NUTRITION

Dietary analysis of meals served in the breakfast and lunch programs of Puerto Rican schools

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ABSTRACT. ***Background.*** **Nutritional analysis of meals in the Federally-sponsored Breakfast and Lunch Programs in Stateside Schools has recently been completed. However due to ethnic and cultural differences, the findings may not be directly applicable to similar nutrition programs in Puerto Rico. It is our aim to carry out an analysis of meals served in Federal programs in Puerto Rico and to compare results to the stateside study.**

Methods. **Twenty eight different breakfast meals and 96 different lunch meals being cycled in elementary, middle and secondary schools throughout the entire island of Puerto Rico were analyzed for content using the Minnesota Nutrition Data System 32 and compared with: 1) compliance to meal pattern requirements of federal programs, 2) dietary guidelines for Americans (DG) and 3) recommended dietary allowances (RDA's).**

Results. **Breakfasts and lunches served in Puerto Rican Schools satisfy federal meal pattern requirements however most frequently offered foods different from programs in the mainland, reflecting ethnic and cultural food preferences. In terms of DG's adequate protein was present, cholesterol content was satisfactory but meals had excess percent energy from fat as well as excess energy from saturated fat, high sodium and a lower than recommended level of energy from carbohydrate. In terms of RDA's meals had prescribed levels of vitamin A, vitamin B_{12}, vitamin C, calcium, folacin, magnesium, phosphorus and potassium. Below prescribed levels included vitamin B_6, copper, vitamin E, energy, fiber, iron, niacin and zinc.**

Conclusions. **While differences in food preferences exist between foods available in the Breakfast and Lunch Programs in Puerto Rican and U.S., schools, they have similar strengths and weaknesses when compared to compliance with U.S. Dietary Guidelines and with recommended dietary allowances.**

The School Lunch Program (SLP) was created in 1946 to protect all children against dietary deficiency diseases by establishing meal patterns to satisfy recommended dietary allowances (RDA's) (1,2). The scope of this program was expanded in 1966 to include the School Breakfast Program (SBP) (1). More recently, emphasis has been given to ensure that the school meals implement the Dietary Guidelines for Americans which minimize risks of chronic, degenerative and dietary deficient diseases in light of newer knowledge of nutrition and health (3). Meal pattern requirements of the Programs are listed as follows (4):

- Breakfast. Provide 1/4 daily RDA for specific nutrients including total energy, protein, vitamin A, vitamin C, thiamin, riboflavin, niacin, vitamin B_6, folate, vitamin B_{12}, calcium, iron, phosphorus, magnesium, zinc. Include a serving (8 oz) of fluid milk and a serving (1/2 cup) of fruit or vegetables or meat (1 oz).
- Lunch. Provide 1/3 daily RDA for specific nutrients. (See breakfast item 1). Include 1 serving of meat (2 oz). Include 2 3/4 cup servings of fruit or vegetables and1 serving (8 oz) of fluid milk. Also include grain or enriched bread or alternate.

As a Commonwealth of the United States, Puerto Rico participates in federally-aided nutrition programs, including the SBP and SLP. In order to qualify for free breakfast or lunches, family income must be 130% of the

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Table 1. How Meals in the Breakfast and Lunch Programs of Puerto Rico Compare with Dietary Guidelines for Americans

		Mean Levels in Meals Served				% of Meals In Compliance with Guidelines			
		Breakfast	Lunch			Breakfats	Lunch		
	Recommended		Elementary	Intermediate	High School		Elementary	Intermediate	High School
Percent energy derived from fat	30	39.5	42.1	41.8	41.0	8.5	0	1.0	8.1
Percent energy derived from saturated fat	10	16.7	15.6	15.4	14.4	0	0	0	2.1
Cholesterol consumption/day(mg)	300	83.9	84.9	89.2	89.3	67.9	85.0	83.3	81.3
Percent energy from carbohydrate	55	48.5	42.4	42.6	43.8	25.0	4.2	5.2	6.3
Protein intake (see RDA section)	<2xRDA	---	---	---	---	---	---	---	---
Sodium consumption/day(mg)	2400	83.6	1509	1579	1702	32.1	6.3	5.2	4.2

Table 2. How Meals Compare with RDA'S Values

Nutrient	RDA's*						Nutrients in Meals		
	Children 4-6 yr	Children 7-10 yr	Males 11-14 yr	Females 11-14 yr	Males 15-18 yr	Females 15-18 yr	Breakfast	Lunch elementary, Intermediate, High School	Total Breakfast + Lunch Elementary, Intermediate, High School
Vit A (μg RE)	290	406	580	464	586	464	157	400, 404, 431	557, 558, 589
Vit B_6 (mg)	0.6	0.8	1.0	0.8	1.2	0.9	0.4	0.5, 0.6, 0.6	0.9, 1.0, 1.0
Vit B_{12} (μg)	0.6	0.7	1.2	1.2	1.2	1.2	1.3	1.7, 1.8, 1.8	3.0, 3.1, 3.1
Vit C (mg)	26	26	29	26	35	32	21	31, 29, 31	52, 50, 52
Cacium (mg)	464	464	696	696	696	696	414	357, 368, 365	771, 782, 779
Copper (mg)(Range)	0.6-0.9	0.6-1.2	0.9-1.5	0.9-1.5	0.9-1.5	0.9-1.5	0.2	0.4, 0.4, 0.4	0.6, 0.6, 0.6
Vit E a-tocopherol (mg)d a form	4.1	4.1	5.8	4.6	5.8	4.6	1.3	2.7, 2.9, 3.2	4.0, 4.2, 4.5
Energy (Kcal)	986	1392	1566	1276	1624	1218	486	608, 628, 672	1094, 1114, 1158
Fiber (g) based on 10g/Kcal E	9.9	13.9	15.7	12.8	16.2	12.2	2.3	4.7, 5.1, 5.4	7.0, 7.4, 7.7
Folacin (μg)	44	58	87	87	116	104	67	71, 75, 81	138, 142, 148
Iron (mg)	5.8	5.8	7.0	8,7	8.7	8.7	2.1	3.7, 3.5, 3.9	5.8, 5.6, 6.0
Magnesium (mg)	70	99	157	162	232	174	76	89, 93, 98	165, 169, 174
Niacin (mg)	7.0	7.5	9.9	8.7	11.6	8.7	2.9	5.3, 5.7, 6.1	8.2, 8.6, 9.0
Phosphorus (mg)	464	464	696	696	696	696	380	434, 446, 464	8.4, 826, 844
Potassium(mg) (Minimun Requirement)	812	928	1160	1160	1160	1160	729	1034, 1073, 1120	1763, 1802, 1849
Protein (g)	13.9	16.2	26.1	26.7	34.2	25.5	16	25, 26, 27	41, 42, 43
Riboflavin (mg)	0.6	0.7	0.9	0.7	1.0	0.7	0.7	0.6, 0.6, 0.7	1.3, 1.3, 1.4
Thiamin (mg)	0.5	0.6	0.7	0.6	0.9	0.6	0.4	0.5, 0.5, 0.5	0.9, 0.9, 0.9
Zinc (mg)	5.8	5.8	8.7	8.7	8.7	8.7	2.1	3.3, 3.4, 3.6	5.1, 5.5, 5.7

* RDA adjusted to 58% of total nutrient intake (dinner and snacks provide remaining nutrients).

poverty guidelines; which has been set at $13,000 for a family of four; consequently virtually all children in Puerto Rico which has an average household income of $14,800 (5) are eligible to receive free or reduced priced meals.

Monitoring of these federally assisted school nutrition programs has provided a source of valuable information on the eating and dietary intake patterns of broad populations of children. The first National Evaluation of the School Nutrition Programs was conducted in 1980-81 (1). Since then, there have been significant changes in menus offered, revisions in nutritional standards and advances in understanding of the relation between diet and health. Consequently, in 1993 the USDA conducted a School Dietary Assessment (SDA) at schools throughout the United States (6). This study reported nutrient content of meals as offered on the basis of information provided by school food service personnel from a nationally representative sample of 544 schools, however sampling was restricted to the 48 contiguous states.

Since federal meal programs are available on a free or reduced cost to an even higher percentage of Puerto Rican children than their mainland counterparts and given that cultural and ethnic food preferences exist (7) it was decided to use the SDA study as a model for determining the nutrient composition of meals currently being served in Puerto Rican schools and to compare the two programs in terms of compliance to Dietary Guidelines and to RDA's.

Methods

Dietary analysis of the menus served in the Breakfast and Lunch Programs was carried out by entering foods in the Minnesota Nutrition Data System (NDS 32) version 2.8, which consists of a software program, a food data base (16,000 foods) and a nutrient data base (32 nutrients). In addition to nutrients presented in the SDA report we have also included copper, potassium and vitamin E. Menus were provided by the Puerto Rico Department of Public Instruction, Nutrition Program. Currently, 28 different breakfast menus and 96 different lunch menus are being served, with the same menu cycle being used for the entire island of Puerto Rican elementary, intermediate and high school levels. Because each meal is served at the same frequency, nutritional content reported here is an average of either all 28 breakfast menus or 96 lunch menus. This method of analysis differs from that performed by the SDA which calculated the average nutritional content of foods served in 1 wk of meals of a nationally representative sample of U.S. schools (8).

Recommended portion sizes for some items in the lunch menus are proportional to the type of school attended i.e. Elementary (grades K-4: ages 4-10 yrs, Rice 1.5 oz); Intermediate (grades 5-8: ages 11-14 yrs, Rice 2.0 oz); High School (grades 9-12: ages 15-18 yrs, Rice 2.5 oz).

All menus were evaluated in terms of compliance with the Dietary Guidelines for Americans (DG's) and for levels of recommended dietary allowances (RDA's).

Results

In terms of federal meal pattern requirements menus were in compliance with recommended amounts (data not shown).

Dietary Guidelines. Results show that for DG's, percent energy and percent energy from fat and from saturated fat exceed the suggested levels of 30% and 10%, respectively for breakfast and lunch in more than 90% of schools (See Table 1, p. 382). Likewise sodium levels are exceeded especially in luncheon menus. Percent of dietary carbohydrate is below the recommended level of 55% of total energy in 75% of breakfast menus and over 90% of lunch menus. On the other hand, cholesterol levels in the menus comply with the 300 mg limit (Table 1). Comparable lunch programs in the mainland have only 1% with less than 30% of food energy from fat, 2% with greater than 55% of energy from carbohydrate and 0.01%

Table 3a. Compliance with RDA's - Breakfast

Nutrient	% Meals Meeting RDA's				
	Elementary	Intermediate		High School	
	Children 7-10	Males	Females	Males	Females
Vit A (μg) RE)	21.9	17.9	17,9	17.9	17.9
Vit B_6 (mg)	35.7	14.3	35.7	14.3	17.9
Vit B_{12} (μg)	100	100	100	100	100
Vit C (mg)	100	100	100	100	100
Calcium (mg)	100	100	100	100	100
Copper (mg)	28.6	0	0	0	0
Vit E (mg)	17.9	0	7.1	0	7.1
Energy (kcal)	3.6	3.6	10.7	3.6	14.3
Fiber (g)	3.6	0	3.6	0	3.6
Folacin (μg)	100	100	100	75	92.9
Iron (mg)	17.9	14.3	3.6	14.3	3.6
Magnesium (mg)	100	75	75	10.7	50
Niacin (mg)	17.9	17.9	17.9	14.3	17.9
Phosphorus (mg)	100	96.4	96.4	96.4	96.4
Potassium (mg)	96.4	28.6	28.6	28.6	28.6
Protein (g)	100	100	100	71.4	100
Riboflavin (mg)	100	100	100	100	100
Thiamin (mg)	100	96.4	96.4	32.1	96.4
Zinc (mg)	10.7	0	0	0	0

and 0% meeting the guidelines for saturated fat and sodium (8).

For breakfast programs compliance rates are 45% for fat calories, 4% for saturated fat, 68% for carbohydrate calories, and 32% for sodium (8). Both the programs here as well as the mainland programs meet recommended levels for cholesterol (8).

RDA's. For comparison to RDA's, mean values are listed in Table 2 (See p.382). Compliance of nutrients to RDA's is given in Tables 3A (breakfast) and 3B (lunch) and results are summarized in Table 4.

Reference RDA values have been adjusted to correspond with norms established by the SBP and SLP's namely that 25% of daily nutrients are supplied at breakfast and 33% are supplied at lunch (or a total of 58% of daily nutrients). Dinner and snacks provide the remaining nutrients. Those nutrients found in adequate amounts are: vitamin B_{12}, vitamin C, folacin, magnesium, phosphorus, protein, riboflavin, and thiamin. Those nutrients found in inadequate amounts are vitamin B_6, copper, energy, fiber, iron, niacin, and zinc. Nutrients in marginal amounts are vitamin A, calcium, vitamin E, and potassium. The SDA study reported fewer nutrients below recommended levels (energy, magnesium, and zinc for breakfast and lunch programs) (8). In a separate study in Ohio schools, breakfast meals had low calories and iron (9). Tables 5a and 5b give the foods offered in the SBP and SLP's along with frequency in which they are served. Foods are arranged according to major food categories.

Food content differed significantly from menus present in the SDA reflecting cultural differences and availability of food stuffs. For example ready to eat cereals were the choice of mainland schools whereas soda crackers were the most available food from the bread and cereals group (8). Likewise hamburgers and pizza are the most frequently offered entree's in U.S. schools and meat stews are served with the greatest frequency in Puerto Rican Schools (8).

Table 3b. Compliance with RDA's - Lunch

Nutrient	% Meals Meeting RDA's				
	Elementary	Intermediate		High School	
	Children 7-10	Males	Females	Males	Females
Vit A (µg RE)	47.9	42.7	45.8	44.8	47.9
Vit B_6 (mg)	52.1	37.5	59.4	29.2	61.5
Vit B_{12} (µg)	100	100	100	100	100
Vit C (mg)	81.3	80.2	85.4	71.9	77.1
Calcium (mg)	100	16.7	16.7	17.7	17.7
Copper (mg)	56.2	15.6	15.6	21.9	21.9
Vit E (mg)	51.0	28..1	40.6	35.4	49.0
Energy (kcal)	9.2	6.3	16.7	7.3	36.5
Fiber (g)	6.25	5.2	13.5	9.4	18.8
Folacin (µg)	100	89.6	89.6	69.8	80.2
Iron (mg)	43.8	27.1	7.3	45.8	12.5
Magnesium (mg)	100	50.0	38.5	9.4	40.6
Niacin (mg)	70.8	41.7	58.3	29.2	67.7
Phosphorus (mg)	100	79.2	79.2	86.5	86.5
Potassium (mg)	100	42.7	42.7	44.8	44.8
Protein (g)	100	97.9	97.9	91.7	97.9
Riboflavin (mg)	100	100	100	74.0	100
Thiamin (mg)	80.2	63.5	76.0	43.8	96.9
Zinc (mg)	44.8	9,4	24.0	12.5	29.2

Table 4. Summary: RDA Adequacy of Nutrients in Meals

Nutrient	Breakfast				Lunch					
	Adequate		Inadequate		Adequate		Marginal		Inadequate	
	M*	F**	M	F	M	F	M	F	M	F
Vitamin A			x	x			x	x		
Vitamin B_6			x	x		x			x	
Vitamin B_{12}	x	x			x	x				
Vit C	x	x			x	x				
Calcium	x	x							x	x
Copper			x	x					x	x
Vit E			x	x			x	x		
Energy			x	x					x	x
Fiber			x	x					x	x
Folacin	x	x			x	x				
Iron			x	x			x			x
Magnesium	x	x					x	x		
Niacin			x	x		x		x		
Phosphorus	x	x			x	x				
Potassium			x	x			x	x		
Protein	x	x			x	x				
Riboflavin	x	x			x	x				
Thiamin	x	x			x	x				
Zinc			x	x					x	x

* Males
**Females

Discussion

Nutrient analysis of meals served in the SBP and SLP in Puerto Rico compare closely to nutrient data in the USDA-sponsored SDA study. Breakfasts provided one

Table 5a. Food Content of Breakfast Program*

	Percent of Meals in which food was Available
Breads and Cereals	
Soda crackers	32.1
White sandwich bread	25.0
Oatmeal (hot)	21.4
Corn flakes	14.3
Cream of rice	14.3
Sweet rolls	14.3
Corn meal	10.7
Fruits	
Pineapple juice	64.3
Guava/pineapple nectar	25.0
Fresh banana	7.1
Guava nectar	3.6
Meats - Proteins	
Vienna sausage	25.0
Luncheon meat	21.5
Dehydrated egg subst	17.9
Fresh egg	14.3
Peanut butter	3.6
Dairy	
Whole white milk	100.0
American cheese	3.6
Condiments	
Salt	53.6
Cinnamon	50.0
Sugar	46.4
Vanilla extract	46.4
Oils/Fats	
Vegetable oil	50.0
Margarine	46.4

* Menus

Table 5b. Foot Content of Lunch Program*

Percent of meals in which food was available		Percent of meals in which food was available	
Breads and cereals		**Meats-Proteins**	
Rice	76.0	**Beans**	62.5
Soda crackers	10.4	Pink	19.8
Pasta	10.4	Red kidney	14.6
Sweet bread rolls	7.3	Chick peas	14.6
White bread	5.2	White	7.3
		Pinto	6.2
Fruits			
Pineapple	29.2	**Meat stew**	46.9
Fruit cocktail	14.6	Beef	12.5
Papaya slices	12.5	Chicken	7.3
Pears	10.4	Corned beef	5.2
Peaches	9.4	Ham	4.2
Grapefruit	5.2	Hot dog	4.2
Prune (Rehydr.)	5.2	Pork	4.2
Prune (Fresh)	3.1	Turkey	4.2
Applesauce	1.0	Tune	3.2
Guava mango sauce	1.0	Codfish	2.1
Pineapple juice	1.0	Ham	13.5
		Meat loaf	10.4
Vegetables		Vienna sausage	5.2
Onion	30.2	Hog dog	4.2
Potato	27.1	Corned beef	3.1
Boilet	2.1	Beef ravioli	3.1
Dehydrated	5.2	Beef patties	1.0
Fries	19.8		
Carrots	25.0	**Dairy**	
Corn	25.0	Whole white milk	100.0
Green beans	21.9	Cheese	2.1
Cabbage	20.8		
Green pepper	19.8	**Condiments**	
Plantain	16.7	Vinagar	68.5
Lettuce	8.3	Garlic	4.2
Yautia	7.3	Sugar	4.2
Peas	4.2	Vanilla	4.2
		Oils/Fats	
		Vegetable	97.9
		Margarine	10.4

* Menus

fourth and lunches provided one third of RDA's for most nutrients in specified age groups. Meals, satisfy DG's for cholesterol but provide more fat calories, saturated-fat calories and sodium as well as less calories, saturated-fat calories and sodium as well as less calories from carbohydrates than recommended. The most commonly served foods differ from those served in meals on the mainland reflecting cultural and ethnic preferences as well as availability of food stuffs.

Since a greater percentage of Puerto Rican children participate in federal meals programs than over the mainland, it would be especially beneficial to develop programs to make meals even healthier by meeting national dietary recommendations. These types of programs are being developed, for example the Child and Adolescent Trail for Cardiovascular Health (CATCH) has been successful in reducing the percentage of fat from total calories and increase essential nutrients in both school breakfasts (10) and lunches (11).

It should also be noted that the study in Puerto Rico does not report actual dietary intake of children participating in the SBP and SLP's. Herein contained are simply the contents of the menus offered which ideally represent a projected intake of 58% of total daily intake. Conclusions given here should not be interpreted to mean that children in Puerto Rico are ingesting too little or too much of any particular nutrient. These types of conclusions can only be realized after more complete surveys such as 24 recall or food frequency questionnaires are administered.

Resumen

Los Programas de Desayuno y Almuerzo Escolar de Puerto Rico son parte de la red de nutrición auspiciada por el gobierno federal que opera diariamente en las escuelas de la nación. El contenido de 28 menús de desayuno y de 96 menús de almuerzo se determinó en el Sistema de Análisis de Datos Nutricionales de Minnesota y se compararon con las porciones Diarias Recomendadas (RDA's) y con las guías Dietéticas para Americanos (DG). Los resultados indican, de acuerdo a DG que los desayunos y almuerzos que se sirvieron tenían la cantidad de proteínas y colesterol adecuadas pero son excesivas en cuanto a grasas energéticas, porciento de energía derivada de grasas saturadas y sodio, pero son bajas en cuanto al porciento de energía derivada de carbohidratos. De acuerdo a los RDAs los Programas de Desayuno y Almuerzo tienen niveles prescritos de vitaminas A, B_{12} y C, de calcio, folacina, magnesio, fósforo y potasio. Por debajo de estos niveles están las vitaminas B_6 E, cobre, energía, fibra, hierro, niacina y zinc. En conclusión, cuando se comparan los alimentos que se sirven en los Estados Unidos con los que se suministran en Puerto Rico se aprecia que ellos tienen fortalezas y debilidades similares.

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References

1. Radzikowski J, Gale S. Requirements for the national evaluation of school nutrition programs. Am J Clin Nutr 1984; 40:365-367.
2. Food and Nutrition Board. Recommended Dietary Allowances. 10th ed. Washington, DC: National Academy Press; 1989.
3. Nutrition and Your Health: Dietary Guidelines for Americans. 4th ed. Washington, DC: US Depts of Agriculture and Health and Human Services; 1995. Home and Garden Bulletin No 232.
4. Dwyer J. The school nutrition dietary assessment study. Am J Clin Nutr 1995; 61(suppl): 173S-177S.
5. Le Blanc B. Business notebook: price of lacking education. San Juan Star; March 28, 1994 B3.
6. Burgharot JA, Devancy BL. Background of the school nutrition dietary assessment study. Am J Clin Nutr 1995; 61 (suppl): 1785-1819.
7. Fanelli-Kuczmarski M, Woteki CE. Monitoring the nutritional status of the Hispanic population: selected findings for Mexican Americans, Cubans and Puerto Ricans. Nutr Today 1990; 25:6-11.
8. Burghardt JA, Gordon AR, Fraker TM. Meals offered in the national school lunch program and the school breakfast program. Amer J Clin Nutr 61(suppl): 187S-198S.
9. Gordon K, Foulk DJ. The nutrient content of school-provided breakfast meals in Ohio public elementary schools. (Abstract) J Am Diet Assoc 1995; 95 (suppl): A-96.
10. Dwyer JT, Hewes LV, Mitchell PD, Nicklas TA, Montgomery DH, Lytle LA, Snyder MP, Stone EJ, Zive MM, Bachman KJ, Rice R, Parcel GS. Improving school breakfasts: Effect of the CATCH eat smart program on the nutrient content of school breakfasts. Prevent Med 1995; 25:413-422.
11. Osganian SK, Ebzery MK, Montgomery DH, Nicklas TA, Evans MA, Mitchell PD, Lytle LA, Snyder MP, Stone EJ, Zive MM, Bachman KJ, Rice R, Parcel GS. Changes in the nutrient content of school lunches: Results from the CATCH eat smart food service intervention. Prevent Med 1995; 25:400-412.