschool Hispanic populations. They were created to meet criteria for effectiveness: age and culturally appropriate, fun, and foster family participation. The first, a pictorial bilingual food bingo game, emphasized vegetable and water consumption and the limitation of sugar-sweetened beverages. A population was selected to study the effectiveness in changing dietary habits, and we were able to show a significantly improved consumption of vegetables at home after using the game during the school year. Next, we developed bilingual video games used to teach nutrition and enhance exercise. The animal characters and narrative were created to allow immersion. The concept was that the animals needed the children's help to obtain food, exercise tasks were assigned, and nutritional foods were discussed. Focus groups were reviewed for the effectiveness of the concept, ease of usability, and appropriateness for the target audience. The videos were tested in a summer session, and teachers concluded that after two viewings the children enhanced their exercise, bonded to the animals, and were answering the nutrition questions correctly.

Keywords: designing educational games; bilingual educational games; games to teach nutrition and exercise

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1. Introduction

Childhood obesity is a worldwide concern. The prevalence more than doubled between the 1970's and late 1990's in Australia, Brazil, Canada, Chile, Finland, France, Germany, Greece, Japan, the UK, and the US [1]. Forty million children under the age of 5 years and more than 330 million children and adolescents aged 5–19 years were overweight or obese worldwide in 2016. This condition is in part due to the availability of inexpensive energy-dense unhealthful foods and beverages that are then utilized particularly by those families in the lower socioeconomic strata [2]. The authors felt that the education of the population alone was insufficient until society made changes such as the taxation of unhealthful foods to make then less accessible.

In 2019 the World Health Organization reported that in the European region 1/3 of children were overweight or obese, with increases all across the region. The report targeted the primary causes, as unhealthful diets low in fruit and vegetables and high in sugar-sweetened beverage and lack of physical exercise, and suggested intervention at an early age. The importance of dietary changes and exercise enhancement in preschools was emphasized. Proposed interventions generally involved both parents and children in dietary instruction and implemented exercise for children as part of the school curriculum. Improving the economic conditions of the low-income families was also considered to be an important contributor to allow for the consumption of more nutritious foods. [3].

Among preschool children aged 2–5 years in the United States, obesity increased from 5.0% to 12.1% between 1976–1980 and 2009–2010, with the highest prevalence in children of Black and Hispanic origin [4]. Interventions in the United States in this vulnerable population involved legislation to update and continue Head Start and WIC (Special Supplemental Nutrition Program for Women, Infants and Children). WIC was established and

administered by the Food and Nutrition Service of the U.S. Department of Agriculture. WIC programs provide low-income mothers with nutrition education and food vouchers they may use at authorized food stores and so represent a socioeconomic action [5]. Head Start is a government-funded locally operated organization that provides preschool education to 3–6 year old children with parents in the lower socioeconomic strata. It was organized to provide preschool children of low-income families with a comprehensive program that not only provided education but also nutritious meals and health screening, and prepared them for the local school system. Major requirements of the local program were that it involved families as well as children and that it be culturally responsive [6].

This article presents an overview of methods used to develop games to improve nutritional knowledge and exercise capacity to prevent and treat obesity in a high-risk Hispanic population of preschool children enrolled in Head Start in Texas. This age group is ideal because they are beginning to establish behavioral patterns including dietary choices and exercise regimens and developing fine motor skills [7]. In addition, obesity in this group predicts future adult obesity, and leads to early onset of multiple diseases, including diabetes and cardiac disease [8]. Interventions to improve physical activity in this type of daycare setting have been studied and found to be successful in Canada [7]. The centers provide meals that comply with United States department of Agriculture standards and are able to introduce new food choices featured in interventional games. They also provide safe physical activity areas which may be lacking in the children's' neighborhoods. In the Texas counties with which we partnered, the majority of children in Head Start are Hispanic, and we determined the prevalence of obesity in this population to be 20.01% in the males and 19.04% in the females when the studies started, which represents a high risk for the future development of diabetes [9]. The Center for Disease Control recently reported that the prevalence of obesity in this age group is 13.9% [9]. However, the degree of obesity is as high as 28.5% in 2–19-year-old Hispanic children in the lower-income groups [10]. The Head Start system facilitates the involvement of the child's care givers. Dietary interventions that provide education about childhood nutrition to Hispanic caregivers are a potent predictor of family dietary changes and weight loss, as noted in the review of interventions to improve risk of obesity in Hispanic preschool children [11]. Serious games are an accepted venue to change dietary and exercise habits and have been used in Europe and the United States with the aim of improving nutrition, particularly the consumption of fruit, vegetables, and water, and increased exercise in children [12].

The budget was limited and computer services were not available initially, so a board game was used to provide the only nutrition education. Subsequently, narrative video games were developed to increase exercise capacity in addition to nutritional education. The recommendations of Ickes et al. [13] for the development of school-based obesity interventions were followed. Games and exercises were tailored to be age and culturally appropriate, and caregivers were involved and participated in focus groups to evaluate the games. Most of the children and their caregivers are bilingual or speak mainly Spanish, so the games were bilingual. The nutritional message was age-appropriate to increase water and vegetable and fruit consumption and decrease sugar-sweetened beverage consumption. Teachers were trained and utilized the games as a part of the curriculum, and the enjoyment of the games was sustained throughout the school year. The games were inexpensive to produce and edit. The video games provided achievable tasks and enjoyment, and the children were praised by the characters, as suggested by Baranowski et al. [14]. The review of Schwartz et al. [15] discusses design features associated with engagement or involvement in the games, which is important for effectiveness. Games should be tailored to the age and culture of the target group, have characters with which they can identify, and have simple instructions for playing the game, and these features were included in the games used for the children in Head Start. The plot and characters were developed to provide immersion, as suggested by Lu et al. [16], since immersion helps to achieve behavioral change. Immersion in a narrative allows for the suspension of disbelief. It is facilitated by

the enjoyment of the game's narrative, events in the narrative that are familiar and lead to acceptance of the whole concept, and a strong attachment to the characters. Narratives are an important part of Hispanic culture, and this form of communication is generally enjoyed. The concept of feeding farm animals is familiar to these children, and they bonded with the animals at the first viewing of the videos. Focus groups of the managers and teachers were used to test the appropriateness of the concept and the feasibility of using the games in the classroom and to identify technical problems, as suggested by Baranowski et al. [14].

Unlike articles reviewing game design principles, reviews of the effectiveness of games providing exercise and nutritional education to children have been mixed. In a review of nutrition education and dietary behavior change games, Baranowski, et al. [12] concluded that many articles reported positive outcome but more objective outcome measures and randomized populations should be used. However, the review of interventions in Hispanic preschool children by Inella et al. [11]) and the review of Ickes et al. [13] point out that the objective outcome of weight reduction may depend on multiple factors, particularly economic interventions. This is illustrated by the study of Pan et al. [17], which reported that the WIC (Special Supplemental Nutrition Program for Women, Infants and Children) change in benefits to promote the purchase of fruits, vegetables, and whole grains correlated with a decrease in severe obesity from 2.12% to 1.96% in children whose mothers were in the program. This reflects the results of the focus group study conducted in both Spanish and English speaking parents by Sonneville et al., which revealed that low-income families frequently could not afford healthful foods and chose more affordable high calorie options [18].

This article provides a discussion of the development of enjoyable, inexpensive, sustainable games for educating families about basic nutrition and increasing exercise activity in preschool children to help decrease the development of early diabetes and cardiovascular disease.

2. Materials and Methods

2.1. Population

Head Start Centers were the venue used for the games. Initially, for the development of the board game, the manager of the center in Hidalgo County Texas was contacted and agreed to participate, allowing the games to be used as a part of the curriculum. Eight teachers were trained to use the game. All of the 148 children in the center classrooms participated in the board game. Head Start is a government-funded locally operated preschool program providing education for the children of low-income families. Most of the children are between 3 and 5 years of age. This group of children in Texas is predominately Hispanic. The game had to be bilingual, since we wanted to involve the family and honor the culture in South Texas. Most of the children were bilingual in Head Start centers participating in the studies in South Texas (Hidalgo and San Benito counties) and in Central Texas (Bastrop and McLennan counties).

2.2. Bilingual Nutrition Game

The game was patterned after Loteria, a popular pictorial bingo game in the Hispanic community played by adults and children. Game boards were made of heavy card stock and laminated so that they could be sanitized, and the foods that were pictured were selected from the Head Start menu and teacher suggestions about the local food supply that would be available and culturally appropriate for the children. The reverse side of the cards shows the name of the food in Spanish and English and contains simple information about the foods (Figure 1). When a card is displayed, the teacher gives simple nutritional information about the food, discussing its place in a healthy food plan, and recites a rhyme or phrase about the food which the children repeat. For example when a card with grapes is displayed the teacher says: "Grapes are fruit, a natural sweet very good for you to eat." The phrase for the cards picturing soda or candy: "just now and then for a treat; not for every day to sweet": pictures of vegetables: "good for you every day, good for you in every way".

There were simple rhymes in Spanish as well. The goal was to increase fruit and vegetable and water consumption and limit the consumption of sugar-sweetened beverages and high-sugar desserts. The script can be easily modified as new dietary information becomes available. This information is repeated by the children and a token placed on any card that pictures the food. Tokens were breakfast cereal, so that they would be safe if eaten. The teachers were able to vary the games so that the children could be engaged 2–3 times a week for 20–30 min over the course of the school year. The teacher could vary the play time by altering the number of cards in the deck used before the winning cards (which appear on all the boards) were shown. The winners were required to identify the pictures that made a winning pattern on the deck and say if they had tried them. The game could be played near snack time, where some of the unfamiliar foods from the game could be introduced. The game was also made available to the parents, and they were encouraged to play it at home with the children. [19]

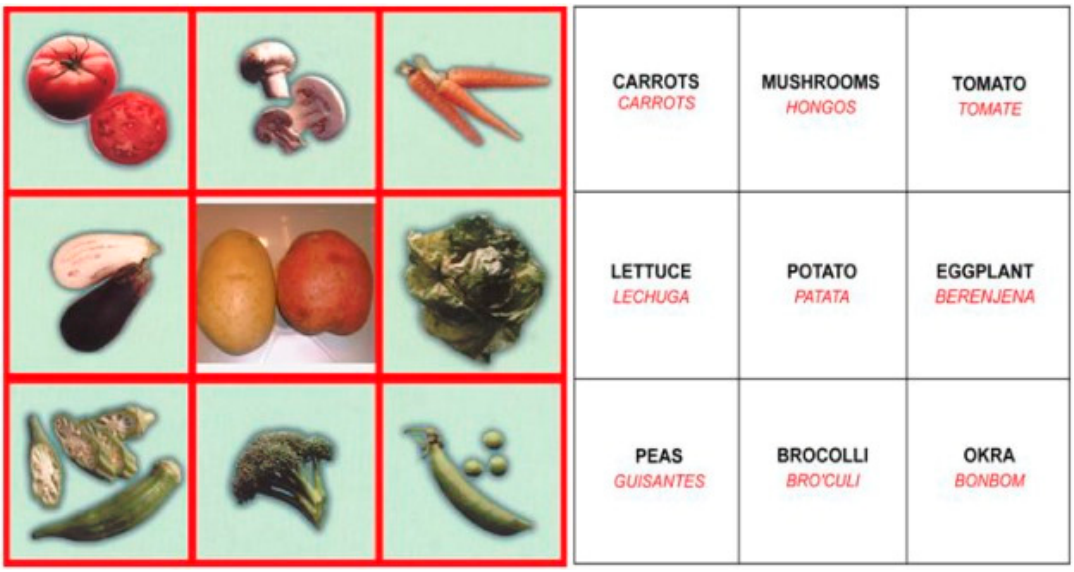

Figure 1. Sample game board displaying healthful foods.

The next step was to determine if families changed any of their food consumption habits after the children had used the game for a school year [20]. Four hundred thirteen children enrolled in Head Start in Bastrop county, Texas, participated in this phase of the project. Teachers were taught the game and their suggestions implemented to customize the game to their group of children. Parents were introduced to the game and played for small prizes. Parents supplied data about home food frequency during the week and on weekends at the beginning and end of the school year. They were asked to document the number of times a day the children were served milk, sugar-sweetened beverages, water fruit and vegetables. The game was played at least twice a week, and the same total number of times in each classroom. Teachers supplied data about food knowledge and interest in the game as the year progressed. To preserve the privacy of the children and families, anonymous aggregate data from the entire group were provided. The signed rank test was used to test the statistical significance of the difference from the beginning of the school year to the end of the year for water, sugar-sweetened beverages, milk, and vegetables served at home.

2.3. Bilingual Video Nutrition and Exercise Game

The next objective was to develop a game that could improve exercise capacity and incorporate nutrition education. The availability of computers at the Head Start sites allowed for the wide screen projection of video games. The development was more complex, since characters and a narrative had to be created that would engage the children.

Characters had to be designed so that the children would bond to them. The setting of the video should feel safe and contain familiar objects, and the narrative had to be engaging enough to produce immersion for successful interaction. Animal cartoon characters (goats, dogs, chickens, and cows) were chosen, as they would be familiar to most of the children. The use of animal characters also eliminated the issues of race, socioeconomic status, and clothing choices, and both genders were present and treated equally. Our animal characters also ate nutritious diets appropriate for them and exercised as a part of their daily life and emphasized the importance of these habits to the children. The exercise plan was reviewed by a pediatric orthopedist and was age-appropriate, with upper and lower body exercises and the practice of fine motor skills. Dance pads were developed by the Nanohmics Corporation of Austin, Texas, that could record the activity of each child to evaluate exercise improvement during the studies. The dance pads reported an individual child's exercise by number of steps and step pressure on the pads, and the results were transferred to a computer. Thus both the individual child and the group exercise could be tracked throughout the school year if desired. The nutrition education was designed to emphasize the intake of healthful foods high in fiber and low in sugar, was reviewed by a registered dietician, and was felt to be acceptable and age-appropriate. The teachers were encouraged to stop the video to provide information, answer questions, and make sure that the children had succeeded in their tasks and enjoyed the video experience.

The videos are 10–15 min long, which is appropriate to children's attention span, and each narrative has non-threatening characters, simultaneously presenting the narrative in English and Spanish. The children exercise while helping the animals obtain food and water. Some of the centers used plastic fruits and vegetables that could actually be collected to improve fine motor skills.

The animals ask questions about the foods eaten by the children and provide information about which foods are best and which are to be limited, to encourage participation, and they introduce some humor. They also ask the children to participate as a group and encourage team work as well as individual participation. We chose the harvesting of fruits and vegetables as a task for the children since many of their parents are farm workers, and we wanted to emphasize the importance and social acceptability of this occupation. Sample clips from the bovine video demonstrating the type of exercises, dietary information, and the assurance of the children's success are found in the Supplementary Materials.

Several teacher focus groups in central and southern Texas reviewed and/or used the videos in small groups and felt that they were age-appropriate, that the children were involved, and that they were able to suspend disbelief and identify with the characters. There were no areas that produced anxiety. Positive and negative comments of these groups were utilized to implement changes. Parent focus groups who attended Head Start meetings were also asked to comment. One of our parent focus groups pointed out that on their budget they choose "the most calories for their dollar" to prevent hunger in their children and that "sugar-sweetened soda is the most affordable treat." This is a problem for all of the parents of Head Start children, since they must have incomes below the poverty level for the children to be eligible to enter the program. The video narratives were implemented to demonstrate treats that did not involve food, such as dancing and singing and storytelling, and information about low-cost vegetables was provided to the parents. [21].

The latest study was an unpublished project [22] involving the summer session of a Head Start facility with classrooms in five geographical areas in South Texas. Approximately 200 children participated. The number is not precise, since there is some variability in the population during the summer session. The purpose was to evaluate factors that determined the number of repetitions of each video required for active participation, consisting of answering questions in the nutrition education portion and active exercise participation. The nutrition portion of the video was updated to include a short section that may be used to deal with avoiding endocrine disruptors found in plastic bottles, which are felt to be linked to obesity in children. Otherwise, the characters and narratives were

those previously designed and piloted in small groups in different parts of Texas. The dance pads were not used, since the assembly time was felt to be too long. The classes were small enough to utilize direct observation by the teachers, to estimate the percent of the children actively participating in the exercises, and would record the percent of questions answered at the beginning and the end of the use of the videos. Data sheets were provided to the classrooms, and the teachers scored them 1–4, depending on the percent of children participating in the exercise and the number of questions answered by the group.

The studies were approved by the Baylor Scott and White IRB; Exempt Category 45 CFR 46.101(b) (4).

3. Results

In the initial study, the bilingual board game was demonstrated to a focus group of teachers and the administrator of the Hidalgo Head Start centers to determine the feasibility of use in the classrooms. It was felt to be culture- and age-appropriate and safe, and the bilingual concept was well received. The game was used at the centers for the school year. The primary end point for this study was the recognition by the children of healthful dietary choices, such as fruits and vegetables, milk, and water, and unhealthful choices, particularly sugar-sweetened beverages. The center used the game, and it was felt by the teachers and administrator that the end point was reached and that the children enjoyed playing the game repeatedly [19]. The game was then distributed to Head start centers in the region to reach more than 1000 children in South Texas to provide a source of dietary education.

The next study was conducted in Bastrop County. Head Start tested the effect of the games on dietary patterns at home. The Head Start center served an USDA-mandated food plan and did not allow the consumption of sugar-sweetened beverages at the sites. Parents were acquainted with the game and provided data about home food frequency at the beginning and end of the year. 81% of the families returned the food frequency forms. The end points were to improve the consumption of vegetables and milk and water and decrease the consumption of sugar-sweetened beverages. The game was played 2–3 times a week for the entire school year by 413 children. There was a statistically significant increase in the consumption of vegetables in the home both during the week and on the weekends. The total servings of vegetables increased from 17–20 per week. In addition, before using the game, 38 families reported no vegetables served on the weekend, and 16 reported no vegetables served at all, but at the end of the study only 12 families reported no vegetables served on the weekend and only four reported no vegetables served at any time. We were unable to show a change in the water served, but the children were given four servings a day every day both before and after the intervention, so the water served was sufficient. There were also three servings of milk daily, and this group received less than two servings of sugar-sweetened beverage daily before the intervention and one less sugar-sweetened beverage a week after the intervention. The centers requested to keep using the game, and it was supplied to them [20].

The interactive video games were developed primarily to improve the exercise time of preschool children but also include nutrition education designed to increase vegetable, fruit, and water consumption and decrease sugar-sweetened beverage consumption. Focus groups were set up to evaluate the content as it was developed, demonstrate usability, and identify technical problems. The videos were then tested with a preschool target audience. The concept was first discussed with focus groups of teachers and managers of Head Start centers in Central Texas. The majority of the focus group members were Hispanic and bilingual, which is similar to the composition of the Head Start classes. The end points were cultural and age appropriateness and the believability of the concept. They felt that all of the end points were met, particularly the need for bilingual content, the familiar animals, and nutrition information. The videos were then demonstrated to teachers and managers to determine their usability in the classroom setting and to see if the type of exercise depicted was appropriate and if the equipment to determine the exercise intensity

was usable. The teachers felt that the end points were met and that the children would enjoy the exercise and would be able to perform the tasks successfully in the classroom space. The discussion with parent groups in our studies revealed that they enjoyed the games but had limited knowledge of nutrition recommendations for their children and limited budgets for food. These parent groups were also representative of the total Head Start parent group and had incomes below the poverty level for their children to qualify for Head Start. The majority of the parents had limited dietary education.

Videos were then shown to a class at the Bastrop County preschool, where teachers and the researcher agreed that the children were immersed in the cartoon story, enjoying the exercise, and speaking with the animals. The teachers suggested pausing the video to give the children rest breaks and discuss the nutrition information, and these were added. Revisions to the dance pads were needed and made to facilitate their use.

The last study in the development of the games was performed at five Head Start centers in South Texas during a summer session involving approximately 200 children aged 3–6. The purpose was to determine the number of viewings needed to engage the children and if there were factors in individual videos that determined the number of times they had to be shown for the children to be engaged and fully participate in the exercises and nutritional education sections. Otherwise, the characters and narratives were those previously designed. The teachers collected data about the number of children actively participating in the exercises and answering questions during each showing of the videos. By the second showing, at least 75% of the students were participating in both exercises and answering the nutrition questions. The major factor affecting the rate of engagement was the familiarity of the animals to the children. If an animal was unfamiliar to a group at the first showing, participation was as low as 25%; if the same animal was familiar, participation could be as high as 100% at the first showing. It was suggested that the teacher discuss the featured animal before starting the game [22].

4. Discussion

This article illustrates the processes of developing education games to improve exercise time and eating habits in low-income Hispanic preschool children as a means of controlling weight gain and preventing early onset of diabetes, cardiovascular disease [8], hypertension [23], low bone density [24], and, more recently, nonalcoholic steatohepatitis (NASH) [25], all of which are related to unhealthful lifestyle choices. The pictorial board game is an example of game-based learning [26]. A major strength of this game is the simple but important messages repeated by the children every time the game is played, among which diminishing the consumption of sugar-sweetened beverages and increasing vegetable and fruit intake. The behavioral change suggested by these messages is a key factor in preventing obesity and the related diseases. Sugar-sweetened beverages, particularly those with high fructose corn syrup, have been shown to decrease insulin sensitivity and lead to the development of intraabdominal fat [27], both of which increase the risk of diabetes. They are associated with hypertension [23] and metabolic syndrome [28]. Diets high in sugars and low in fiber result in unfavorable changes in the gut microbiome, particularly increased gut permeability, leading to the release of inflammatory factors which increase the risk of cardiac disease [29] and liver dysfunction (NASH). [30] All of these risks are diminished by a diet high in plant fiber and low in sugar-sweetened foods [25,31].

The board game is unique because it is patterned after a familiar game in this culture that is accepted as a format to provide education and information. It is also bilingual so it may be easily used by families that speak mainly Spanish at home. Other similar interventions that provide nutrition education have bilingual handouts for families, but the actual games are in English [32] or provide interventions to Hispanic families but require them to be English-speaking to enroll [33].

By working with Head Start, large groups of children could be impacted with sustained interventions using an established network, as suggested by the directives of the WHO-proposed measures to stop the increase in obesity [3] and the interventions of Gold-

field, in Canada [7]. Another factor vital to the success of the game in implementing dietary changes was parental participation [34], that was facilitated by the Head Start system, which conducts parent meetings. Focus groups could be assembled at these meetings and game demonstrations conducted which provided parental nutrition education. These meetings also reinforced the importance of data collection about vegetable consumption at home.

The improved vegetable consumption in our population was in part due to the introduction of unfamiliar foods seen in the games by Head State during snacks and meals at the centers. This strategy was also successfully used by Nekitsing et al. [35] with a cartoon story book to acquaint children with unfamiliar foods which were then offered to children for consumption. Joyner D. et al. [36] used a comic book information format in the cafeteria to educate children about vegetables linked with a teacher-guided script and a game that would reward the children for choosing vegetables to eat.

The video games conveyed the same bilingual messages about decreasing sugar-sweetened beverages and eating more vegetables, fruit, and milk. In addition, they introduced an exercise component. Exercise in this age group is particularly important because NASH is associated with a sedentary lifestyle [30], diabetes prevention is facilitated by exercise, and exercise decreases cardiac risk factors [37]. This is also a time when bone mass accrual is significant, and that is closely linked to exercise [38]. The exercise interventions were reviewed by a pediatric orthopedist and were felt to be appropriate in type and duration and helpful for the development of fine motor control.

Although games that increased physical activity have been used as a reward for making healthful diet choices in a nutrition education game [39], the interventions are generally separate. An advantage of our videos was combined actual physical exercise time with dietary education. The narrative allowed the animals to provide dietary education and teachers to obtain dietary information about home food consumption from the children. The exercise involvement could then be recorded by the teacher if desired. The teachers pause the video to provide rest and discussion periods and can point out parts of the narrative that have particular importance to each classroom. Other strengths of the videos appreciated by the teachers were that the narrative never produced anxiety, the animals were never in danger, the efforts of the children were always praised, and rewards were not food-related. The physical activity tasks were achievable, and the majority of children were engaged by the second viewing.

Another advantage was that the videos were produced with a low cost, could be sent to the parents via the internet to be played at home with the family, and follow-ups could occur at parent meetings. Video clips may also be shown at parent meetings to emphasize important messages for discussion. For example: "Keep your plastic water bottles cool!" The animals discuss plastic water bottles, since endocrine disruptors (phthalates) used in plastic containers leach into the foods when the plastic is heated, and exposure to those compounds—particularly prenatal exposure—has been linked to childhood obesity [40], so this message is important to both children and parents.

A weakness in the studies was the inability to have a control group or randomize the participants or the participating centers in any way, since the intervention was a required part of the curriculum. However, many of the studies of interventions to promote lifestyle changes could not be randomized and obtained positive results [12]. Moreover, weight changes during the interventions could not be tracked. Data were gathered on the population when the games were first introduced [9], but the weights of individual children could not be used, and there was a considerable turnover of the population during the school year since some of the parents were migrant farm workers. The end points of dietary change and increased exercise were considered adequate to show that the interventions could decrease the risk of early lifestyle-related diseases, and this decrease in risk can occur before significant weight loss is achieved [37,38,41].

5. Conclusions

The serious health games described in this article illustrate the processes necessary to develop games that engage preschool children in learning about healthy eating and improving exercise activity. The children accomplish tasks successfully to build confidence and are given rewards that are not food-centered. A rationale for age-appropriate games throughout the school years is to try to foster the habit of daily exercise and teach basic dietary principles that can be implemented when children make more of their own dietary choices. In addition, the risk factors for lifestyle-related disease are decreased during these years, and bone mass is increased to help prevent fractures in later life. The games have been used by several Head Start centers over a period of 15 years to improve exercise time and knowledge of nutrition. Further research is needed to determine whether the positive changes observed in knowledge and activity translate into behavior changes and result in a sustained decrease in body mass index (BMI) in this population. Future research partners for the games would be welcome.

Supplementary Materials: The following are available online at https://www.mdpi.com/2071-1050/13/6/3340/s1, Video S1: Clip1-4_WMV V9.

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Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Institutional Review Board of Scott and White Hospital and Clinic. Protocol code: CFR 46.101(b) (4). Date of approval 4/4/2002.

Informed Consent Statement: Informed consent was waived under "Exempt Category 45" since there were no personal identifiers used and all the data was anonymous aggregate data.

Data Availability Statement: The data is available from the author.

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References

1. Han, J.C.; Lawlor, D.A.; Kimm, S.Y. Childhood obesity. *Lancet* **2010**, *375*, 1737–1748. [CrossRef]
2. Di Cesare, M.; Sorić, M.; Bovet, P.; Miranda, J.J.; Bhutta, Z.; Stevens, G.A.; Laxmaiah, A.; Kengne, A.-P.; Bentham, J. The epidemiological burden of obesity in childhood: A worldwide epidemic requiring urgent action. *BMC Med.* **2019**, *17*, 1–20. [CrossRef]
3. Nittari, G.; Scuri, S.; Petrelli, F.; Pirillo, I.; Di Luca, N.M.; Grappasonni, I. Fighting obesity in children from European World Health Organization member states. Epidemiological data, medical-social aspects, and prevention programs. *La Clin. Ter.* **2019**, *170*, e223–e230.
4. Ogden, C.L.; Carroll, M.D.; Lawman, H.G.; Fryar, C.D.; Kruszon-Moran, D.; Kit, B.K.; Flegal, K.M. Trends in Obesity Prevalence Among Children and Adolescents in the United States, 1988-1994 Through 2013–2014. *JAMA* **2016**, *315*, 2292–2299. [CrossRef] [PubMed]
5. History of WIC. Available online: https://www.nwica.org/wic-basics (accessed on 14 February 2021).
6. History of Head Start. Available online: https://www.thegravelygroup.com/resources/history-of-head (accessed on 14 February 2021).
7. Goldfield, G.S.; Harvey, A.; Grattan, K.; Adamo, K.B. Physical Activity Promotion in the Preschool Years: A Critical Period to Intervene. *Int. J. Environ. Res. Public Health* **2012**, *9*, 1326–1342. [CrossRef] [PubMed]
8. Chung, S.T.; Onuzuruike, A.U.; Magge, S.N. Cardiometabolic risk in obese children. *Ann. N. Y. Acad. Sci.* **2018**, *1411*, 166–183. [CrossRef] [PubMed]
9. Piziak, V.; Morgan-Cox, M.; Tubbs, J.; Rajab, M.H. Elevated Body Mass Index in Texas Head Start Children: A Result of Heredity and Economics. *South. Med. J.* **2010**, *103*, 1219–1222. [CrossRef]
10. Centers for Disease Control and Prevention. Childhood Obesity Facts. Available online: https://www.cdc.gov/obesity/data/childhood.html (accessed on 14 February 2021).

11. Innella, N.; Jameson, B.E. Interventions that impact weight status in Hispanic preschool children. *Public Health Nurs.* **2019**, *37*, 25–38. [CrossRef] [PubMed]
12. Baranowski, T.; Ryan, C.; Hoyos-Cespedes, A.; Lu, A.S. Nutrition Education and Dietary Behavior Change Games: A Scoping Review. *Games Health J.* **2019**, *8*, 153–176. [CrossRef]
13. Ickes, M.J.; McMullen, J.; Haider, T.; Sharma, M. Global School-Based Childhood Obesity Interventions: A Review. *Int. J. Environ. Res. Public Health* **2014**, *11*, 8940–8961. [CrossRef]
14. Baranowski, T.; Buday, R.; Thompson, D.; Lyons, E.J.; Lu, A.S.; Baranowski, J. Developing Games for Health Behavior Change: Getting Started. *Games Health J.* **2013**, *2*, 183–190. [CrossRef] [PubMed]
15. Schwarz, A.F.; Huertas-Delgado, F.J.; Cardon, G.; Desmet, A. Design Features Associated with User Engagement in Digital Games for Healthy Lifestyle Promotion in Youth: A Systematic Review of Qualitative and Quantitative Studies. *Games Health J.* **2020**, *9*, 150–163. [CrossRef] [PubMed]
16. Lu, A.S.; Baranowski, T.; Thompson, D.; Buday, R. Story Immersion of Videogames for Youth Health Promotion: A Review of Literature. *Games Health J.* **2012**, *1*, 199–204. [CrossRef] [PubMed]
17. Pan, L.; Park, S.; Slayton, R.; Goodman, A.B.; Blanck, H.M. Trends in Severe Obesity Among Children Aged 2 to 4 Years Enrolled in Special Supplemental Nutrition Program for Women, Infants, and Children From 2000 to 2014. *JAMA Pediatr.* **2018**, *172*, 232–238. [CrossRef]
18. Sonneville, K.R.; La Pelle, N.; Taveras, E.M.; Gillman, M.W.; Prosser, L.A. Economic and other barriers to adopting recommendations to prevent childhood obesity: Results of a focus group study with parents. *BMC Pediatr.* **2009**, *9*, 81. [CrossRef] [PubMed]
19. Mier, N.; Piziak, V.; Valdez, L. Ultimate Nutrition Game for Mexican American Preschoolers. *J. Nutr. Educ. Behav.* **2005**, *37*, 325–326. [CrossRef]
20. Piziak, V. A Pilot Study of a Pictorial Bilingual Nutrition Education Game to Improve the Consumption of Healthful Foods in a Head Start Population. *Int. J. Environ. Res. Public Health* **2012**, *9*, 1319–1325. [CrossRef] [PubMed]
21. Piziak, V. The Development of a Bilingual Interactive Video to Improve Physical Activity and Healthful Eating in a Head Start Population. *Int. J. Environ. Res. Public Health* **2014**, *11*, 13065–13073. [CrossRef]
22. Piziak, V.; Baylor Scott & White Medical Center, Temple, TX, USA. Unpublished work. 2021.
23. Kim, Y.; Je, Y. Prospective association of sugar-sweetened and artificially sweetened beverage intake with risk of hypertension. *Arch. Cardiovasc. Dis.* **2016**, *109*, 242–253. [CrossRef]
24. McKay, H.; Smith, E. Winning the Battle Against Childhood Physical Inactivity: The Key to Bone Strength? *J. Bone Miner. Res.* **2008**, *23*, 980–985. [CrossRef]
25. Ullah, R.; Rauf, N.; Nabi, G.; Ullah, H.; Shen, Y.; Zhou, Y.-D.; Fu, J. Role of Nutrition in the Pathogenesis and Prevention of Non-alcoholic Fatty Liver Disease: Recent Updates. *Int. J. Biol. Sci.* **2019**, *15*, 265–276. [CrossRef]
26. Saucedo-Araujo, R.G.; Chillón, P.; Pérez-López, I.J.; Barranco-Ruiz, Y. School-Based Interventions for Promoting Physical Activity Using Games and Gamification: A Systematic Review Protocol. *Int. J. Environ. Res. Public Health* **2020**, *17*, 5186. [CrossRef]
27. Stanhope, K.L. Sugar consumption, metabolic disease and obesity: The state of the controversy. *Crit. Rev. Clin. Lab. Sci.* **2016**, *53*, 52–67. [CrossRef] [PubMed]
28. Malik, V.S.; Popkin, B.M.; Bray, G.A.; Després, J.-P.; Willett, W.C.; Hu, F.B. Sugar-Sweetened Beverages and Risk of Metabolic Syndrome and Type 2 Diabetes: A meta-analysis. *Diabetes Care* **2010**, *33*, 2477–2483. [CrossRef]
29. Ramezani, A.; Raj, D.S. The Gut Microbiome, Kidney Disease, and Targeted Interventions. *J. Am. Soc. Nephrol.* **2013**, *25*, 657–670. [CrossRef] [PubMed]
30. Xi, D.; Kohli, R. When the Beverage Is Sweet, How Does the Liver Feel? *Curr. Treat. Options Pediatr.* **2019**, *5*, 458–465. [CrossRef]
31. Markowiak-Kopeć, P.; Śliżewska, K. Effects of Probiotics, Prebiotics, and Synbiotics on Human Health. *Nutritions* **2017**, *9*, 1021. [CrossRef]
32. Chuang, R.-J.; Sharma, S.V.; Perry, C.; Diamond, P. Does the CATCH Early Childhood Program Increase Physical Activity Among Low-Income Preschoolers?—Results From a Pilot Study. *Am. J. Health Promot.* **2017**, *32*, 344–348. [CrossRef] [PubMed]
33. Keita, A.D.; Risica, P.M.; Drenner, K.L.; Adams, I.; Gorham, G.; Gans, K.M. Feasibility and Acceptability of an Early Childhood Obesity Prevention Intervention: Results from the Healthy Homes, Healthy Families Pilot Study. *J. Obes.* **2014**, *2014*, 1–16. [CrossRef]
34. Brown, C.L.; Halvorson, E.E.; Cohen, G.M.; Lazorick, S.; Skelton, J.A. Addressing Childhood Obesity: Opportunities for Prevention. *Pediatr. Clin. N. Am.* **2015**, *62*, 1241–1261. [CrossRef] [PubMed]
35. Nekitsing, C.; Blundell-Birtill, P.; Cockroft, J.E.; Fildes, A.; Hetherington, M.M. Increasing Intake of an Unfamiliar Vegetable in Preschool Children Through Learning Using Storybooks and Sensory Play: A Cluster Randomized Trial. *J. Acad. Nutr. Diet.* **2019**, *119*, 2014–2027. [CrossRef] [PubMed]
36. Joyner, D.; Wengreen, H.J.; Aguilar, S.S.; Spruance, L.A.; Morrill, B.A.; Madden, G.J. The FIT Game III: Reducing the Operating Expenses of a Game-Based Approach to Increasing Healthy Eating in Elementary Schools. *Games Health J.* **2017**, *6*, 111–118. [CrossRef]
37. Tarp, J.; Child, A.; White, T.; Westgate, K.; Bugge, A.; Grøntved, A.; Wedderkopp, N.; Andersen, L.B.; Cardon, G.; Davey, R.; et al. Physical activity intensity, bout-duration, and cardiometabolic risk markers in children and adolescents. *Int. J. Obes.* **2018**, *42*, 1639–1650. [CrossRef] [PubMed]

38. Weaver, C.M.; Gordon, C.M.; Janz, K.F.; Kalkwarf, H.J.; Lappe, J.M.; Lewis, R.; O'Karma, M.; Wallace, T.C.; Zemel, B.S. The National Osteoporosis Foundation's position statement on peak bone mass development and lifestyle factors: A systematic review and implementation recommendations. *Osteoporos Int.* **2016**, *27*, 1281–1386. [CrossRef] [PubMed]
39. Rosi, A.; Scazzina, F.; Ingrosso, L.; Morandi, A.; Del Rio, D.; Sanna, A. The "5 a day" game: A nutritional intervention utilising innovative methodologies with primary school children. *Int. J. Food Sci. Nutr.* **2015**, *66*, 713–717. [CrossRef] [PubMed]
40. Kim, S.H.; Park, M.J. Phthalate exposure and childhood obesity. *Ann. Pediatr. Endocrinol. Metab.* **2014**, *19*, 69–75. [CrossRef] [PubMed]
41. Balk, E.M.; Earley, A.; Raman, G.; Avendano, E.A.; Pittas, A.G.; Remington, P.L. Combined Diet and Physical Activity Promotion Programs to Prevent Type 2 Diabetes Among Persons at Increased Risk: A Systematic Review for the Community Preventive Services Task Force. *Ann. Intern. Med.* **2015**, *163*, 437–451. [CrossRef]