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THE EFFECTS OF AN AEROBIC PROGRAM ON HEALTH-RELATED FITNESS AND INTRINSIC MOTIVATION IN ELEMENTARY SCHOOL PUPILS

Key words: health-related fitness, intrinsic motivation, aerobic dance, fifth grade pupils, Fitnessgram.

ABSTRACT

The purpose of the present study was to evaluate the level of health-related fitness and intrinsic motivation in 10 to 11-year old pupils, before and after the application of an intervening dance aerobic program. Thirty-three pupils composed the experimental group and the rest twenty-four the control group. The experimental group followed an aerobic dance program for twelve weeks, three times per week, in 45-minute sessions. The control group followed the regular PE school program. The Prudential Fitnessgram test battery (Cooper Institute for Aerobics Research 1992) was used for the evaluation of the physical condition of the pupils. Both groups filled in a questionnaire measuring intrinsic motivation (IMI – McAuley, Duncan & Tammen, 1989). The results showed that a dance aerobic program enables pupils of 10 to 11 years of age to improve all health-related abilities, as well as their intrinsic motivation, in an easy and enjoyable way.

INTRODUCTION

The modern lifestyle and the absence of physical activity has produced high percentages of obesity among children and adolescents and has led scientists to focus their interest on how to sustain or improve health-related physical abilities during childhood, since the development of risk factors during childhood is regarded as a fore-runner of the development of risks in adulthood. This means that today's unhealthy children are tomorrow's potential patients. If, however, we manage to check the development of risk factors during childhood, we may be able to anticipate and prevent the development of cardiorespiratory and other chronic disorders in adulthood [16].

Research has shown that the sedentary life led by children and adolescents contributes to the development of cardiorespiratory and other chronic

disorders even during childhood [2]. According to the National Children and Youth Fitness Study in the United States, 20% of children between 5 and 17 years of age are considered obese, which is 50% higher than the equivalent percentage twenty years ago. Moreover, 40% of children from 5 to 8 years of age develop at least one risk factor – obesity, hypertension, high cholesterol levels – for cardiorespiratory diseases [5].

Physical fitness can be divided into two categories: (a) skill-related fitness and (b) health-related fitness. Skill-related fitness includes those elements which render an individual capable of performing athletic activities, and it largely depends on one's genetic characteristics. It comprises such skills as precision, balance, spatial orientation, coordination, reaction time, strength and speed. Conversely, health-related fitness comprises cardiorespiratory endurance, muscular strength and

endurance, flexibility and body composition. These elements protect the human body from disorders caused by the absence of kinetic activities in everyday life and enhance an individual's self-esteem [3, 10, 12, 23, 25].

One form of exercise, which has been exceptionally popular in recent decades, particularly among women, is dance aerobic. Many studies have dealt with the influence of dance aerobic on one's cardiorespiratory capacity, since the improvement of this capacity reduces the likelihood of the development of cardiovascular disorders. Furthermore, studies involving adults have proven that dance aerobic does not only have a positive impact on one's cardiorespiratory capacity [24], but also on other physical abilities [15, 26].

Studies, which applied dance aerobic programs on children aged 8-12, have shown positive effects of dance aerobic on health-related physical abilities [21, 27] and that children accept such programs easily and with pleasure [17]. McIllroy et al. [21] applied a dance aerobic program on children of the second and fifth grades of primary school for a period of eight weeks. The findings of their study showed a considerable improvement of all health-related physical abilities of the experimental group. A study by Albert, Field, Goldstein & Perry [1] on preschool children has shown that dance aerobic programs offer us the opportunity to considerably improve children's cardiorespiratory endurance, agility and self-confidence.

The satisfaction caused by the sense of competence during the practice of a physical activity is a positive predictor of intrinsic motivation [6, 13]. Students with high perceived competence opt for challenges and self-determination in learning contexts. Nicholls [22] supports that at the age of 10 a major decline of perceived ability occurs, which is due to the cognitive maturity of children. From this age on, however, children can understand that they can not be the best in some activities even if they make the greatest effort. Therefore, an occupation which causes intrinsic motivation enhances a positive attitude towards exercise [9], which is essential to achieve in primary school ages.

The present study aimed at evaluating dance aerobic programs for pupils aged 10 and 11, as a means to improve: a) health related fitness and b) intrinsic motivation, examining, simultaneously, their correlation.

METHODS

Sample

The sample consisted of 57 pupils of the fifth grade of primary school, aged 10 and 11 ($M=10.6$, $SD=0.2$). Of these, 33 were the experimental group and the remaining 24 were the control group. The experimental group followed a dance aerobic program, while the control group only followed the school's physical education program. None of the children participated in kinetic activities out of school. Also, no dietary suggestions were provided.

Measurements

For the evaluation of the pupils' physical abilities, the Prudential Fitnessgram (Cooper Institute for Aerobics Research, 1992) battery was used, which is recommended as appropriate by the American Alliance for Health, Physical Education, Recreation and Dance for children aged 5 to 17. All children were measured before and after the program in accordance with the protocol in the following tests:

Strength/endurance of abdominal muscles: The "Curl Ups" test was used to measure this ability. The children were lying in supine position with their legs bent, while the tips of their fingers were touching the edge of an 11.3 cm-wide band. At the beat of a metronome, which allowed the performance of a repetition (lifting the trunk and returning to the initial position) every three seconds, the children lifted their trunks to the point where their fingers traveled the distance of the width of the band and then returned to their initial position. Each child performed this exercise until s/he felt tired and the number of successful attempts was used to evaluate this ability.

Flexibility of trunk stretching: The "Trunk Lift" test was used to measure this ability. The children were lying in prone position, with their hands under their thighs, and lifted their trunks without supporting their legs against an obstacle. The distance from the ground to the child's chin was measured with a 50 cm ruler, while the child was not encouraged to rise above 30.5 cm, where there was a visible "risk" line. The children performed two attempts and the best performance in centimeters was recorded.

Strength/endurance of the upper part of the body: The "90-degree Push-Ups" test was used to measure this ability. The children performed the test from the regular bending position: the hands

were placed under the shoulders, with the fingers slightly open and stretched and the back was aligned with the knees. The toes supported the body. The children had their hands placed on a band measuring 11.43 cm in width. The tips of the fingers rested on the outer side of the band in order to avoid any carrying of the body forward during the performance of the exercise. In performing this exercise, the children bent their elbows until the forearm formed a 90° angle with the upper arm, keeping their back and knees in a straight line. These exercises were performed to the beat of a metronome, which allowed one repetition every three seconds, until the children felt tired and were unable to continue. At the end, only the number of correctly performed repetitions was recorded.

Flexibility of the posterior femoral muscles: The “Back Saver Sit and Reach” test was used to measure this ability. The children removed their shoes and assumed a sitting position, with one leg stretched out and its sole resting on the flexion meter, and the other leg bent at the knee, resting on the ground. The distance between the two legs was 5-7 centimeters. The children had their arms stretched to the front, with the palms, one on top of the other, facing down. From this position they bent their trunks forward, trying to reach as far as possible on the flexion meter. They performed four attempts. At the fourth attempt they had to keep their hands at the position reached for at least one second and that was the value that was recorded in centimeters. The same procedure was followed for the second leg. Values before the point where the stretched leg was resting were acceptable at a distance of 22.8 cm, since point 0 of the ruler was placed closest to the child, and point 22.8 was placed on the instrument, exactly at the straight line of the front vertical surface.

Cardiorespiratory endurance: The “One mile Walk-run” test was used to evaluate this ability, adjusted to the 10-11 year age group. An electronic stopwatch was used to measure the time that was required for the children to cover a distance of one mile, running or also walking in between.

To measure intrinsic motivation, the questionnaire used was the IMI (Intrinsic Motivation Inventory) [20], which is made of 18 questions and includes 4 factors. For the purposes of the study, only the 8 questions forming the two factors were used: a) interest – enjoyment and b) effort, as they were modified for the Greek

population by Diggelidis and Papaioannou [8]. The answers were indicated on a five-point scale (Definitely yes = 5, Definitely no = 1).

Initial and final measurements procedure

The initial and final evaluation of the elements related to the physical fitness, which promotes health, was carried out within the school environment. Each child was individually assessed and was provided with specific instructions before the beginning of each test, in accordance with the battery protocol. It was emphasized that s/he should perform each test as best as s/he could. The questionnaire was filled in during the first and twelfth week in class.

Intervention program

After the initial measurements, the experimental group followed the aerobic dance program for twelve weeks, three times per week, as proposed by Hinson [14], for 45 minutes per class. The control group only followed the school’s physical education program.

RESULTS

The internal cohesion of the questionnaire was checked with α Cronbach test. The results supported the structural validity of the questionnaire and the factors were found to have a high degree of internal cohesion in both measurements (0.68 to 0.90).

Initially the One-Way ANOVA analysis was applied to check whether there were any statistically significant differences in the physical abilities between the experimental group and the control group at the initial measurement. From the results it appeared that any differences in the abilities in abdominal muscle endurance, dorsal flexibility, posterior thighs, strength of the upper extremities and cardiorespiratory endurance were not statistically significant. Therefore, the members of the two groups were considered to be characterized by the same level of development as to the physical abilities which were studied before the commencement of the program.

Then, the ANOVA repeated measures analysis was applied for each physical ability, as much as for the ‘enjoyment’ and ‘effort’ variables. The analysis model (2x2) included the variable “measurement” (initial – final) as the repetition

variable and the variable “group” (experimental – control) as the independent variable.

The results of the ANOVA repeated measures analysis showed that there was a statistically significant interaction between the variable “measurement” and “group” for the improvement of physical abilities (abdominal muscle endurance, trunk flexibility, strength of the hands, flexibility of the posterior femoral muscles, cardiorespiratory endurance), enjoyment and effort. The differences

between experimental and control group are shown in Table 1.

Moreover, after the dance aerobic intervention program, there was a statistically important correlation among the factors of the intrinsic motivation and the physical abilities of the pupils in the experimental group, which was not true in the initial measurement (Table 2).

Table 1. Means and standard deviation of variables experimental and team of control at the initial and final measurement ($F_{1, 53}$)

Variables	Team	Initial		Final		Measurement/ Group Interaction
		<u>M</u>	SD	<u>M</u>	SD	
Enjoyment	Experimental	2.96	0.52	4.48	0.36	F=190.14, p<0.001
	Control	3.33	0.44	3.03	0.38	
Effort	Experimental	3.12	0.35	4.41	0.29	F=177.07, p<0.001
	Control	3.27	0.51	3.18	0.64	
Abdominal muscle endurance	Experimental	26.60	7.95	51.47	8.64	F=137.88, p<0.001
	Control	27.71	7.33	31.50	6.89	
Trunk flexibility	Experimental	19.16	2.93	25.87	2.22	F=125.10, p<0.001
	Control	20.31	2.64	21.12	2.36	
Strength of the hands	Experimental	3.85	1.14	8.45	2.21	F=121.04, p<0.001
	Control	4.63	1.37	2.12	2.93	
Flexibility of the right posterior femoral muscle	Experimental	16.19	2.68	22.31	3.13	F=251.63, p<0.001
	Control	16.91	2.70	16.64	3.37	
Flexibility of the left posterior femoral muscle	Experimental	15.34	3.22	21.94	2.62	F=158.26, p<0.001
	Control	16.22	2.94	15.81	2.39	
Cardiorespiratory endurance	Experimental	13.49	1.40	11.36	1.58	F=124.44, p<0.001
	Control	13.14	1.41	12.78	1.16	

Table 2. Correlations between variables at the initial and final measurement

	Enjoyment	Effort	Abdominal muscle endurance	Trunk flexibility	Strength of the hands	Flexibility of the posterior femoral muscle		Cardiorespiratory endurance
						right	left	
Initial								
Enjoyment	1.00	0.178	0.173	-0.151	0.239	-0.102	0.102	-0.204
Effort	0.178	1.00	0.089	0.154	0.024	0.052	0.114	-0.104
Final								
Enjoyment	1.00	0.838**	0.651**	0.626**	0.467**	0.541**	0.635**	-0.469**
Effort	0.838**	1.00	0.688**	0.656**	0.402**	0.618**	0.733**	-0.504**

Note: ** = $p < 0.01$

DISCUSSION

The present study aimed at evaluating the health-related physical fitness level of pupils aged 10 to 11 before and after the application of a dance aerobic intervention program, as a means to improve health related fitness, intrinsic motivation and their correlation.

The reason of choosing dance aerobic as a means of improving health-related physical fitness elements was that children participate in it with pleasure [17, 21]. Moreover, such programs contribute to children's cognitive and emotional development [3] and significantly ameliorate kinetic skills, which are considered essential for the establishment of a kinetic basis for children in the upper grades of primary education.

With the application of a dance aerobic intervention program, as shown by the findings of the experimental group, there was an improvement of all health-related physical fitness parameters and an increase of the intrinsic motivation, which was expressed by the increase in interest, enjoyment and effort [7, 19]. Specifically, there was an improvement in the strength/endurance of the abdominal muscles, flexibility of the muscles of the back and of the hip and an improvement in the strength of the hands, due to the special exercises, which were carried out in each training unit by the experimental group. Conversely, the performance of the control group declined. The findings of the study agree with the findings of other studies [16, 21, 27], according to which the above physical abilities improved in experimental groups. In terms of the cardiorespiratory endurance, the findings showed that the experimental group improved considerably after the application of the program, since, in the final measurement, the pupils covered the distance of one mile in less time than in the initial measurement. However, the control group also showed an improvement, and this may be due to its participation in the physical education classes at school, as well as to the variable "age". Martin [18] says that children's endurance increases, at the age of 7 to 11, due to maturation. Ignico et al. [16] have also ascertained an improvement of the cardio-respiratory endurance of children. Similar studies [1, 21, 27] showed an improvement of the cardio respiratory endurance in both groups with the improvement of the experimental group being better than the improvement of the control group.

In relation to intrinsic motivation, the findings revealed that the pupils who participated in the dance aerobic intervention program increased their intrinsic motivation, by increasing their levels of interest, enjoyment and effort. These findings are in accordance with those of McIlloy et al. [21], who supported that the use of dance aerobic is a non-competitive, entertaining activity, which improves health-related fitness and intrinsic motivation. On the contrary, participation only in the typical physical education program seems inadequate to achieve the above purpose. According to Gabbard [11], the first half of a physical education class should be dedicated to dance aerobic, which is a complex activity, since it develops endurance, muscular strength, flexibility and rhythm coordination.

In summary, the application of a dance aerobic program is easy for physical education instructors to design and enjoyable for pupils to apply. It can be said that today, the application of such programs is imperative due to the modern way of living, which is characterized by the absence of any kinetic activity. Moreover, it could also be used as a preventive measure against potential disorders, since today's unhealthy child is tomorrow's potential adult patient.

REFERENCES

- [1] Albert B., Field T., Goldstein S., & Perry S., Aerobic Enhances Cardiovascular Fitness and Agility in Preschoolers, *Health Psychology*, 1990, 9: 48-56.
- [2] Biering-Sorensen F., Bendix J., Jorgensen K., Manniche C. & Nielsen H., Physical activity fitness and back pain, (in:) C. Bouchard, R.J. Shepard & T. Stephens, eds, *Physical Activity Fitness and Health*, Champaign, Illinois, Human Kinetics 1994, pp. 737-748.
- [3] Brodie D.A. & Birtwistle G.E., Children's Attitudes to Physical Activity, Exercise, Health and Fitness before and after a Health - related Fitness Measurement Programme, *International Journal of Physical Education*, 1990, 27, 2: 10-14.
- [4] Cooper Institute for Aerobics Research, *The prudential Fitnessgram test administration manual*, Dallas: Author, 1992.
- [5] Cotton R.T. & Goldstein R.L., *Aerobics instructor manual. The resource for group fitness instructors*. USA: American Council on Exercise, 1997.

- [6] Deci E. & Ryan R., Intrinsic motivation and self-determination in human behavior, New York: Plenum, 1985.
- [7] Derri V., Kioumourtzoglou E. & Bousiou S., Enhancing health-related fitness in young children. (in:) International Seminar on Physical Fitness and Health Development of Infants and Young Children, Macao Sport Development Board, Macao SAR, 2003, pp. 64-73.
- [8] Diggelidis N. & Papaioannou A., Age group differences in intrinsic motivation, goal orientations and perceptions of athletic competence, physical appearance and motivational climate in Greek physical education, *Scandinavian Journal of Medicine and Science in Sports*, 1999, 9: 375-380.
- [9] Duda J.L., Maximizing motivation in sport and physical education among children and adolescents: the case for greater task involvement, *Quest*, 1996, 48: 290-302.
- [10] Eickhoff J., Thorland W. & Ansoerge C., Selected physiological and psychological effects of aerobic dancing among young adult women, *Journal of Sports Medicine*, 1983, 2: 273-280.
- [11] Gabbard C., Health-related fitness. Curricular formats for elementary physical education, *Strategies*, 1990, pp. 14-18.
- [12] Harsha D.W., The Benefits of Physical Activity in Children, *American Journal of Medical Science*, 1995, 310: pp. 109-113.
- [13] Harter S. & Connel J., A comparison of alternative models of the relationships between academic achievement and children's perceptions of competence, control, and motivational orientation, (in:) J. Nicholls, ed., The development of achievement-related cognitions and behaviors, Greenwich: JAI Press, 1984, pp. 219-250.
- [14] Hinson C., Fitness for Children, Human Kinetics, 1995.
- [15] Hooper P.L. & Noland B.J., Aerobic dance program improves cardiovascular fitness in men, *Physical and Sports Medicine*, 1984, 12 (5): 132-135.
- [16] Ignico A.A. & Mahon D.A., The Effects of Physical Fitness Program on Low – Fit Children, *Research Quarterly for Exercise and Sport*, 1995, 66: 85-90.
- [17] Kremenitzer P.J., Aerobic Fitness Dancing in the Elementary Schools, *Journal of Physical Education, Recreation and Dance*, 1990, 61: 89-90.
- [18] Martin D., Training in Kindes- und jugendalter. Schorndorf: Verlag Karl Hofmann, 1988.
- [19] Mavridis G., Filippou F., Rokka S., Bousiou St. & Mavridis K., The effect of a health-related aerobic dance program on elementary school children, *Journal of Human Movement Studies*, 2004, 47: 337-349.
- [20] McAuley E., Duncan T. & Tammen V.V., Psychometric properties of intrinsic motivation inventory in a competitive sport setting: A confirmatory factor analysis. *Research Quarterly of Exercise and Sport*, 1989, 60: 48-58.
- [21] McIllroy H.B., Roundy S.E. & Jacobson C.P., A Progressive Aerobic Program for Elementary Aged Children, *The Physical Educator*, 1989, 46: 21-26.
- [22] Nicholls J., The competitive ethos and democratic education. Cambridge, MA: Harvard University Press, 1989.
- [23] Pangrazi P.P., Teaching Elementary Physical Education: A Handbook for the Classroom Teacher, USA: Allyn and Bacon, 1997.
- [24] Rockfeller K.A. & Burke E.J., Psycho – physiological analysis of an aerobic dance program for women, *British Sports Medicine*, 1979, 13: 77-80.
- [25] Sheefeldt V. & Vogel P., Children and fitness: a public health perspective. A response, *Research Quarterly for Exercise and Sport*, 1987, 58: 331-333.
- [26] Silvestri L. & Oescher J., Use of Aerobic Dance and Lights Weights in Improving Selected Measures of Strength, Endurance and Flexibility, *Perceptual and Motor Skills*, 1990, 70: 595-600.
- [27] Werner P. & Durham R., Health Related Fitness Benefits in Upper Elementary School Children in a daily Physical Education Program, *The Physical Educator*, 1988, 45: 89-93.