

8-1-2004

Physical Activity Behavior, Dietary Patterns, and Nutrition Knowledge of Third- and Fourth-Grade Students in Western Massachusetts

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Recommended Citation

Huang, H., & Volpe, S. L. (2004). Physical Activity Behavior, Dietary Patterns, and Nutrition Knowledge of Third- and Fourth-Grade Students in Western Massachusetts. *The Journal of Extension*, 42(4), Article 12. <https://tigerprints.clemson.edu/joe/vol42/iss4/12>

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August 2004 // Volume 42 // Number 4 // Research in Brief // 4RIB2



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Physical Activity Behavior, Dietary Patterns, and Nutrition Knowledge of Third- and Fourth-Grade Students in Western Massachusetts

Abstract

Our Extension project assessed physical activity patterns and nutrition behavior and knowledge in elementary school students in a low-income community. Dietary patterns were similar to many large-scale studies, which have shown a trend of lower fat consumption; however, these children were unfamiliar with certain nutrient terms and categories. Most physical activities were performed in PE classes; however, community organizations and family played important roles. This survey provides a basis of children's nutrition knowledge and physical activity behavior. From this project we plan to develop appropriate nutrition and physical activity programs for children of similar age and socioeconomic status.

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Introduction

School-age children may be at nutritional and health risks due to the dramatic increase in physical development and their lack of nutrition knowledge, both of which may be exacerbated in children of low-income. Two of Healthy People 2010's goals are to: 1) "Increase the proportion of persons aged 2 years and older who consume no more than 30 percent of calories from total fat" and 2) "Increase the proportion of adolescents who engage in moderate physical activity for at least 30 minutes on 5 or more of the previous 7 days" (U.S. Department of Health and Human Services, 2000).

These goals should also be applied to Extension programs that are targeted toward low-income communities because this could result in healthier communities, which is a major goal of extension programs. However, little attention has been given to monitoring nutrition knowledge (Resnicow et al., 1997) and physical activity levels in children.

The purpose of the Extension project discussed here was to assess physical activity patterns, and nutrition behavior and knowledge in third- and fourth-grade students in an elementary school in a low-income community. Based on the results, appropriate nutrition and physical activity programs will be developed for children of similar age and socioeconomic status.

Methods

Participants

Sixteen third- and fourth-grade students from low-income families participated in this study. They were 9.3 ± 0.5 years of age and attended an elementary school located in Western Massachusetts. There were 10 boys and 6 girls (11 Caucasian, 3 Asian, 1 African-American, and 1 "other"). Among the 16 children, one boy (Caucasian) did not complete the Nutrition Knowledge and Physical Activity Questionnaire. Therefore, his data was only included for the Youth-Adolescent Questionnaire.

Data Collection

Prior to administering the survey, informed consent forms were reviewed and approved by both the University of Massachusetts Human Subjects Review Committee and the School Committee of the participating elementary school. Written informed consents were obtained from both children and parents. Three individuals from the University of Massachusetts and two classroom teachers implemented three questionnaires on 2 separate days within a week during class time in June of the school year.

Physical activity behaviors were assessed by using a self-administered questionnaire revised from the validated National Children and Youth Fitness Survey (NCYFS) I and II (Pate, Dowda, & Ross, 1990; Ross, 1997; Ross & Gilbert, 1985). It contains physical education (PE) class and leisure time-related participation in approximately 78 different kinds of physical activity. Children were provided with the physical activities, as well as the frequency and duration of the activities in which they had participated during the last year, both within and outside of PE class. They also chose from a list containing eight different settings of community organizations.

The top ten and top five physical activities in which the children most frequently engaged in school and community organizations were respectively ranked. The top three community organizations were also ranked. Finally, there was a question regarding physical activity patterns during each season of the year.

The Youth-Adolescent Questionnaire (YAQ) (Rockett, Wolf, & Golditz, 1995) was used to assess dietary patterns. The YAQ included a list of 151 foods. Reproducibility (Rockett et al., 1995) and validity studies (Rockett & Golditz, 1997) have shown reasonable ability of YAQ to assess children's eating habits. A standard serving size is given for each food, and there are nine frequency-of-use responses for the amount eaten, ranging from "never" or "less than once per month" to "over 6 per day" (Rockett et al., 1995). The Channing Laboratory in the Department of Medicine at Harvard Medical School conducted dietary intake analyses.

Seventeen questions were asked that were developed to evaluate children's nutrition knowledge. This questionnaire consisted of seven true and false questions and 10 multiple-choice questions designed to obtain children's knowledge of general nutrition and nutrition related to physical activity. All the multiple-choice items allowed students an "I don't know" response to minimize guessing. Their nutrition knowledge score was calculated as "1" for a correct response and "0" for incorrect and "I don't know" responses. A score of 17 denoted a perfect score.

Statistical Analyses

Statistical comparisons were accomplished by the student's T-test. A level of significance was set *a priori* at 0.05. All results are presented as means ± standard deviations (SD).

Results

Physical Activity Behavior

The average PE classes met 2 days per week for about 41.4 minutes per day, which included time for changing clothes and washing up. The most common PE class offerings are listed in Table 1.

Table 1.
Most Frequently Performed Physical Activity in Physical Education Class
(n = 15)

Rank	Activity
1	Basketball
2	Tag
3	Baseball/Softball

4	Soccer
5	Tennis
6	Climbing ropes/Monkey Bars
7	Jogging (distance running)
8	Jumping/Skipping rope
9	Running (Sprints)
10	Walking quickly
Note: these are listed from most frequent to least frequent	

Home and neighborhood were ranked as the first places, other than school, for providing physical activity opportunities for these students. The top three community organizations where children usually performed their physical activity are listed in Table 2.

Table 2.
Top Three Community Organizations (n = 15)

Rank	Community Organization
1	Local sports teams/Leagues
2	Recreation departments
3	Scouts
Note: these are listed from most frequent to least frequent	

The top five most frequently performed physical activities outside of PE class are listed in Table 3. The average time spent in physical activity was about 2.8 ♦ 1.0 days/week and 36.5 ♦ 9.4 minutes/day outside of PE classes. Boys reported that they spent 2.3 ♦ 1.0 days/week and 34.3 ♦ 9.5 minutes/day in physical activity. Although girls reported spending more time than boys in physical activity, with 3.5 ♦ 0.7 days/week and 39.7 ♦ 9.0 minutes/day, there were no differences between them.

Table 3.
The Top Five Most Frequent Physical Activities Outside of Physical Education Class (n = 15)

Activity Rank	All Students (n=15)		Boys (n = 9)		Girls (n = 6)	
		n ^a		n		n
1	Basketball	9	Basketball	6	Baseball/Softball	6
2	Baseball/Softball	7	Soccer	5	Swimming	5
3	Spud	7	Bicycling	4	Basketball	4

4	Swimming	6	Kickball	3	Bicycling	3
5	Bicycling	5	Tag/Rollerskating	2	Tennis	2
Note: these are listed from most frequent to least frequent a n = frequency of each physical activity						

The average days per week these children spent in physical activity during the four seasons varied (Table 4). In the winter, days per week spent on physical activities were significantly lower than any other season.

Table 4.
Average Days per Week Spent on Physical Activities During Each of the Four Seasons (n = 15)

Season	Days/ Week
Spring	4.0 \diamond 2.1
Summer	4.3 \diamond 2.3
Fall	3.4 \diamond 2.2
Winter	2.0 \diamond 1.8*
Values expressed as mean \diamond standard deviation (SD) *Significantly (p < 0.05) lower than other three seasons	

Dietary Patterns

Average dietary intake for energy, total carbohydrate, total protein, total fat, and selected nutrients compared with the Dietary Reference Intakes (DRIs) (Food and Nutrition Board [FNB], 1997, 1998, 2000) and the Recommended Dietary Allowances (RDAs) (FNB, 1989) are shown in Table 5.

Table 5.
Nutrition Intake Data from Youth-Adolescent Questionnaire (YAQ) (n = 16)

Nutrient	Mean \diamond SD	%RDAs / %DRIs ^a	% Energy
Energy	1800 \diamond 688	90 ^b	NA ^c
Protein (g)	65 \diamond 29	232 ^b	14
Carbohydrate (g)	257 \diamond 111	NA	57
Dietary fiber (g)	16 \diamond 12	NA	NA
Saturated fat (g)	24 \diamond 9	NA	NA
Polyunsaturated fat (g)	10 \diamond 5	NA	NA
Monounsaturated fat (g)	22 \diamond 9	NA	NA

Cholesterol (mg)	170 \diamond 72	NA	NA
Vitamin A (mg)	924 \diamond 0.5	600 ^d	NA
Vitamin D (mg)	11 \diamond 7	5 ^d	NA
Vitamin E (mg)	12 \diamond 6	11 ^d	NA
Vitamin C (mg)	157 \diamond 118	45 ^d	NA
Thiamin (mg)	2 \diamond 1	0.9 ^d	NA
Riboflavin (mg)	3 \diamond 1	0.9 ^d	NA
Niacin (mg)	23 \diamond 8	12 ^d	NA
Vitamin B ₆ (mg)	2 \diamond 1	1 ^d	NA
Vitamin B ₁₂ (mg)	7 \diamond 4	1.8 ^d	NA
Folate (mg)	402 \diamond 170	300 ^d	NA
Calcium (mg)	1199 \diamond 646	1300 ^d	NA
Iron (mg)	19 \diamond 7	8 ^d	NA
Potassium (mg)	2727 \diamond 1593	NA	NA
Phosphorous (mg)	1339 \diamond 596	1250 ^d	NA
Magnesium (mg)	284 \diamond 140	240 ^d	NA
Zinc (mg)	13 \diamond 6	8 ^d	NA
Iodine (mg)	47 \diamond 57	120 ^d	NA
Sodium (mg)	2046 \diamond 843	NA	NA

Values expressed as mean \diamond standard deviation (SD)

^aRDA = Recommended Dietary Allowances; DRIs = Dietary Reference Intakes. DRIs consist of four reference intakes: Recommended Dietary Allowances (RDA), Tolerable Upper Intake Level (UL), Estimated Average Requirement (EAR), and Adequate Intake (AI) (Trumbo et al., 2001; Yates, Schlicker, & Suitor, 1998)

^bCompared to RDAs (FNB, 1989)

^cNA = not applicable

^dCompared to DRIs (FNB, 1997, 1998, 2000)

Nutrition Knowledge

The average nutrition knowledge score for boys and girls were 10.8 \pm 2.6 and 9.8 \pm 1.7, respectively, out of a possible 17, with no differences in scores between genders. The number of children correctly responding to the nutrition knowledge test for each question is listed in Table 6.

Table 6.
Number of Correct Responses on the Nutrition Knowledge Questionnaire

Question	Number of Correct Responses		
	All Students (n =15)	Boys (n = 9)	Girls (n = 6)
True and False			
The basic nutrients are carbohydrates, fats, proteins, vitamins, minerals, and water	10	7	3
Only carbohydrates, proteins, and fats can give me energy.	3	2	1
Fats provide more energy than carbohydrates and proteins, so I should eat more fat to fit my daily energy needs.	13	8	5
The food groups include the following three groups: milk/dairy, meats, and vegetables groups.	12	6	6
The Food Guide Pyramid is a guide to daily food choices and I should try to follow it.	12	7	5
I should eat different kinds of foods every day, but not eat too much of any one food.	12	8	4
The food I eat may affect my future health, so I should eat more vegetables and fruits, but less fat and cholesterol.	12	8	4
Multiple Choice (Only the questions are listed here)			
Which food is a good source of carbohydrates?	4	3	1
Which food also belongs to the same food group as apples?	13	8	5
Which food also belongs to the same food group as bread?	11	6	5
Which diet would be the healthiest?	8	6	2
Which one is highest in fat?	11	7	4
	4	3	1

Which one does not give me protein?			
Which food is best for me 2 hours before I exercise?	2	1	1
During physical activity, when should I drink water?	8	5	3
Which food is best for me right after I exercise?	11	7	4

Discussion

Although it is generally believed that boys spend substantially more time in physical activity than girls (Sallis, 1993), we did not observe this. We expect that the difference in physical activity habits between boys and girls was minimal due to the young age. Nonetheless, boys and girls did have different preferences in types of physical activities chosen.

School played a major role in providing physical activity for these children because half of the activities performed were in PE classes. As for outside of school, local sports teams or leagues, recreation departments, and scouts were the most popular places for physical activity. Community organizations have long played an important role in providing physical activity opportunities to children (Ross, 1997; Ross & Gilbert, 1985) and should be considered when planning Extension programs.

It has been reported that children are less active in winter than in other seasons, especially in places with cold, long winters (Ross, 1997; Ross & Gilbert, 1985; Stephens, 1993). Conversely, children living in areas where the summers are hot and humid were least active in the summer due to the heat (Baranowski, Thompson, Durant, Baranowski, & Puhl, 1993). It was therefore not surprising that the children in our study, living in Massachusetts, were more physically active in the summer and less physically active in the winter. Because of this difference in activity level during the winter months, efforts need to be made to increase children's physical activity during the winter months.

Although the macronutrient intake distribution in their diets was within the recommended levels, the total energy (kilocalorie) intake of these children was 90% of the RDAs (FNB, 1989), which were established to promote normal growth. The percentage of energy intake from fat was lower than the average of 35% observed in many epidemiological surveys of children (Johnson, Guthrie, Smicklas-Wright, Wang, 1994; National Heart, Lung, and Blood Institute Growth and Health Study Research Group, 1992; Nicklas, Webber, Srinivasan, & Berenson, 1993).

Many studies have showed a trend toward lower percentages of energy intake from dietary fat in recent years; therefore, our results might parallel this trend toward a lower dietary fat consumption. It may be a result of the YAQ, because Rockett et al. (1995) also reported a lower dietary fat (30%) intake compared to the Bogalusa Heart Study and NHANES II which used 24-hour recalls to assess children's dietary intakes (Carroll, Abraham, & Dresser, 1983; Farris & Nicklas, 1993).

These children consumed greater than 100% of the DRIs (FNB, 1997, 1998 & 2000) for almost all vitamins and minerals except calcium and iodine, which were 92% and 39% of the DRIs, respectively (FNB, 1997; Trumbo, Yates, & Schlicker, 2001). The reported consumption of vitamins C, B₁₂, and riboflavin were up to three times above the DRIs (FNB, 1998 & 2001), perhaps because 10 out of the 16 children reported taking vitamin/mineral supplements.

Although the nutrition knowledge of the boys and girls was equal, all children could not correctly indicate the major nutrient source of each food. Nonetheless, they did show a better knowledge of foods high in fat, possibly because these children received more information about fat since this has been a focus of public advertisements.

Regarding the questions about nutrition and exercise, children were not fully aware of what to consume before exercise or that hydration was important for better exercise performance. Therefore, more nutrition education on basic functions of nutrients, food choices, and the importance of hydration is essential for children of this age. In addition, children should be taught the importance of nutrition in exercise.

Summary

- Both school and community organizations provided physical activity opportunities for children.
- This study provides a basis of the type, duration, frequency, and seasonal variations in children's physical activity, which could be used as a reference for developing Extension programs.
- Children's nutrient intakes, especially macronutrients, appear to be similar with what has

been documented in many large-scale dietary surveys in this age group.

Limitations

- The surveys took two full class periods, which was difficult for the children and the school.
- The survey we developed was not validated prior to use.
- The small sample size limits the generalizability of our results.

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