5-A-DAY: Dietary Behavior and the Fruit and Vegetable Intake of Latino Children

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ABSTRACT

Objectives. The purpose of the study was to examine children's intake of fruits and vegetables in relation to the recent national "5-A-DAY" campaign.

Methods. Four 24-hour dietary recalls per child collected from 205 mothers of 4- to 5-year-old urban Latino children were used to analyze average 5-A-DAY fruit and vegetable consumption and examine associations between 5-A-DAY consumption, nutrient intakes, and eating patterns.

Results. The reported mean servings per day of fruits and vegetables, as defined by 5-A-DAY criteria, were 1.8 and 1.0, respectively, with only 6.8% (n = 14) of the children averaging five or more servings per day. Fruit juice accounted for 36% of 5-A-DAY servings. There were significant linear trends in intake of vitamins A and C, potassium, iron, cholesterol, protein, and fiber across quintiles of 5-A-DAY intake. There were no differences among quintiles in intake of saturated or total fat or in servings from most non–5-A-DAY food groups.

Conclusions. Latino children's intake of fruits and vegetables falls far short of current recommendations. Fruit juice accounted for a disproportionate amount of 5-A-DAY intake in this population. Sensible 5-A-DAY interventions should take into consideration the existing eating patterns of the target population. (*Am J Public Health.* 1994;84: 814–818)

Introduction

Systematic reviews of epidemiologic studies in adults indicate that higher levels of fruit and vegetable intake are associated with reduced risk of cancer at several sites.[1–8] As a result, as one of its cancer and nutrition risk reduction objectives for the year 2000, the US Public Health Service,[1] with wide support from other agencies,[9–13] has called for adults to increase servings of fruits and vegetables from an estimated current average of 2.8 servings per day to five or more servings per day. In accordance with this goal, the National Cancer Institute (NCI), with the cooperation of selected food industry representatives, has sponsored a multifaceted national campaign known as "5-A-DAY."[14] Although the 5-A-DAY recommendation was formulated with adults in mind, the Public Health Service has also recommended that children 2 years of age and older progress toward this dietary pattern.[1]

The weight of existing evidence supports protective health effects for a dietary pattern high in fruit and vegetable intake without identifying the specific vitamins, minerals, or nutrients responsible for these effects.[4,5,15] Causal mechanisms involved in the relationship between fruit and vegetable consumption and reduced cancer risk[4] may involve individual responses to dietary factors and nutrient interactions, which are themselves determined by genetic, physiologic, and life-style factors.[15] Thus, even though basic and epidemiologic research have identified specific vitamins, minerals, micronutrients, and macronutrients as the most likely agents responsible for the association between fruit and vegetable intake and cancer, the 5-A-DAY message is not to increase intake of these nutrients per se but to increase intake of fruits and vegetables. The emphasis on foods as opposed to nutrients[16] exemplified by the 5-A-DAY program reflects a relatively recent focus in public health nutrition.

While there has been some research describing fruit and vegetable consumption patterns and associated nutrient intakes in adults,[17,18] we did not identify any such studies in young children. Current eating behaviors of a target population should guide the formulation of effective, acceptable, and sustainable 5-A-DAY intervention strategies. We therefore analyzed repeated 24-hour dietary recalls in a sample of 205 urban Latino children to describe intake of 5-A-DAY foods, to determine whether high 5-A-DAY food consumption was associated with differential intake of specific nutrients and calories, and to examine whether high 5-A-DAY consumers substituted fruits and vegetables for other foods not in the 5-A-DAY group or added fruits and vegetables to a similar underlying diet.

Methods

Study Sample

Subjects were young healthy Latino children and their mothers (n = 214 mother/child pairs) who participated in a 3-year observational study of children's

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This paper was accepted January 31, 1994.

Editor's Note. See related editorial by Nestle (p 713) in this issue.

TABLE 1—Mean Number of 5-A-DAY Servings per Day Derived from Four 24-Hour Dietary Recalls, by Quintiles of 5-A-DAY Servings

	Lowest Quintile (n = 41)		Second Lowest Quintile (n = 41)		Middle Quintile (n = 41)		Second Highest Quintile (n = 41)		Highest Quintile (n = 41)		Total Sample (n = 205)		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Median
All 5-A-DAY foods	1.3	0.4	2.1	0.2	2.7	0.2	3.3	0.2	4.8	0.9*	2.8	1.3	2.7
All 5-A-DAY fruits	0.9	0.4	1.3	0.5	1.7	0.5	2.1	0.5	3.0	1.0*	1.8	0.9	1.8
Fresh fruits	0.2	0.3	0.4	0.3	0.5	0.4	0.6	0.4	0.9	0.6*	0.5	0.5	0.4
Other fruits	0.1	0.2	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.4	0.3	0.3	0.3
Juices	0.5	0.4	0.7	0.4	0.9	0.4	1.2	0.5	1.7	0.9*	1.0	0.7	0.9
Orange juice	0.4	0.4	0.5	0.4	0.7	0.5	0.9	0.5	1.3	0.8	0.8	0.6	0.7
Apple juice	0.1	0.2	0.1	0.2	0.2	0.3	0.2	0.2	0.4	0.6	0.2	0.4	0.0
All 5-A-DAY vegetables	0.5	0.3	0.8	0.5	0.9	0.5	1.2	0.5	1.8	0.8*	1.0	0.7	1.0
Dark green/yellow vegetables	0.0	0.0	0.1	0.2	0.1	0.2	0.2	0.3	0.2	0.2*	0.1	0.2	0.0
Beans	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.3	0.6	0.4	0.4	0.3	0.3
Other vegetables	0.2	0.3	0.4	0.5	0.5	0.4	0.6	0.4	1.1	0.6*	0.6	0.5	0.4

*$P < .001$ (linear trend).

diet and physical activity. All subjects were living in New York City. None of the children were on special diets. Recruitment was mainly from a large urban pediatric practice and has been described in greater detail elsewhere.[19] Analyses for the present study included all Latino mother/child pairs with four completed 24-hour dietary recalls for the child taken during the first year of the study (n = 205; 103 male children). At the time of the first recall, children's mean age was 4.4 years (SD = 0.34) and mothers' mean age was 31.8 years (SD = 5.2). Spanish was the language spoken at home by 95% (n = 195) of these families. More than 90% of the children for whom we had birthplace data (n = 184) were born in the United States. Seventy-four percent of the mothers were born in the Dominican Republic. Ninety percent of the mothers received Medicaid.

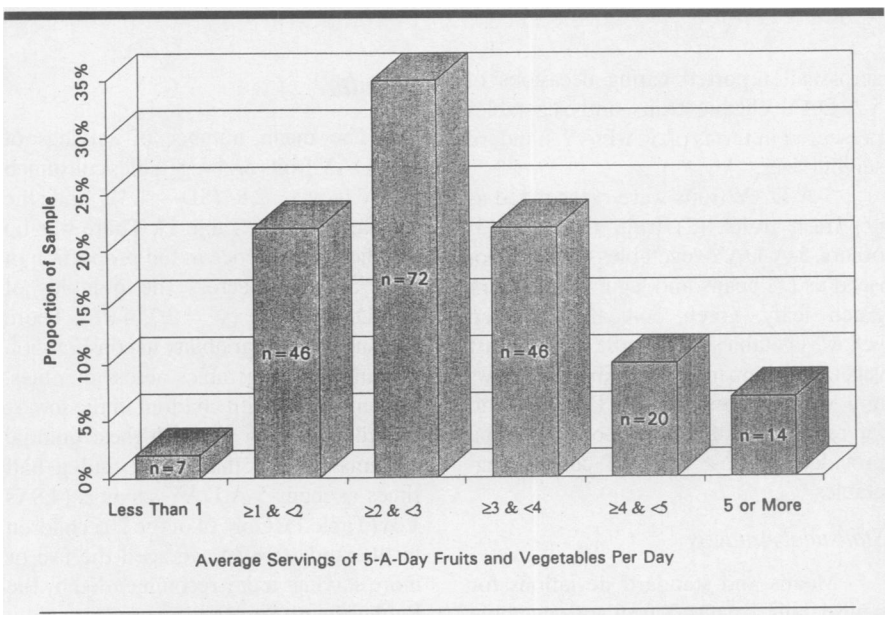

FIGURE 1—Frequency distribution for proportion of children (n = 205) who consumed varying serving levels of 5-A-DAY fruits and vegetables derived from an average of four dietary recalls over 1 year.

Measurements

From 1986 to 1989, trained research staff interviewed mothers (usually in Spanish) at our community-based field site. An existing reliable and validated protocol[20,21] was used to collect up to seven 24-hour dietary recalls over the course of 3 years. Additional descriptions of the data collection procedures and the nutrient analysis program and database have appeared in other published reports, and support for the reliability and validity of mothers' reports of children's diet has been shown.[20,21]

Typical nutrient intakes for each child were derived by averaging results from the four 24-hour recalls collected during the first year of the study. Inclusion/exclusion criteria and serving size guidelines specified by NCI[14] were used to calculate the number of servings of 5-A-DAY fruits and vegetables for each recall. Avocados, coconut, olives, nuts, and seeds were excluded, as were foods that were sweetened or fried. Only 100% nonsweetened fruit juices were included. Lacking complete information in our dietary recalls and nutrient database, we assumed that all apple juice consumed was unsweetened. Mixed vegetable dishes were included if the percentage of calories from fat was less than 30, the percentage of calories from saturated fat was less than 10, and the number of milligrams of sodium per serving was less than 360.[14] 5-A-DAY standard serving sizes are one piece of fresh fruit, one-half cup of cooked fruit and vegetables, six fluid ounces of juice, one cup of leafy vegetables, or one-fourth cup of dried fruit. In this paper, 5-A-DAY fruit and vegetable consumption represents the sum

TABLE 2—Daily Intake of Selected Nutrients and Total Calories Derived from Four 24-Hour Dietary Recalls, by Quintiles of 5-A-DAY Servings

	Lowest Quintile (n = 41)		Second Lowest Quintile (n = 41)		Middle Quintile (n = 41)		Second Highest Quintile (n = 41)		Highest Quintile (n = 41)		Total Sample (n = 205)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Total energy intake, calories	1484	348	1482	297	1536	356	1545	376	1690	403*	1547	362
Protein, g	55.0	18.5	54.7	12.2	56.7	16.9	60.7	13.6	64.9	14.5**	58.4	15.7
Carbohydrates, g	190.3	41.3	197.4	42.1	205.4	44.0	202.6	49.3	224.4	51.8*	204.0	46.9
Dietary fiber, g	8.0	3.6	9.1	3.0	9.8	2.2	12.0	3.6	14.8	4.4**	10.7	4.2
Saturated fat, g	22.5	7.1	22.4	6.0	22.2	6.8	23.6	7.3	24.1	8.2	23.0	7.1
Saturated fat, % of calories	13.7	2.7	13.6	2.2	12.9	2.1	13.6	2.0	12.7	2.0	13.3	2.2
Total fat, g	56.4	19.0	53.6	14.5	55.4	16.6	55.9	17.4	60.8	19.1	56.4	17.4
Total fat, % of calories	33.8	5.0	32.4	4.3	32.1	3.8	31.2	3.3	32.0	3.8	32.5	4.1
Cholesterol, mg	248.1	105.7	295.7	145.6	290.7	121.3	313.2	120.0	362.3	125.8**	302.0	128.6
Cholesterol/1000 kcal	168.6	60.0	200.1	83.1	189.4	69.2	203.4	67.8	216.2	62.4*	195.5	70.1
Vitamin A, IU	3227	3115	3494	2074	3920	1906	5503	3339	5594	2981**	4348	2899
Vitamin C, mg	90.9	36.0	100.8	39.1	115.5	33.4	123.6	29.1	155.7	58.5**	117.3	45.9
Calcium, mg	818.3	290.8	820.0	200.8	815.0	294.7	904.6	215.1	931.8	295.9	857.9	265.1
Potassium, mg	1928	469	2034	294	2201	466	2444	437	2859	563**	2293	560
Iron, mg	8.5	3.0	8.6	2.6	9.6	2.8	10.0	2.7	11.2	4.3**	9.6	3.3

*$P < .01$ (linear trend); **$P < .001$ (linear trend).

across all reported eating occasions of 5-A-DAY eligible fruits and vegetables presented in terms of 5-A-DAY standard serving sizes.

5-A-DAY fruits were categorized as (1) fresh fruits, (2) fruit juices, or (3) others. 5-A-DAY vegetables were categorized as (1) beans and legumes; (2) dark green leafy, green nonleafy, or deep yellow vegetables; or (3) others.[14] This last vegetable group included homemade stews and soups meeting the NCI sodium and fat restrictions if one cup of the recipe provided at least one-half cup of vegetables.*

Statistical Analysis

Means and standard deviations for typical daily 5-A-DAY fruit and vegetable consumption were calculated. Children were then classified into quintiles of 5-A-DAY servings per day. Linear trends[22] across quintiles were tested for calories and selected nutrients and for numbers of servings from each food group. The regression technique recommended by Willett [23–25] was used to adjust nutrients to control for caloric intake. The natural logarithm transformation [ln $(x + 0.5)$] was used to normalize skewed distributions of both nutrient intakes and numbers of servings. Untransformed values are presented in the tables, but all statistical analyses involving significance testing and calorie adjustment of nutrients were performed on transformed data.

Results

The mean number of servings of 5-A-DAY fruits and vegetables consumed per day was 2.8 (SD = 1.3), and the median was 2.7 (Table 1). There was no significant difference in the proportion of boys and girls across the quintiles of 5-A-DAY intake ($\chi^2 = 2.7$, 4 *df*). There was substantial variability in consumption of fruits and vegetables across quintiles. In comparison with children in the lowest quintile, children in the highest quintile consumed more than three and a half times as many 5-A-DAY servings (4.8 vs 1.3) (Table 1). Only 14 of the 205 children in the study (6.8%) averaged the five or more servings a day recommended by the Public Health Service[1] (Figure 1).

About two thirds of the children (n = 128) consumed less than two servings of fruit per day. Only one child consumed three or more servings of vegetables per day. Children in all quintiles consumed more servings of fruit than of vegetables (mean = 1.8 vs 1.0 for the total sample) (paired $t = 10.7$, $df = 204$, $P < .001$). Fruit juice was the largest source of 5-A-DAY servings, accounting for 36% of total 5-A-DAY intake and 56% of 5-A-DAY fruit intake for the sample as a whole. Orange juice was by far the most popular fruit consumed in our sample. Dark green leafy, green nonleafy, and deep yellow vegetables were consumed least frequently (mean = 0.1, SD = 0.2, for the total sample).

The children who consumed more 5-A-DAY servings per day had slightly higher daily caloric intakes ($P < .01$), with a difference of approximately 14% (206 calories) between the lowest and highest quintiles of 5-A-DAY servings (Table 2). There were significant linear trends ($P < .001$) in intake of vitamins A and C, potassium, iron, cholesterol, protein and fiber, with intakes increasing from lowest to highest quintiles of 5-A-DAY intake. After calorie adjustment, the significance of the linear trends for cholesterol and protein dropped to $P < .01$. The others remained unchanged. There were no differences across quintiles in percentage of calories from saturated or total fat.

With regard to intake of non–5-A-DAY foods, children in the highest quintile of 5-A-DAY food intake ate more than twice as many eggs as those in the lowest quintile (0.7 vs 0.3 eggs per day), explaining their higher dietary cholesterol intake. Children in the highest 5-A-DAY quintile also consumed fewer servings of fruit punch and soda (0.3 vs 0.8 servings per day) and slightly more un-

*Appendixes ("Appendix A—Mean No. of 5-A-DAY Servings per Eating Occasion" and "Appendix B—Thirty-three Food Groups [US Dept of Agriculture Typology] Excluding 5-A-DAY Fruits and Vegetables") are available from the author.

fried poultry and fried fish. There were no other differences across the quintiles in numbers of servings from any of the non–5-A-DAY food groups analyzed.

Discussion

In our sample of 4- to 5-year-old urban Latino children, even those in the highest quintile of 5-A-DAY fruit and vegetable consumption averaged fewer than the five servings a day currently recommended by the Public Health Service.[1] Only about one third averaged two servings of fruit per day, and just one child averaged three servings of vegetables per day. Fruit juice, usually orange juice, was the most prevalent source of 5-A-DAY servings. Children in our sample averaged one serving of fruit juice per day but only one half of one serving of fresh fruit per day. They consumed almost no dark green leafy, green nonleafy, or deep yellow vegetables.

It is perhaps unreasonable to expect young children to eat the same number of adult-sized portions of fruits and vegetables as adults. In our sample, the standardized 5-A-DAY fruit serving sizes were compatible with children's actual consumption patterns, but the standardized 5-A-DAY vegetable serving sizes were generally too large (data not shown). Nevertheless, even if we halve vegetable serving sizes, thereby doubling the number of servings of vegetables, only children in the top quintile of 5-A-DAY consumption average five or more servings per day.

The direct associations between servings of fruits and vegetables and intakes of vitamins A and C, potassium, and dietary fiber were expected. Fruits and vegetables are rich sources of these vitamins and nutrients. There was no evidence that implementation of the 5-A-DAY dietary guideline would reduce children's percentage of calories from saturated or total fat.

On the basis of analyses of variance of the average number of servings from each of the non–5-A-DAY food groups by 5-A-DAY classification, the children in our sample who ate more 5-A-DAY servings generally did not substitute fruits and vegetables for other foods (data not shown). They added fruits and vegetables to an underlying diet that did not differ greatly across quintiles of 5-A-DAY intake. The one substitution we found was fruit juice for fruit punch and soda. Children in the highest quintile consumed 3.4 times as much fruit juice a day as children in the lowest quintile but less than half the amount of punch and soda. Examining individual recalls rather than averages for each child, we found that punch and fruit juice were essentially interchangeable. Days with low juice consumption were characterized by high punch consumption, and vice versa (data not shown). The only other statistically significant differences found were higher egg, unfried poultry, and fried fish consumption for high 5-A-DAY consumers.

Patterson et al. analyzed dietary recall data from the second National Health and Nutrition Examination Survey (NHANES II), which represents the adult civilian noninstitutionalized population of the United States in 1976 through 1980.[18] Few adults (9%) consumed three or more servings of vegetables and two or more servings of fruit a day. Vegetables were more commonly eaten than fruits, with mean servings per day of 1.8 and 1.1, respectively. Among the children we studied, fruits were more commonly eaten than vegetables. This reversal suggests the need for different emphases in 5-A-DAY campaigns directed at children and at adults.

In the NHANES II data, total fat intake increased with servings of fruits and vegetables, and the percentage of calories from total and saturated fat varied directly with servings of vegetables and inversely with servings of fruits. In our data, total fat intake did not rise with increased 5-A-DAY consumption. When analyzing the data to determine whether intake of fruits alone or vegetables alone was associated with intake of percentage of calories from saturated and total fats, we found no association between percentage of calories from fats and fruit intake and an inverse association between percentage of calories from fats and vegetable intake (data not shown). These differences are not surprising when methods are compared. We followed the recently formulated NCI 5-A-DAY inclusion/exclusion criteria and serving size definitions,[14] which the Patterson paper predates.[18] Particularly relevant is the fact that we excluded fried vegetables (e.g., french fried potatoes), while Patterson et al. did not. French fries were mentioned 80 times in our 820 recalls, and the average amount consumed per eating occasion was 13 strips. Furthermore, Patterson's "servings" are what we would call "mentions." They are not presented in terms of a fixed, predefined serving size for each food. In neither study was there a relationship between servings of fruits and vegetables and body mass index (data not shown).

Several limitations of our study warrant mention. First, the nutrient database we used, which was based on US Department of Agriculture Handbook 7[26,27] and supplemented by other sources,[28–31] did not always permit us to distinguish between allowed and disallowed fruits and vegetables, the most relevant instance being sweetened vs unsweetened apple juice. Nevertheless, we believe that our recall data adequately represent children's dietary intakes from both behavioral and nutrient perspectives.[19–21] Second, while our data collection plan was not designed to assess directly the effects of seasonal variation, we did check for nonrandomness in the distribution of season of dietary recall by quintile of 5-A-DAY consumption. There was no relationship between season of recall and 5-A-DAY quintile. Third, we attempted to estimate typical consumption using only four 24-hour recalls over a 1-year period. In this sample, the intraclass correlation for the number of 5-A-DAY servings was .55 (.46 for fruits and .57 for vegetables). Finally, our assessment of children's diet was based on mothers' reports. Reanalyzing previously published data on the validity of such reports from a subsample of 55 children in this same study,[21] we found significant overreporting in only one of the six 5-A-DAY fruit and vegetable categories, namely dark green and yellow vegetables, and no significant underreporting. In the data analyzed here, children's average intake of dark green and yellow vegetables was only 0.1 servings per day. These findings support the reliability and validity of the data set as used in the context of this paper.

Generalizability of our results to groups of children of different ages or other ethnic backgrounds may be limited. The Latino population is important from a public health perspective because it is a substantial and rapidly growing segment of the population[32] that, relative to non-Hispanic Whites, has been shown to purchase[33] and consume[34] fewer low-fat foods. Our population was of low income (90% received Medicaid), and there is evidence in adults that those with lower incomes generally eat fewer fruits and vegetables.[17] Also, language and cultural differences may result in this population being harder to reach with public health nutrition campaigns aimed at the general public.

Sensible 5-A-DAY interventions must take into consideration the existing eating patterns of the target population. Fruit juices—particularly apple juice—

make relatively small contributions per calorie to intakes of vitamins A and C and dietary fiber, nutrients frequently implicated in the protective effect of a diet high in fruits and vegetables. For example, a 6-oz serving of frozen orange juice contains approximately 83 calories, 143 IU of vitamin A, 73 mg of vitamin C, and 0.8 g of fiber. The same amount of apple juice contains approximately 87 calories, no vitamin A, less than 2 mg of vitamin C, and 0.5 g of fiber. This issue of empty calories is especially relevant in our population since 44% of the children in our sample were above the 85th percentile of national norms for body mass index for their age and sex.[35] On the basis of our study, we would advocate increased consumption of fresh fruit and dark green leafy and nonleafy and deep yellow vegetables among children in our sample of low-income urban Latinos as a means of implementing the 5-A-DAY objectives. We would not advocate increased consumption of juice (especially fruit juice with a high calorie-to-nutrient ratio) in our sample. In addition, the Committee on Nutrition of the American Academy of Pediatrics[36] has expressed concern about gastrointestinal problems (chronic diarrhea, abdominal pain and bloating) related to excessive intakes of sorbitol from certain juices. The challenge for public health nutrition interventions is to find a balance between retaining the simplicity of the 5-A-DAY message and designing an intervention appropriate for the target population. □

Acknowledgments

This study was supported in part by grants from the National Heart, Lung, and Blood Institute (HL-35189 and HL-49508) and the Cancer Research Foundation of America.

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