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## ***Efficacy of a Mexican food guide: a quantitative evaluation in school-age children.***

**Original Article**

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### **ABSTRACT.**

**Introduction.** In Mexico, at national and regional levels, efforts have been conducted to design and evaluate different food guides to be used as tools to prevent undernutrition and obesity and to promote a healthy diet. The aim of this study is to determine the effectiveness of a Mexican food guide.

**Material and methods.** The Apple of Health, to appropriately design a 1-day menu among school-age children from different socioeconomic status (SES). There were 953 children (487 boys and 466 girls) ages 10 to 12 years, from 13 elementary schools from low SES, low SES Indian, and high SES private schools who participated in the study. The first day of the test (pre-test), after children were given a poster of the illustrated Apple of Health (post-test 1), and after 30 minutes of instructions (post-test 2), children were asked to complete a 1-day-menu plan. Scores were given to each menu according to a pre-established point system. Pretest, post-test 1 and post-test 2 were analyzed using nonparametric Wilcoxon test.

**Results.** Overall, 16% increase in the score was observed after looking at the illustration and 77% increase after the instruction was completed ( $p < 0.001$ ). The median number of all food groups was two times higher after looking at the illustration and three times higher after the instruction ( $p < 0.001$ ). Improvement in the knowledge of the recommended portions of each group was also observed.

**Discussion.** The significant improvement in knowledge from baseline to post-test in all groups indicates that the food guide, The Apple of Health, is a simple tool that can be effective in improving the nutrition knowledge of Mexican children from low and high SES. (*Rev Biomed 2004; 15:93-100*)

**Key words:** food guide, infantile nutrition, children, nutrition education.

### **RESUMEN.**

**Eficacia de una guía alimentaria mexicana: una evaluación cuantitativa en edad escolar.**

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**Introducción.** En México, a nivel nacional y regional, se han dirigido esfuerzos para evaluar diferentes guías de alimentos, para ser usadas como herramientas para prevenir tanto la desnutrición como la obesidad y promover una dieta sana. El objetivo de este estudio es determinar la efectividad de una guía de alimentos mexicana.

**Material y métodos.** “La Manzana de la Salud” fue designada un día al menú de un grupo de niños en edad escolar de diferentes niveles socioeconómicos (NSE). Fueron 953 niños (487 niños y 466 niñas), con edades entre 10 y 12 años, provenientes de 13 escuelas de educación elemental, de bajo NSE, bajo NSE indígena y escuelas privadas de NSE alto. El primer día de la prueba (pre-test), después de que a los niños se les dio un póster con la ilustración de la Manzana de la Salud (post-test 1) y después de 30 minutos de instrucción (post-test 2), los niños completaron un día del menú. La puntuación fue dada a cada menú de acuerdo con un sistema de puntuación pre-establecido. El pre-test, post-test 1 y post-test 2 fueron analizados usando la prueba no paramétrica de Wilcoxon.

**Resultados.** Un 16% de incremento en la puntuación fue observada después de mirar la ilustración y un 77% después de que la instrucción fue completada ( $p < 0.001$ ). La media de todos los grupos de alimentos fue dos veces mayor después de mirar la ilustración y tres veces mayor después de la instrucción ( $p < 0.001$ ). Una mejora en el conocimiento de las porciones recomendadas de cada grupo de alimentos también fue observada.

**Discusión.** La significativa mejoría en el conocimiento, desde la línea basal hasta el post-test en todos los grupos, indica que la guía de alimentos, “La Manzana de la Salud”, es una herramienta sencilla que puede ser efectiva en mejorar los conocimientos sobre nutrición en niños mexicanos de bajo y alto NSE.

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**Palabras clave:** guía de alimentos, nutrición infantil, educación nutricional.

## INTRODUCTION.

Obesity is an epidemic of unintended consequence of the economic, social, and technological advances that have contributed to unhealthy dietary habits and sedentary behavior during the past several decades (1). The World Health Organization has described obesity as an “escalating epidemic” and the “greatest neglected public health problem of our time with an impact on health which may prove to be as great as smoking (2)”. In Mexico the prevalence of obesity among children 6 to 11 years of age was 28% in 1999 (3), whereas in the most prosperous U.S.-Mexican border city of Tijuana, Mexico, prevalence as high as 48% among children of Indian migrants has been observed (4). Additionally, in Mexico, prevalence of type 2 diabetes has increased from 8.7% in 1994 to 11.8% in 2000, reaching more than 14% in the southern region of the country (5). These are the states where less developed communities are located, with a large Indian population. In those areas there is less availability of health care services and resources to achieve adequate metabolic control.

In Mexico, in addition to having few or no facilities for physical education in the school system, there are “school convenience stores” where foods with little nutritional value are sold. In the state of Baja California, in a consumption study conducted among 6- to 12-year-old children during 1996, it was observed that more than half of the children eat, on a daily basis, high-fat-containing snacks and soft drinks while the consumption of fruits and vegetables was quite low (6).

On the other hand, in Mexico, at national and regional levels, efforts have been conducted to design and evaluate different food guides to be used as tools to prevent undernutrition and chronic diseases (overnutrition, diabetes, hyperlipidemia, hypertension) as well as to promote a healthy diet (7-12). Those guides are based on similar guidelines promoting variety, moderation, and adequate nutrition. The Apple of Health guide includes beans in both grain and meat groups and excludes the fat and sugar components. The Apple of Health guide depicts five groups and includes a statement over the depicted apple stating

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*Quantitative evaluation of The Apple of Health.*

breakfast, dinner and supper (8, 10) followed by a same-color arrow signaling a row which shows the number of servings that should be eaten in each meal (3, 10, 11).

Different approaches have been conducted to evaluate food guides in Mexico and elsewhere (10, 12-15). Schuette et al. (1996) evaluated the usefulness of the food guide pyramid using 1-day food records on 2,849 college students. They used two systems, one recorded the number of foods suggested by the pyramid, and the other system recorded the number of food groups for which at least one serving was included (13). A food group of 5 was given to 11 and 35% of the diet records by systems 1 and 2, respectively. The systems were validated and found to be highly sensitive to be used as a quantitative tool for screening nutritional inadequacy. In the U.S., in addition to the U.S. food pyramid, a regional food guide has also been designed and evaluated (15). The Northeast Regional Food Guide was found useful for daily life decisions (15).

In Mexico, two food guides have been designed by national institutions (7,9) with the purpose of being used at a national level, and one has been developed by a regional institute focusing at the regional level (12). At an early evaluation, the Mexican Food Pyramid and The Apple of Health were compared. Thirty-five women with an average of 15 years of education and 23 women with an average of 7 years of education participated in the quantitative evaluation. Participants were asked to design the full-day menu using the specific randomly assigned food guide (Mexican Food Pyramid or The Apple of Health). A menu planning score for each of the two food guides was developed because each of the guides had distinct food groups and messages. The participants' menus were evaluated and they received one point for each food from a food group included in each meal and an additional point for the correct number of servings from each food group that met the specific food guide's recommendations. Seventy-five percent of the participants obtained a percentage score higher than 67 using The Apple of Health, and higher than 55 using the Mexican Food Pyramid ( $p = 0.006$ ). There were

no statistical differences between the scores considering the two levels of education (12). More recently, several institutions located in Mexico City designed a new food guide called The Good Eating Dish guide (9). The rationale of this was that after evaluating three shapes (pyramid, rainbow and a circle), participants from Mexico City chose the circle. The Mexican Food Pyramid and the Good Eating Dish use a three-food group system. The rationale for the three-food group system was that after assessing the menus using a three-group system or a five-group system, there was no statistical difference in the menus designed by the 30 participants. Although no statistical difference was found at the 25<sup>th</sup>, 50<sup>th</sup> and 75<sup>th</sup> serving consumption, a higher inclusion of servings from animal products using the three-food group system was shown. At the median consumption for all food groups and for animal products, participants designed a menu with 20% higher servings with the three- food group system (9), suggesting that with the use of a three-food group system a higher consumption of energy will be expected. This would be inadvisable and with potential dangers for a society with a high prevalence of obesity and type 2 diabetes.

A quasi-experimental study to compare the ability to design adequate menus of Mexican children from high SES in the most prosperous city of the U.S.-Mexico border (Tijuana, Baja California) was conducted with The Apple of Health or the Good Eating Dish. Two fifth-grade groups at a private elementary school participated in the study. One group was given The Apple of Health and the other was given the Good Eating Dish illustrations. Children were asked to design the full-day menu using one specific food guide. Three weeks after the first evaluation, children were instructed for 30 minutes on the ideal menu based on each of the illustrations. After the instructional period, they were asked to design a full-day menu using the specific guide and verbal instructions. A menu planning score for each of the two food guides was developed because each of the guides had distinct food groups and messages. The participant's menus were evaluated, and they received one point for each food from a food group included in

each meal and an additional point for the correct number of servings from each food group that met the specific food guide's recommendations. The children from both groups showed significant improvement in the diet scores after the instruction period. The group from the Good Eating Dish improved 17%. The group from The Apple of Health guide improved 24%. While there was no statistical difference between groups in the pre-test period, a statistical difference was shown in the post-test period between each group. After instructions, the average score in the Good Eating Dish was 8.5, and after The Apple of Health the score was 9.3 ( $p < 0.005$ ) (12). However, the effect of any Mexican food guide on the ability to design adequate menus in children from different SES has not been evaluated. The aim of this study is to determine the effectiveness of a Mexican food guide, The Apple of Health, to appropriately design a 1-day menu among school-age children from different SES status.

## **SUBJECTS AND METHODS.**

### **Setting.**

Baja California (known as Baja) is the northwestern-most Mexican state that borders the U.S. state of California. According to the 2000 census (16), Baja has approximately 2,480,000 residents and a strong economic relationship with the U.S. Thirty-four percent of the population are under 14 years of age. Tijuana is the largest county in Baja California accounting for 50% of the Baja population (16). Tijuana is the name of both the county and the largest city in that county.

### **Consent procedures.**

Approval was obtained from the superintendent of the school system, the principal, the teachers, the parent's association and the graduate program of the nutrition review board.

### **Subjects.**

During 2000-2001, the number of students enrolled in primary education in Tijuana was 153,221 (16). Seven public schools from low SES, eligible for school meals (279 children), six public schools from the Indian System (602 children), also from low SES, and one private school (72 children), from high SES,

agreed to participate, thus making the total number of the population 953 children (487 boys and 466 girls) ages 10 to 12 years.

### **Data collection.**

All students from the fifth grade were required to enroll. The first day of the test, students were asked to complete a healthy 1-day-menu plan (pre-test). After a week, students were given a poster of the illustrated Apple of Health and were asked to design a 1-day menu plan based on the illustration (post-test 1). One week later, for a period of 30-40 minutes, children were instructed about the messages of The Apple of Health (post-test 2), servings per day, and food equivalents, having been given a poster and a pamphlet with food equivalents. After the instructional period, children were asked to design a 1-day menu based on the knowledge acquired from The Apple of Health.

### **Evaluation.**

The evaluation focused on the foods included in each group and the number of servings of those foods that should be attempted daily. The participant's menu was evaluated and they received two points for the correct number of servings from each of the five-food groups depicted in The Apple of Health illustration and pamphlet.

### **Statistical analysis.**

Food servings were calculated according to size equivalents from each designed menu. The adequate sum of food servings from each food group in each test was analyzed using nonparametric Wilcoxon test. Score differences between types of schools were calculated with Kruskal-Wallis test. Pre-test, post-test 1 and post-test 2 differences of number of food servings from each food group was calculated using Wilcoxon test.

## **RESULTS.**

The differences between the pre-test, post-test 1, and post-test 2 scores are shown in Table 1. An overall 16% score increase is shown after looking at the illustration and a 77% score increase after 30-40 minutes of instruction. The median percentile was two times higher after looking at the illustration and three

*Quantitative evaluation of The Apple of Health.*

**Table 1**  
**Pre-test and post-test differences in all children.**

Evaluation	N	Mean $\pm$ SD	Percentiles			P*
			25 <sup>th</sup>	50 <sup>th</sup>	75 <sup>th</sup>	
Pre-test	917	3.0 $\pm$ 2.2	2	2	4	
Post-test 1	917	3.5 $\pm$ 2.3	2	4	4	0.02
Post-test 2	917	5.3 $\pm$ 3.1	4	6	8	0.0001

\*Wilcoxon test.

times higher after instruction. However, the median post-evaluation shows that only three food groups were correctly made. Girls had a better score in the pre-test; however, after the instruction, boys increased 72% while girls increased only 63% (table 2). Table 3 shows score differences among subsystem schools and SES; the low SES public school children had the lowest score at pre-test, while the high SES private school had the highest score. Table 4 shows differences in each food group while designing a healthy diet, after looking at The Apple of Health and after receiving instruction. After looking at the illustration, 50% of the children correctly made the grain, fruit and meat group's recommendations, and after the instruction 50% of the children met all the food group

recommendations. The mean presentation of the grain, fruit and vegetables groups increased and the meat group decreased after looking at the illustration. At the Indian schools, in the post-test 2, an increase is shown in grains, fruit and vegetable groups and a decrease in the meat group. At the public schools there was an increase in grain, vegetable and milk groups and a decrease in the meat group. At the private schools there was an increase in grains and vegetables and a decrease in fruit and meat groups (table 5).

### DISCUSSION.

This study is the first in Mexico demonstrating the effect of a Mexican food guide to persuade children in designing a menu that meets the food guide recommendation. An overall 16% score increase is shown after looking at the illustration and a 77% score increase after 30-40 minutes of instruction. In addition, after looking at The Apple of Health, 50% of the children correctly made the grain, fruit and meat group's recommendations. After the instruction 50% of the children made all the food group recommendations. Additionally, an increase was shown in children from different SES and ethnic backgrounds, from all schools, in making the recommendations both after

**Table 2**  
**Gender differences in pre-test and post-test evaluation.**

Evaluation	Boys (mean)	Girls (mean)	P*
Pre-test	2.9	3.2	0.02
Post-test 1	3.2	3.4	0.2
Post-test 2	5.0	5.2	0.03

\*Mann-Whitney test.

**Table 3**  
**Pre-test and post-test differences between school subsystem and SES.**

Evaluation	Low SES Indian		Low SES-Public		High-SES Private		P*
	Mean $\pm$ SD	Median	Mean $\pm$ SD	Median	Mean $\pm$ SD	Median	
Pre-test	3.1 $\pm$ 2.0	2	2.7 $\pm$ 2.0	2	3.8 $\pm$ 1.2	4	0.002
Post-test 1	3.5 $\pm$ 2.0	4	3.2 $\pm$ 2.3	4	5.0 $\pm$ 1.0	4	0.0001
Post-test 2	5.8 $\pm$ 3.1	6	3.8 $\pm$ 2.7	4	7.7 $\pm$ 1.8	8	0.0001

\*Kruskal-Wallis test.

**Table 4**  
Pre-test and post-test differences in food group evaluation.

Food group evaluation	Mean	Percentiles			P*
		25 <sup>th</sup>	50 <sup>th</sup>	75 <sup>th</sup>	
<b>Grains</b>					
Pre-test	7.5	2.5	5	10	
Post-test 1	7.6	3	6	11	0.018
Post-test 2	9.9	6	9	12	0.0001
<b>Fruits</b>					
Pre-test	2.7	1	2	4	
Post-test 1	3.1	1	3	4	0.0001
Post-test 2	2.9	2	3	3	0.063
<b>Vegetables</b>					
Pre-test	2.0	0.3	2	3	
Post-test 1	2.5	0	2	4	0.0001
Post-test 2	2.4	1	3	3	0.6
<b>Milk &amp; milk products</b>					
Pre-test	2.9	1.3	2	4	
Post-test 1	2.7	1.5	2	3.6	0.05
Post-test 2	2.9	2	3	3	0.001
<b>Meat &amp; meat substitutes</b>					
Pre-test	3.1	1	2	4	
Post-test 1	2.8	1	2	4	0.12
Post-test 2	2.1	1	2	2.5	0.0001

\*Wilcoxon test.

showing them The Apple of Health and after 30 minutes of instruction. Although the changes obtained after the instruction did not meet the recommendations for all the children, these results suggest that with longer periods of teaching and/or repeating the instructions for several days, children might obtain better score results.

Teaching consumers to make wise food choices in the context of the total diet is not a simple process. The American Dietetic Association suggests that a continuum of nutrition information, communication, and promotion strategies must be integrated in order to design the most appropriate educational intervention (17). Some research indicates that children and adolescents are not eating a healthy, balanced diet (18-20). Therefore, educators are being challenged on how to integrate effective nutrition and physical education. Implementation of an integrated approach to promote increased physical activity and improve dietary intake among children and adolescents may encourage lifelong, healthy habits (19). Some authors suggest that one challenge is to find ways to effectively use the Food

**Table 5**  
Pre-test and post-test scores according to food groups and schools

Food group evaluation	School subsystem			P*
	Indian (low SES)	Public (low SES)	Private (high SES)	
<b>Grains</b>				
Pre-test	8.2	6.6	5.8	0.9
Post-test 1	8.0	7.0	5.5	0.3
Post-test 2	11.0	7.8	6.0	0.0001
<b>Fruits</b>				
Pre-test	2.6	2.4	4.3	0.003
Post-test 1	3.3	2.5	3.7	0.0001
Post-test 2	3.2	2.0	3.5	0.0001
<b>Vegetables</b>				
Pre-test	2.2	1.4	2.2	0.0001
Post-test 1	2.8	1.6	2.3	0.0001
Post-test 2	2.7	1.6	3.2	0.0001
<b>Milk and milk derivatives</b>				
Pre-test	3.0	2.6	2.7	0.5
Post-test 1	2.6	2.8	3.9	0.001
Post-test 2	2.9	2.7	2.7	0.001
<b>Meat and meat substitutes</b>				
Pre-test	3.4	2.5	3.6	0.004
Post-test 1	2.8	2.7	2.6	0.25
Post-test 2	2.2	1.9	2.1	0.009

\*Kruskal-Wallis test.

### *Quantitative evaluation of The Apple of Health.*

Guide Pyramid to teach clients how to put the Dietary Guidelines into action; another challenge involves designing materials that adapt the messages of the food guide pyramid to a variety of audiences (21). In addition, Epstein et al. (1998) analyzed predominantly randomized, control studies for the prevention and treatment of childhood obesity and concluded that there are several different approaches to improving food choices and to reducing caloric intake in obese children (22).

However, very few studies have been addressed to promote a food guide illustration that is culturally appropriate. This is especially important in those countries where a diverse population is widespread, such as the U.S. and Mexico. In these countries, several illustrations have been developed and evaluated (7-9,15,21,23-28). These evaluations have shown that illustrations designed and applied at the national level might not be as effective on changes of food concepts expected than an illustration developed and validated at the regional level (10,12,15). Tavelli et al. (1998) suggested that at least two major skills are necessary for correct use of the Food Guide Pyramid. First, one must be able to convert the amount of food consumed into Food Guide Pyramid serving sizes. Second, one must be able to categorize a food correctly in terms of pyramid food groups (29). In this study, children had a poster and a handout with the size of portions before they designed the menu at post-test 2, and the results showed a significant improvement. However, we did not test to what extent these changes might result in changes in food habits.

From the perspective of the food industry the use of different food guides within one country might be more expensive if the industry wants to use it as a tool in their packages and boxes; however, the aims of public health policies and those of the private industries will not always be similar. This would not mean that using culturally appropriate food guides to promote a healthy diet and reduce obesity would avoid efforts for collaboration among the food industries. The significant improvement in knowledge from baseline to post-test in all groups indicates that the food guide The Apple of Health is a simple tool that

can be effective in improving the nutrition knowledge in Mexican children from low and high SES. Additionally, increased instruction time may improve the children's ability to apply the concepts presented in The Apple of Health.

The limitation of this study is that schools and participants were not selected from a random sample. They were residents of one city of a mainly migrant population and that the ability for designing a 1-day menu might depend on the general knowledge of the participants.

However, these results have the potential to be useful for several purposes, but further research should be done to include children from schools from other areas, with a longer instruction period, assessment of changes in food habits and the development and evaluation of new, culturally appropriate food guides. This may apply to different age groups as well as groups with different levels of education, SES, and ethnicity. Future research could explore its effectiveness in usability. Therefore, the use of validated regional food guides such as The Apple of Health and the design and evaluation of new food guides that are culturally sensitive are highly recommended. The Apple of Health might be an effective food guide for the promotion of a healthy diet and for the prevention of childhood obesity in the Mexican population.

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*M Bacardí-Gascon, A Jiménez-Cruz, C Sánchez-Aguirre, E Jiménez-Moran, E Santillana-Marin y col.*

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