



Original Article

The effect of nonlinear pedagogy on motor proficiency and self-esteem of hyperactive obese girls

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Abstract

Introduction: Obesity and hyperactivity have links with various diseases and trying to eliminate the related problems is of importance. The purpose of the study was to investigate the effects of fundamental motor skills interventions with non-linear pedagogy on motor proficiency and self-esteem in obese hyperactive girls in Tehran, Iran.

Materials and Methods: In this study, twenty obese hyperactive girls were selected through convenience sampling in Tehran during summer-2018, and were assigned to control and experimental groups based on the scores in pre-test. In order to determine the obesity, charts from World Health Organizations were used. Campbell Scale and child's health document, which usually is validated by a medical doctor's comment, were utilized to evaluate hyperactivity. For measuring self-esteem, Cooper-smith Self-Esteem Inventory was used, and motor proficiency was measured using Bruininks-Oseretsky Test of Motor Proficiency-2. The experimental group fulfilled exercises for nine weeks (twice one-hour sessions). Motor interventions included bouncing with ball, jumping, long step, jump-up, kicking with foot, hopping, catching, running, and over-arm throwing, all done through non-linear method. The control group did the usual activities during the study. The data analyzed through descriptive statistics, covariance analysis and SPSS software.

Results: The results indicated that the selected motor interventions in experimental group compared to control group had significant effect on self-esteem ($F= 52.3, P=0.00$), and motor proficiency ($F=9.021, P= 0.008$).

Conclusion: It seems that interventions with non-linear method affect the elimination of problems of obese hyperactive children. This issue confirms the role of physical activity based on exploratory methods in eliminating the problems of obese and hyperactive people.

Keywords: Hyperactivity, Motor skill, Obesity, Self-esteem.

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Introduction

Attention-Deficit Hyperactivity Disorder (ADHD) is a neural disorder determined based on attention deficit, hyperactivity, and irritability, which are common in childhood (1). Hyperactivity disorder leads to several problems for many students in educational, cognitive, social, and emotional aspects, also in later adulthood in occupational performance and family fields. Moreover, these children represent difficulties attending and concentrating on repetitive training (1). The rate of hyperactivity in children estimated as 7% in the worldwide. In Iran, this rate is increasing, and such children deserve special attention (2). On the other hand, the literature has illustrated the link between hyperactivity, overeating, and obesity (3).

Obese hyperactive children suffer from psychological and social problems, including lack of self-confidence and motor clumsiness (4). Concerning motor problems, lack of attention, and concentration may lead to negative image and low self-confidence in hyperactive and obese children. Obese children suffer from low self-esteem, and hyperactive children are prone to obesity. Therefore, low self-esteem is more pronounced in obese hyperactive children (5).

Self-esteem is defined as the person's satisfaction with his/herself, or the value the person holds for him/herself (6). High self-esteem directly links with rational behavior, realism, intelligence, independence, flexibility, ability to accept change, tendency to amend the mistakes, benevolence, collaboration, motor skills learning, and cooperation (6). In addition to low self-confidence, hyperactive children appear to be lower than their peers in terms of motor proficiency as the optimal level of fundamental motor skills. Based on motor competence theory, this can affect physical activity in which immobility and related problems occur. Hence, attention to the promotion of motor proficiency in such children is of importance (4).

Trying to eliminate the problems of hyperactive children has been represented in many ways. Medical and pharmaceutical interventions have been expected; however, researchers believe utilizing effective methods such as motor interventions with no side effects is preferable (7). Several studies on this matter have indicated positive results on

hyperactive children. Among the recommended interventions for eliminating the problems of obese children are motor interventions (4). In a study, physical activity is effective to promote the self-esteem in blind children (8). Other studies about the self-esteem showed similar results as well (9,10). Hence, it seems that self-esteem is trainable; however, the issue for obese hyperactive children is solely hypothesized and needs to be investigated.

Studies on the effect of different types of exercise on motor proficiency (11) and children with disorder (12) have been conducted. Shahbazi et al. have reported the positive effects of perceptive-motor exercises on motor proficiency of hyperactive children (13). In another study, the selected motor interventions were effective on improving motor skills (14). Selected motor interventions are among the most critical interventions in improving motor skills and other related factors (15) because they are the base of professional sport and motor performance and routine activities, such interventions have attracted attention in schools, especially pre-elementary and elementary schools (4).

In contrast, in other motor learning studies, especially the ones conducted on low age individuals, researchers believe interventions and training have a significant impact on development, learning, and motor performance, and hence the type of exercise is necessary (16,17). Nonlinear training methods are among the introduced methods of pedagogy by dynamic systems scientists, which accentuate manipulation of constraints compared to presenting optimal pattern and feedback (16). Nonlinear pedagogy methods are based on critical ideas and concepts of environmental dynamics (18), in which nonlinear relationships in human motor systems continually occur in learning situations, and the quality of organization of pedagogical approach should be taken into account. In ecological dynamics, each of the performers is taken into account contrary to a group of learners. This perspective necessarily follows an individual approach to learning, and it investigates how each learner can respond to interactive constraints present in learning situations (16). In this approach, acquisition of a skill is viewed in developing a functional relationship between executor and

environment, and the learner is not separated from the background and performance (19). Through identifying bumps for each person and manipulating the proper constraints about the bumps of all learners, the approach aims to design the exercise (16). The learner in this approach exercises in an exploratory and game-like environment (16) and is stimulated to solve the learning problems, which boosts a person's self-esteem and encourages him/her for active participation (16,18). However, these issues are claimed, and few studies have tried to evaluate them empirically (20,21).

On the other hand, it is claimed in this method that presenting an exploratory exercise is not repetitive and facing a game-like environment fulfills the need for special attention to learning a specific task, the fact which seems to be better for hyperactive children suffering from attention issues, and which encourages them to continue the activity, which in turn affects the motor skill and ultimately improves self-confidence. Nevertheless, the issues above are nonlinear methods, and few studies have empirically investigated them. Several studies have investigated the effect of such training methods on psychological variables such as motivation and creativity (18,19); however, these studies were conducted on normal children, and on the other hand, the effect on other psychological and motor variables such as self-esteem and motor proficiency is not determined. Therefore, the present study aimed to investigate fundamental motor skills with nonlinear methods on self-esteem and motor proficiency of obese hyperactive girls.

Materials and Methods

The research approved by the Physical Education Faculty of Kharazmi University of Tehran, Iran. The statistical population of the study included all obese girls in Tehran, Iran. The participants were selected from four private schools in the Sixth District of Tehran in the summer of 2018. In each school, 200 students were available (a total number of 780 students). Based on Campbell et al. scale and the fourth edition of the Diagnostic and Statistical Manual of Psychiatric Disorders, 24 hyperactive children were selected. Campbell et al. scale is used for diagnosis of hyperactivity and evaluation of the efficacy of intervention since it is based on gender and age. This scale has a high validity and is

fulfilled through reports of teacher and parents (22). In this research, it was used for the primary election, and the final selection was made concerning health documents of children, physician's comments in health documents of schools, and accurate medical reports presented by parents. The inclusion criteria included diagnosis of hyperactivity based on Campbell et al. scale and medical documents, having obesity concerning the charts of World Health Organization (WHO), being devoid of psychological or other disorders which could affect the result of the study, to be referred by health document of the child. Exclusion criteria included lack of cooperation to participate in behalf of sessions during the study, and determining lack of properness in interventions by participants or parents.

In order to determine obesity in girls, height and weight were measured. Body Mass Index (BMI) was calculated using the formula, and charts were used for categorization of BMIs. The charts depict the curve of centiles of BMI, height for age, and weight for age by gender and age by month for people aged 2-20 years. The terms correspond to WHO and are hence used internationally. Using the centiles of anthropometrical data, each person is assigned to a specific group, and the approximate place of each child in the normal distribution of the population can be henceforth determined. The charts can determine weight labels as thin, obese, overweight, and with average weight by BMI. In the present study, children above the 95 centiles were considered obese and selected (23-25). At this level, one of the participants was not above the selected centile based on the obesity criterion of the study and was omitted. The researchers explained the goals of the study to the parents. Parents of three children claimed their disagreement for the presence of children, and consent was taken from the twenty participants, which were ultimately remained.

Research instrument

A) Cooper-smith Self-Esteem Inventory: It was produced and compiled in 1967. This 58-item scale is a self-reported scale. Researchers reported the test-retest coefficient of the scale to be 0.88 after thirty-five days and 0.70 after three years. In a study, the validity coefficient of the scale was calculated through correlation of scores with the mean at the end of the year,

and the coefficients were 0.69 for boys, and 0.71 for girls. The reliability of the inventory was 0.90 based on Cronbach's Alpha and 0.88 based on the halving method. In Iran, the reliability of this inventory for the entire inventory was 0.90, which showed an appropriate reliability coefficient, and the inventory is used in different studies (26).

B) Bruininks-Oseretsky Test of Motor Proficiency 2 (modified version): In order to evaluate the variations of motor proficiency, the Bruininks-Oseretsky Test of Motor Proficiency 2 (modified version) was used (27). The test includes eight subtests (four ancillary tests in gross movements, three ancillary tests for fine movements, and one ancillary test for upper limb conformity), with 46 items including a broad profile of motor skill with good quality separate measurement of gross and fine motor skills. The real test is a comprehensive index for motor proficiency and individual scales of gross and fine motor skills for children aged 4-21 years. The time needed for original and modified versions of the test are 45-60 minutes, and 15-20 minutes, respectively. The test is used for screening, placement, progress evaluation, pedagogy or intervention planning, and researching. The shortened modified form of the test, including 14 items from the original test, can be used as an instrument for quick screening. The validity coefficient of Bruininks-Oseretsky Test in investigating motor skills was 0.90. The reliability coefficient of test-retest for this test in original form and modified form is 0.78 and 0.86, respectively. The modified version measures people's motor skills generally, and the total score illustrates general skills, including gross and fine skills (27). The validity and reliability of the test are reported to be above 0.90 for Iranian children. So, it is a proper instrument for measuring motor proficiency of Iranian children (28). At this level, each of the movements in a specific test before the pre-test to post-test was observed and scored by two physical education experts through precise observation of component variations. The variation of the total score was considered as the criteria. The participants each performed the subtests three times, and two people from the back and forward sides assigned a score for the participants. Selected motor interventions included bouncing with the ball, jumping, long steps, jump-up, kicking with the foot, hopping, catching, running, and

over-arm throwing (29,30). The study environment, which was in a sports hall, was designed by the authors before starting the training sessions. The environment was divided into intervention stops in which images indicated the task to be fulfilled in each stop. The tasks did not provide any instruction about the movement pattern and solely indicated the location of task. The path between tasks was chosen for running or walking; however, participants were told that the green path was running and the yellow path was for walking. The whole hall was covered with mats. The skills were exercised wholly in the interventions, and the coach was not allowed to encourage participants to do one sole skill. The participants were taken to the designed environment, and choosing the task to be fulfilled was granted to them. No detailed information or feedback was given to the participants, except for informational constraints in case the coach realized that the person had learned levels of a task freely through playing, providing that the information did not help form an ideal pattern (16). The role of the coach in environment designing, when needed, was to manipulate the task constraints for the learner when the coach felt that the selected child could not fulfill the performance properly (31,32). Environment manipulations were elastic shoes, colorful and light ball for bouncing with the ball, elastic shoes for jumping, colorful flashes for designing the proper path of the foot for long step, elastic shoes and forming a circle via colorful tableaus and sponge to jump in the right place and prevent damages in case of falling, and lighter balls for kicking with the foot. Moreover, the ball path to the target point was limited and highlighted by colorful tableaus to help lead the ball. In this method, the targets were quickly noticed and determined by the coach; however, the way to reach the target was determined by the child, a process based on principles of innovative pedagogy methods (31,32).

In the present study, 20 cases were selected through convenience sampling from four schools in Six District of Tehran city, Iran. After selecting the participants based on Campbell et al. scale and health documents, arrangements were made for the parents, and consents were taken. Exact weight, height, and age were measured. Pre-test for self-esteem and motor proficiency were done. The

participants were assigned to two control and experimental groups ($n=10$), through a purposive method and based on the pre-test. The experimental group were asked to fulfill training interventions for nine weeks (two one-hour sessions per week), by a female coach expert in nonlinear training in a sports hall in Sixth District in Tehran City, Iran (33,34). The coach held a master's degree in motor behavior with experience working in nonlinear methods and hyperactive children. Nonetheless, the second author of the study, an expert in innovative methods in pedagogy, instructed instruments, environment division methods, and exercise procedures in three sessions for the coach. The Control group did the usual exercises during the study. After the exercises were over, post-tests were taken from both groups, and the results were reported. Warming

up and cooling down were conducted to avoid any potential damage as well. Data analyzed through descriptive statistics, Shapiro-Wilk test, ANCOVA and SPSS software.

Results

The demographic factors of the participants included age, height, weight, and BMI are shown in Table 1. In term of educational degree of the parents, six mothers in the control group and seven mothers in the experimental group had bachelor degrees, and the rest had master degrees.

Five fathers in the control group and four fathers in the experimental group had bachelor degree, and four fathers in the control group and six fathers in the experimental group held master degree. One father in the control group had Ph.D.

Table 1. Descriptive statistics for participants

Group	Weight (kg)	Height (cm)	Age (year)	Body Mass Index
Experimental group	27.80 (2.1)	120.15 (8.14)	7.02 (1.04)	19.25 (3.77)
Control group	27.3 (2.17)	119.17 (6.01)	7.04 (1.06)	19.22 (4.04)

Dependent t-test indicated that there was no significant difference between groups in terms of weight ($P= 0.53$, $t(18) =0.48$), height ($P= 0.49$, $t(18) =0.62$), BMI ($P= 0.41$, $t(18) =0.39$),

and age ($P= 0.37$, $t(18)= 0.44$). Descriptive indices for control and experimental groups in pre-test and post-test levels for dependent variables are shown in Table 2.

Table 2. The scores of self-esteem and motor proficiency

Variables	Experimental group		Control group	
	Pre-test	Post-test	Pre-test	Post-test
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Self-stem	23.16 (2.84)	35.17 (2.28)	22.90 (2.68)	23.6 (2.28)
Motor proficiency	58.68 (5.91)	65.74 (8.57)	58.8 (6.08)	57.8 (4.44)

As shown in Table 2, a score of self-esteem before and after nine weeks of exercise increased from 23.16 to 35.17, which was significant compared to the control group. The score of motor proficiency before and after nine weeks of exercise increased from 58.68 to 65.74 in the experimental group, which was significant compared to the control group. MANCOVA was used to analyze the data and in order to control the effect of pre-and post-test. One of the assumptions of the MANCOVA test is to investigate the homogeneity of variance-covariance matrices. For this purpose, Box's M test was used. The level of significance of Box's M Test was

above 0.05, and homogeneity of variance-covariance matrices was not rejected.

In order to investigate the homogeneity of variance between two groups at the post-test level, Levene's robust test of homogeneity of variances was used. Levene's test was not statistically significant for studied variables, and the variance homogeneity assumption was not rejected as well. In order to determine population distribution (normality of data), Shapiro-Wilks Test was used. In the tests, the significance level was $P>0.05$, which indicates the normality of distribution in the population. Concerning the confirmation of MANCOVA assumptions, using the test was allowed.

Table 3. Results of ANCOVA and the mean scores of self-confidence and motor proficiency in the post-test phase

Variables	Average squares	DF	F	P	Eta	Statistical power
Self-stem	356.488	1	53.31	0.00	0.758	1
Motor proficiency	182.064	1	8.031	0.00	0.357	0.808

In order to investigate the effectiveness of motor interventions, MANCOVA was used. The results indicated the effectiveness of the intervention. In order to investigate the difference pattern, ANCOVA was used as indicated in Table 3. As shown in Table 3, the results indicated a significant difference between the control and experimental groups. ANCOVA was used to determine the difference. Based on Table 3, the value of F for self-confidence is 53.31 ($P= 0.000$), and concerning the calculated squared Eta coefficient (size of effect), 75 percent of the variation in self-confidence was due to the independent variable (nonlinear pedagogy). Concerning data in Table 3, the value of F for motor proficiency was 8.031 ($P= 0.008$), and concerning the calculated squared Eta coefficient (size of effect), 35 percent of the variation in motor proficiency was due to the independent variable (nonlinear pedagogy).

Discussion

The purpose of the present study was to investigate the effect of fundamental motor skills interventions with nonlinear methods on self-esteem and motor proficiency of obese hyperactive girls in Tehran, Iran. In order to conduct the study, nine weeks of motor skills interventions were presented to ten children. The results showed significant progress on self-esteem and motor proficiency in experimental group participants compared to control group participants.

Práxedes et al. reported the importance of nonlinear methods on the emergence of tactical movements in football in children to be positive. The researchers indicated that for children training in the nonlinear method, creative movements of passing, dribbling, and shooting were significant, while the amount of increase in the control group was lower compared to the experimental group (35). In our study, the increase in scores of motor proficiency and self-esteem in the experimental group was same as their study. The difference was noticed between the linear versus nonlinear method for the control group (36), while in our study, this difference was

significant between the nonlinear and control groups. In terms of the effect of sports interventions on hyperactive children, the interventions were not performed non-linearly; however, sports interventions for this group were positive. Da Silva et al. reported swimming interventions to be positive for hyperactive children. The researchers reported the significant effect of swimming compared to control group on depression, cognitive flexibility, selective attention, and stress (37). We reported fundamental motor skills with nonlinear methods on self-esteem and motor proficiency compared to the control group. Moreover, the present study indicated the effect of motor skills interventions with the nonlinear method on motor proficiency as useful. Alizade and Mohamadzade reported the nonlinear pedagogy method effectively on basketball skill learning in children. The researchers reported manipulating constraints in level to be effective on learning basketball skills (38,39). Ghorbani et al. investigated nonlinear pedagogy methods on manipulation skills of eight-year-old children for six weeks and reported the effect of nonlinear over linear method to be positive (40). Both studies support our results for newer variables (i.e., motor proficiency and self-esteem).

In order to illustrate the results of the study, Stooden's Model and Harter's Motor Competency Model can be utilized. In these models, the role of motor competence and qualification in participation in physical activities and self-esteem are emphasized.

The general model claims that motor competence and body image of the individual results in the person's participation in physical activities, and motor competence of the individual boosts by continuing the activity, and the person maintains a right and clear image of him/herself, and self-confidence and self-esteem for continuing the activity increases. Hence, the model claims that self-esteem, as the result of physical activity, encourages the person for a more active life and eliminates mental and physical problems in childhood and adulthood. Selected motor interventions along with a set of motor

activities as in fundamental motor skills improve an individual's motor proficiency (41), and concerning the fact that motor proficiency is a starting point for reaching championship and professional sports, such interventions maintain self-esteem for the person through promoting motor proficiency and encourage the person for participating in physical activities and ignoring the false body image he/she has ever had in his/her mind. Therefore, activity leads the person to consider obesity as a part of society and try to solve the problems resulting from overweight and hyperactivity (4). In nonlinear pedagogy, individual differences are taken into account. By designing an environment in proportion to an individual's characteristics, this method seems to effectively disordered people.

The present study confirmed the claims of nonlinear methods to increase self-esteem in the learner (16,18). As this method puts forward, the individual reaches independence by being placed in an exploratory environment. He/she is happy by doing his/her chores, and his/her self-esteem boosts by being beside other people (16). Nonlinear methods increase motivation by exploratory activities, leading the individual to believe that he/she can do his chores independently (42,43). Moreover, when children learn that they are not evaluated or scolded, extreme withdrawal of the activity is eliminated (33). Exploratory intervention is a method by which the child defines him/herself (44). Innovative pedagogical methods are effective treatment methods that decrease social isolation and its adverse effects on a child's life (33,43,44). In nonlinear methods, being placed in a game-like environment, in which the coach's role is to design the environment in proportion to individual characteristics (20,21), is the best choice for children suffering from social problems such as low self-esteem or problems being mentioned. In contrast, others are

present (e.g., obesity, hyperactivity, and due problems) since the learner does not face the coach's feedback and explores him/herself in the environment. The therapist helps the child to learn to express him/herself and his/her excitements adequately. Helping to participate in learning, self-observation, responsibility for showing emotions, respecting, accepting self and others, improving behaviors such as social skills, maintaining personal dignity, and decreasing depression are among the general objectives of this intervention (16,18,19,30). Among the most critical limitations of the study was that no comparison was made between this training method and a linear or traditional training method, which can motivate future studies to repeat such a study. The researchers can investigate this training method for other disorders such as Developmental Coordination Disorder (DCD).

Conclusion

Concerning the results of this study, it seems that motor interventions with non-linear methods effectively eliminate problems of obese hyperactive children, which confirms the effect and positive role of physical activity in innovative methods for people with special conditions, including obese children. In proportion to the results and utilizing the mentioned interventions, self-esteem and motor proficiency in obese hyperactive children can be improved, and they can progress in self-esteem, social, educational, physical, and familial aspects.

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