

Health-Related Fitness and Nutritional Practices: Can They Be Enhanced in Upper Elementary School Students?

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Abstract

The purpose of the present study was to investigate the effect of an eight-week health-related fitness and nutrition education program on fitness components and dietary habits in upper elementary school students. Forty children from the fifth and sixth grade, 10 to 12 years of age ($M=11.2$, $SD=1.1$), participated in the study. The experimental group consisted of 20 children who participated in the program three days per week for one hour outside the time allotted for school physical education. The control group participated in the typical school physical education program. Health-related fitness components (cardiorespiratory endurance, abdominal strength and endurance, flexibility, and body composition) were assessed with the Prudential Fitnessgram test battery (Cooper Institute, 1992). Also, children's dietary habits were assessed based on the Health Behavior Questionnaire (HBQ) of Parcel et al. (1995) that recorded their dietary habits, after being modified to fit in the Greek diet (Bebetso 1999). The multivariate analysis of variance for repeated measures (2x2) indicated that the group X measure interaction was significant. Children in the experimental group had better scores on cardiorespiratory endurance, on abdominal strength and endurance, and on dietary habits than those in the control group. These findings indicate that certain health-related fitness components and dietary habits as well can be improved with a three hour a week program consisting physical fitness and nutrition education activities.

Traditionally, 'fitness' has become synonymous with cardiorespiratory fitness, especially in

the context of health (Simons-Morton, O'Hara, Simons-Morton & Parcel, 1987). This approach is based on the assumption that cardiorespiratory fitness affects risk for coronary artery disease. However, other fitness components, such as muscle strength and endurance, flexibility, and body composition may be related to health particularly in pediatric populations but are often ignored (Bar-Or, 1986). Therefore, a broader definition of health-related fitness was adopted in which all the above components considered to reduce risk factors for chronic diseases and contribute to the retention of fitness and health in every day life are included (Corbin & Lindsey, 1984; Sheefeldt & Vogel, 1987).

Some important benefits of fitness programs are the following: a) increasing children's physical ability may increase their willingness to become more physically active, b) children who participate in supervised fitness programs may be able to self-regulate their physical activity levels, c) the development of positive attitudes toward physical activity and fitness during childhood may affect the level of fitness during adulthood (Simons-Morton, Parcel, O'Hara, Blair & Pate, 1988). Substantial evidence also indicates that unfit and overweight children exhibit early signs of coronary artery disease, high blood pressure, and high cholesterol (Sallis & McKenzie, 1991; Pangrazi & Dauer, 1995).

Sallis, McKenzie, Alcaraz, Kolody, Faucette and Hovell (1997) stressed that school physical education has the primary role in promoting physical activity in youth. Also, according to Haywood (1991) the goals of physical education programs are to provide students a) opportunities

to be active and b) experiences that will help them adopt active lifestyles as adults. However, Sallis and McKenzie (1991) stated that physical education has to become more health-related because the existing programs have little to no health orientation. In the study of Simons-Morton, Taylor, Snider, and Huang (1993) the physical education specialists provided students with only three minutes of moderate to vigorous physical activity per physical education class, that is less than 10% of class time. There is general agreement, though, that children should obtain more moderate to vigorous physical activity because they are not as fit as should be or once were (Duncan, Boyce, Itami & Paffenbarger, 1983), and many are overweight (Walberg & Ward, 1985; Schlicker, Borra & Regan, 1994).

Based on the belief that in developing and maintaining desirable levels of health-related fitness an improvement in general well-being is accomplished, the topic of health-related fitness generated considerable interest among the researchers (Ignico & Mahon, 1995). During the 1990s the interest was focused on children's health-related fitness levels (Schlicker et al., 1994) and several authors reported using alternative physical education models for health-related fitness enhancement with success. In the program of Koppenrud (1986) students designed their own fitness program with their parents supervision. Siedentop and Siedentop (1985) reported the success of a daily physical education program on children's physical fitness. In this program classroom teachers used model lessons designed by physical educators to develop fitness outside the time allotted for physical education.

Werner and Durham (1988) conducted a study to identify the effect of a 9-week supplemental physical education program based on health-related fitness factors on fourth, fifth and sixth grade children. The experimental group received extra physical education three days per week for twenty minutes each day. Information about nutrition was also given. The results of this study showed a treatment effect in favor of the experi-

mental group in all four health-related fitness components studied. More specifically, the fourth grade experimental group had significantly better scores for the mile run at the end of the 9-week period than the other groups. Also, fourth and fifth grade experimental groups had significant gains in sit-up scores while other groups showed no significant gain. Concerning the sit and reach test, the experimental group had a positive gain score while the control group had a negative gain score. Moreover, the experimental group reduced its skinfold measurements while the control group actually showed larger scores.

Ignico and Mahon (1995) reported significant improvement of cardiorespiratory endurance in low fit children, 8 to 11 years of age, who participated in a health-related fitness program. Also, in the study of Sallis et al. (1997) a two-year supervised program which was implemented with elementary school children improved significantly their cardiorespiratory endurance and their abdominal strength and endurance.

Although the above studies provide valuable information about the effects of health-related fitness programs on the development of fitness components, recent speculation focuses on the effect of intervention programs, which combine health-related fitness and nutrition education, on the health-related fitness components and dietary habits as well. According to Nader, Baranowski, Vanderpool, Dunn, Dworkin and Ray (1983) such programs have greater possibility to be successful since all the above factors are related, directly or indirectly, with risk factors for cardiorespiratory diseases.

The limited research on this topic both in Greece and abroad led the researchers to conduct the present study in which an attempt was made to investigate the effect of an eight-week health-related fitness and nutrition education program on fitness components and dietary habits in upper elementary school students. It was hypothesized that children in the experimental group would improve a) their fitness components and b) their dietary habits.

Method

Participants

Forty children from the fifth and sixth grade, randomly divided in an experimental ($N_1=20$) and a control group ($N_2=20$), participated in the present study. The experimental group followed an after school eight-week health-related fitness program in which a nutrition education program was also included (Hopper, Munoz, & Fisher, 1997). The control group followed the typical school physical education program, two times per week for 45 minutes, which was focused mostly on the development of sport skills.

Measures

Health-related fitness. The health-related Prudential Fitnessgram test battery (Cooper Institute, 1992) was used for the evaluation of the fitness level of both groups before and after treatment. The above battery consists of the following tests (Safrit, 1995):

Abdominal strength and endurance. This ability was assessed with the curl-ups test. The child laid down with knees bent and feet flat on a floor mat. The arms and hands were held straight at the sides and the palms were in contact with the floor mat. The child's fingertips touched the proximal edge of a paper strip 30 inches long and 4.5 inches wide. The strip was placed under the child's knees and another child stood with both feet on its ends to avoid the movement of the strip. A third child placed both his hands under the head of the subject. The child being tested performed a curl up until his fingertips touched the distal edge of the paper strip and then laid back until his head touched the assistant's hands. The child performed as many repetitions as possible to a cadence of one curl-up every 3 sec. The score of the test was the number of curl-ups performed with correct manner.

Trunk extensor flexibility was measured with the trunk lift (extension) test. The child laid with the face down on a floor mat and the hands under the thighs. Then the child lifted the head and

upper body as high as possible, retaining briefly this position in order to be measured. The tester used a 12 inch long ruler to measure the distance from the floor to the chin. This distance in the nearest inch was the score of the test. The child was not encouraged to lift his chin higher than the ruler's height.

Hamstring flexibility was measured with the back saver sit and reach test, a variation of the standard sit-and-reach test. The child without shoes sat down with one leg straight out and the foot flat against the front surface of a typical sit-and-reach box. The other leg was bent and the foot was placed on the floor, 2-3 inches apart from the inside of the opposite leg. The measuring stick on the top of the box was placed in a way that the 9 inch mark corresponded to the proximal edge of the box and the zero point was closest to the subject. The child then placed one hand on the top of the other with palms down and reached out as far as he could, moving the hands along the measuring stick. On the fourth trial the position was held for at least 1 sec. Then, the child performed the test with the other leg. Two scores were recorded in the nearest inch, one for each leg.

Cardiorespiratory endurance was measured with the one mile walk/run test. The child stood behind a starting line and on the tester's signal started to run along one mile area. Walking was allowed but the child was encouraged to finish the course as fast as possible. The score of the test was the time needed to run the one-mile course in the nearest second.

Body composition. The skinfold thickness of triceps and calf on the right side of the body was used to measure body composition. The examiner pinched the child's skinfold slightly above the midpoint of each site (triceps and calf) and placed a specific caliper (Harpenden Co.) at the midpoint. The examiner held the caliper in position for more than 3 seconds and then recorded the measurement. Each site was measured three times. The highest and lowest measurements were discarded and the middle score was recorded. The

total score was the sum of the triceps and calf skinfold scores.

Dietary habits. Children were requested to read and fill in a specific questionnaire based on the Health Behavior Questionnaire (HBQ) of Parcel et al. (1995) that recorded their dietary habits, after being modified to fit in the Greek diet (Bebetsos, 1999). It consisted of 23 items that ascertained consumed foods where a higher fat or higher sodium food was always paired with a lower fat or lower sodium food. Children were asked to circle how many times they replaced less healthy foods with other, more healthy foods during the past week. For example, 'How many times during the past week did you eat fresh instead of frozen vegetables?' or 'How many times during the past week did you drink low-fat milk instead of regular milk?'. Responses used a ten-point Likert-type format ranging from *not at all (once)*, *few (five times)* and *many times (10 times)*, indicating the degree of each food's substitution. Bebetsos (1999) found the questionnaire to have alpha coefficients of high reliability (Cronbach $\alpha = .80$).

Fitness program. The after-school health-related fitness program which also included nutrition education (Hopper, Munoz, & Fisher, 1997) lasted eight weeks and was conducted three days per week, one hour per day. Each session began with a 5- to 10-minute warm-up period, and concluded with a similar 5-minute cool down period. The content of the program consisted of the following weeks: the 1st week information for the heart structure and function and for the food components which improve cardiorespiratory endurance was provided through game-type motor activities. During the 2nd week motor skills were included in the program that emphasized the improvement of health-related fitness components. Concerning nutrition education, information was provided for reducing dietary fat. Practice during the 3rd and 4th week consisted of walking routines and information for the type of activities that contribute to the improvement of cardiorespiratory endurance. Improvement of muscular

endurance, and understanding the food pyramid and its relation with the every day food preferences as well were the goals of the 5th week. The goal of practice during the 6th week was to improve muscular strength while in the 7th week children participated in activities to increase progressively the duration in running (e.g., 5, 7, 10 min.). Children also received information about the biological characteristics and the way of living which contribute to the appearance of cardiorespiratory diseases. Practice during the 8th week aimed to enhance the components of health-related fitness through team games and to reinforce children's perceptions and attitudes for health-related fitness.

An example which shows the way that nutrition education was incorporated to the health-related fitness program is the following: children were divided in five teams and performed certain fitness tasks (different for each team), according to what was written on the puzzle parts scattered in the center of the playground area for each team. When the teams completed all the tasks, they put together the pieces of the puzzle and foods of a certain food group appeared. Then, each team was asked to figure out which food group assembled and how many servings or portion size, per day children should consume. When a team knew the answer, its members raised their hands and the instructor checked their answers. Knowing the amount of each food that represents one serving is an important tool for a healthy lifestyle (Hopper, et al., 1997).

Results

The one-way analysis of variance was employed to test the hypothesis that there were not any significant differences between the experimental and the control group in the pre-treatment measures. In the absence of significant differences between the two groups, the multivariate analysis of variance for repeated measures (2x2) was applied to test the pre- and post-treatment fitness differences (factor "treatment")

between the experimental and the control group (factor “group”). Post hoc comparisons were made using the Scheffé test.

The results indicated a statistically significant interaction between the treatment and group factors ($F_{1,38}=8.25$, $p<0.01$) regarding muscular strength/endurance. Means comparison revealed that the muscular strength/endurance was significantly improved only in the experimental group (Table 1). A statistically significant interaction was also found between the treatment and group factors ($F_{1,38}=7.08$, $p<0.05$) for cardiovascular endurance. Moreover, means comparison indicated that the mean time needed to run the one mile was significantly reduced only in the experimental group (Figure 1). On the contrary, no significant interaction was found between the treatment and group factors for the trunk lift ($F_{1,38}=1.61$, $p=0.21$), the push-ups ($F_{1,38}=3.04$, $p=0.09$) and the body composition ($F_{1,38}=1.20$, $p=0.28$). The mean scores of the two groups are presented in Table 2.

Although the interaction between the treatment and group factors was statistically significant for the sit-and-reach test both with the right ($F_{1,38}=8.57$, $p<0.01$) and the left leg ($F_{1,38}=7.07$, $p<0.05$), means comparison revealed that neither the experimental nor the control group improved. As it can be seen in Table 3, the experimental group had a positive score change after treatment but the control group showed a negative score change. Thus, the different score's change, before and after treatment, between the two groups was responsible for the significance of the interaction between the treatment and group factors.

Regarding the dietary habits, a statistically significant interaction was found between the treatment and group factors ($F_{1,38}=50.34$, $p<0.01$), and the dietary habits were improved after treatment only for the experimental group (Figure 2).

Discussion

The present study aimed to investigate the effect of an eight-week health-related fitness

program on fitness components, and dietary habits in upper elementary school students. The results showed that children who followed the eight-week health-related fitness program in which nutrition education was included improved their abdominal strength and endurance and their cardiorespiratory endurance as well. These findings verify partially the first hypothesis of this study which supported that the experimental group would have better scores on all health-related fitness components. Improvement in cardiorespiratory endurance was also found by Werner and Durham (1988) after implementing a nine-week health-related fitness program and by Ignico and Mahon (1995). Also, Sallis et al. (1997) found significant improvement in cardiorespiratory endurance and in abdominal strength and endurance after implementing a 2-year health-related fitness program. In the above studies nutrition education was not included in the health-related fitness programs. On the contrary, in the current study children received nutrition education during the implementation of the health-related fitness program and this might have contributed to the earlier improvement of the two fitness components mentioned above.

Concerning flexibility, although no significant differences were found between the experimental and the control group, performance of the experimental group was improved, a finding that is not apparent for the control group. On the contrary, both the experimental and the control group increased body composition, after treatment although not significantly. These findings are in consistence with those of Ignico and Mahon (1995) and Sallis et al. (1997) since a significant effect of health-related fitness programs was not apparent neither for flexibility nor for body composition.

The experimental group of the present study also improved significantly its dietary habits while the control group did not. The improvement of these habits was shown by the children reports on their food preferences during the ‘past week’ but also by the comments of their parents and the

ladies in the butterfly who were surprised by the change in children's food preferences. Thus, the second hypothesis of the present study, which supported that the experimental group would have better scores on the dietary habits than the control group, was verified. On the contrary, in the study of Devine, Olson and Frongillo (1992) children who participated in nutrition education classes improved their knowledge and their attitudes toward nutrition but not their dietary habits. Thus, the improvement of children's dietary habits in the present study might be attributed to the respective information provided to them and to the game-type activities they performed, through which movement was related to the nutrition information they had already received. It seems that providing information about nutrition through physical activities is more effective than providing it in the absence of physical activity. Providing knowledge about nutrition through game-type activities is also recommended in the model of nutrition education of Mass (1997).

Although children improved their dietary habits after following the eight-week program, they did not improve significantly their body composition. This finding is in accordance with that of Ignico and Mahon (1995) who found that an after school 10-week health-related fitness program did not contribute to the improvement of body composition. They attributed the lack of improvement in the short duration of the intervention program. A second reason might be that children are not those who decide about the type of food consumed at home, but their parents are. Therefore, the education of parents on healthy foods might be necessary for the enhancement of the effectiveness of a health-related fitness program and the improvement of fitness and health.

In summary, it seems that a specific supplemental program, in which the components of health-related physical fitness and nutrition education are combined, affects positively both the fitness components and the dietary habits of elementary schoolchildren. Consequently, such programs could be successfully incorporated in

the physical education curriculum in order to achieve goals oriented to health improvement. Physical educators should receive additional information about improving children's health-related fitness and dietary habits through game-type motor activities. Pangrazi, Corbin, and Welk (1996) further stressed the role of school in guiding children to participate in aerobic activities, such as walking and housework, in order to improve health and to develop positive attitudes for physical exercise for a life time.

Apart from improving health, a health-related fitness program could promote participation in physical exercise during adulthood (Blair, Clark, Cureton, & Powel, 1989). Therefore, future studies could examine the effect of a health-related fitness and nutrition education program in continuing physical exercise and adopting healthy life styles during adulthood. In addition, future studies may examine the role of parents' education and participation in a health-related fitness program followed by their children at school and at home as well, in order to reinforce the development of new attitudes toward exercise and to improve health.

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Table 1. Curl-up repetitions of the experimental and control group before and after treatment (M±SD).

<i>Group</i>	<i>Treatment</i>	
	<i>before</i>	<i>after</i>
Experimental	16.2 ± 7.1	27.9 ± 11.2*
Control	14.9 ± 7.3	18.7 ± 7.3

* p<.001

Table 2. Height of trunk lift, number of push-ups, sum of triceps and calf skinfolds of the experimental and control group before and after treatment (M±SD).

	<i>Group</i>	<i>Treatment</i>	
		<i>before</i>	<i>after</i>
Trunk lift (cm)	experimetnal	25.6 ± 3.5	27.3 ± 2.3
	control	26.5 ± 3.8	27.0 ± 3.8
Push-ups (units)	experimental	5.35 ± 4.1	7.05 ± 4.3
	control	4.80 ± 3.1	4.95 ± 3.6
Skinfolds (mm)	experimental	32.4 ± 9.2	33.8 ± 10.7
	control	31.0 ± 9.5	33.8 ± 10.1

Table 3. Back saver sit-and-reach scores (cm) with each leg for the experimental and control group before and after treatment (M±SD).

<i>Group</i>		<i>Treatment</i>	
		<i>before</i>	<i>after</i>
Right leg	Experimental	21.45 ± 6.9	22.85 ± 5.7
	Control	23.85 ± 6.6	22.20 ± 6.6
Left leg	Experimental	21.15 ± 5.7	22.65 ± 6.8
	Control	23.30 ± 6.1	21.92 ± 5.8

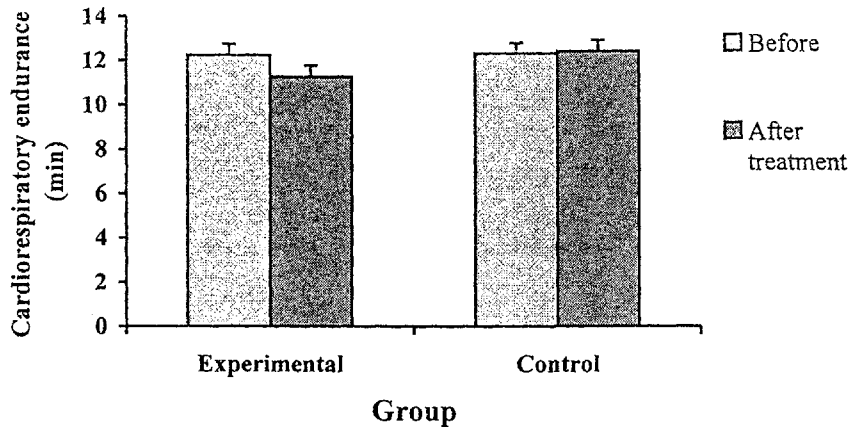


Figure 1. Mean time for the completion of the one mile run test of the experimental and control group before and after treatment.

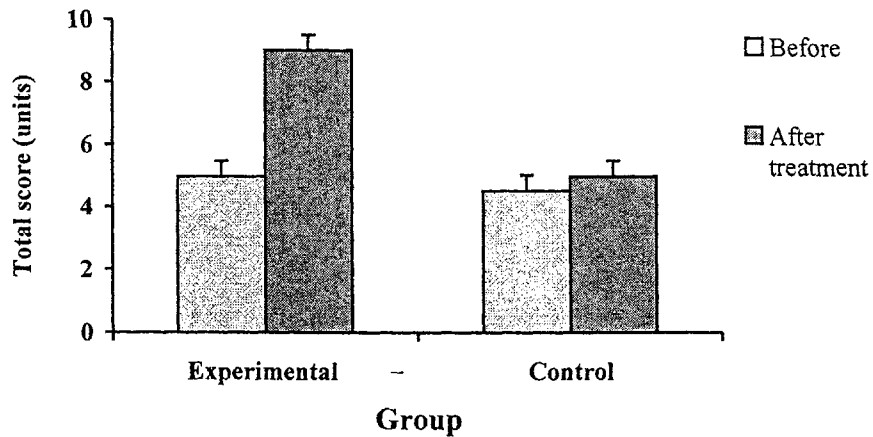


Figure 2. Mean scores of the reported dietary habits of the experimental and the control groups before and after treatment.