

DANCE IN THE TREATMENT OF CHILDHOOD OBESITY: A PROPOSED PROTOCOL




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A DANÇA NO TRATAMENTO DA OBESIDADE INFANTIL: PROPOSTA DE PROTOCOLO

LA DANZA EN EL TRATAMIENTO DE LA OBESIDAD INFANTIL: PROPUESTA DE PROTOCOLO

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ABSTRACT

Introduction: Low levels of daily physical activity is considered to be one of the causes of the exorbitant increase in overweight and obese children, and associated comorbidities. Therefore, it is vital to develop strategies that will be implemented consistently, to improve this situation. Studies have used dance as a resource for training overweight and obese children, but the lack of information about the creation process and its respective stages reduce the possibility of these proposals being effectively applied. **Objectives:** To describe the steps in the creation of a dance protocol as a training resource, and its effectiveness in improving the health parameters of overweight and obese children. **Methods:** 30 children (9 ± 1.1 years) underwent training sessions consisting of a five-minute warm-up at 60% HRmax., and four 10-minute sessions at 70% to 80% at HRmax. interspersed with five 2-minute active recovery periods at 60% HRmax. The sessions were carried out three times a week, and lasted 60 minutes each, over a 13-week period. Before and after the training, the body composition, body mass index (BMI), BMI z-score, waist circumference (WC), waist-to-height ratio (WtHR), systolic (SBP) and diastolic (DBP) blood pressure and blood variables were measured. Statistical analysis was performed using a mixed effects regression model. **Results:** After training with Afro-Brazilian dance, there was a significant reduction ($p < 0.05$) in the BMI z-score and waist-to-height ratio. **Conclusion:** Afro-Brazilian dance training was a strategy with a positive effect on BMI z-score and waist-to-height ratio in overweight and obese children. **Level of evidence IV; Case series.**

Keywords: Child obesity; Dancing; Exercise.

RESUMO

Introdução: A diminuição da prática de atividade física diária é considerada uma das causas do aumento exorbitante de crianças com sobrepeso, obesidade e comorbidades decorrentes. Portanto, é de fundamental importância que estratégias que visem auxiliar na melhora desse quadro sejam desenvolvidas e implantadas de forma consistente. Os estudos têm utilizado a dança como recurso no treinamento de crianças com sobrepeso e obesidade, porém a falta de informação sobre o processo de criação e respectivas etapas diminui a possibilidade dessas propostas serem utilizadas de forma eficiente. **Objetivos:** Descrever as etapas da elaboração de um protocolo de dança como recurso de treinamento e sua eficácia em parâmetros de saúde de crianças com sobrepeso e obesidade. **Métodos:** Trinta crianças ($9 \pm 1,1$ anos) realizaram um treinamento que consistia em cinco minutos de aquecimento a 60% da FCmáx, quatro momentos de dez minutos de 70% a 80% da FCmáx intercalados com cinco momentos de dois minutos de recuperação ativa a 60% da FCmáx, 3x/sem, 60 minutos por sessão, durante 13 semanas. Antes e após o treinamento foi realizada a avaliação da composição corporal, índice de massa corporal (IMC), z-score do IMC, circunferência da cintura (CC), relação cintura/estatura (RCE), pressão arterial sistólica (PAS) e diastólica (PAD) e variáveis sanguíneas. A análise estatística foi realizada utilizando o modelo de regressão de efeitos mistos. **Resultados:** Após o treinamento com danças afro-brasileiras houve redução significativa ($p < 0,05$) no z-score do IMC e na relação cintura/estatura. **Conclusão:** O treinamento com danças afro-brasileiras foi uma estratégia com efeito positivo sobre o z-score do IMC e relação cintura/estatura de crianças com sobrepeso e obesidade. **Nível de evidência IV; Série de casos.**

Descritores: Obesidade infantil; Dança; Exercício.

RESUMEN

Introducción: La disminución de la práctica de actividad física diaria es considerada una de las causas del aumento exorbitante de niños con sobrepeso, obesidad y comorbilidad resultantes. Por lo tanto, es de fundamental importancia que las estrategias que apunten a ayudar en la mejora de ese cuadro sean desarrolladas e implantadas de forma consistente. Los estudios han utilizado la danza como recurso en el entrenamiento de niños con sobrepeso y obesidad, pero la falta de información sobre el proceso de creación y respectivas etapas disminuye la posibilidad de que esas propuestas sean utilizadas de forma eficiente. **Objetivos:** Describir las etapas de elaboración de un protocolo de danza como recurso de entrenamiento y su eficacia en parámetros de salud de niños con sobrepeso y obesidad. **Métodos:** 30 niños ($9 \pm 1,1$ años) realizaron un entrenamiento que consistía en cinco minutos de calentamiento a 60% de la FCmáx, cuatro momentos de diez minutos del 70% a 80% de la FCmáx intercalados con cinco momentos de dos minutos de recuperación activa a 60% de FCmáx, 3x/semana, 60 minutos por sesión, durante 13 semanas. Antes y después del entrenamiento fue realizada la evaluación de la composición corporal, índice de masa corporal (IMC), z-score del IMC, circunferencia de cintura (CC), relación cintura/estatura (RCE), presión arterial sistólica (PAS) y



la diastólica (PAD) y variables sanguíneas. El análisis estadístico se realizó utilizando el modelo de regresión de efectos mixtos. Resultados: Después del entrenamiento con danzas afrobrasileñas hubo reducción significativa ($p < 0,05$) en el z-score del IMC y en la relación cintura/estatura. Conclusión: El entrenamiento con danzas afrobrasileñas fue una estrategia con efecto positivo sobre el z-score del IMC y relación cintura/estatura de niños con sobrepeso y obesidad.

Nivel de evidencia IV; Serie de casos.

Descriptor: Obesidad pediátrica; Baile; Ejercicio.

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INTRODUCTION

Weight gain in infancy becomes more relevant as the years pass. In Brazil, data from the Brazilian Institute of Geography and Statistics (IBGE) show that one in every three children between five and nine years old is overweight or obese¹. The physical and psychological consequences that result from this disease have been the focus of national and international studies^{2,3}. Reducing sedentary behavior by practicing regular exercise can help in the process of decreasing the body mass index (BMI), thus providing better quality of life. Advances in this sense have helped researchers to investigate possible training types that are effective for children and adolescents⁴.

Recent studies use dancing as a form of exercise for obese children, resulting in metabolic improvements, in adherence to practicing a more physically active life^{5,7}, and in quality of life⁷. There are few dancing protocols described that can be reproduced due to a lack of detail about the process of building and executing them.

It is understood that with dancing it is also possible to develop cultural learning, and so it is interesting to incorporate knowledge of Brazilian culture into this context. Afro-Brazilian dances are widely known, however they are barely covered in infancy. For this culture to be positively uncovered, it is important to practice it daily. According to data from the Continuous National Household Sample Survey, published by the IBGE (2016), 55.4% of the population of Brazil define themselves as brown (47.2%) or black (8.2%)⁸. Thus, besides the bodily experience, debating and recognizing the importance of this topic will consistently help in developing awareness in relation to inequalities and differences⁹.

In light of the above and considering the gaps that exist in the science, the aim of this study was to describe the stages in elaborating an Afro-Brazilian dancing protocol as an exercise resource for overweight and obese children and its effects on health parameters after a 13-week intervention.

MATERIALS AND METHODS

This is a longitudinal, quasi-experimental study, conducted in a municipality in the interior of São Paulo state. The research was approved by the Research Ethics Committee of the School of Physical Education and Sport of Ribeirão Preto of the University of São Paulo (CAAE 509757151.1.0000.5659) and by the Commission for Evaluating Research Projects of the Municipal Secretariat of Health of Ribeirão Preto.

30 children were recruited at basic health units and centers specialized in treating obese children in the municipality of Ribeirão Preto, SP, Brazil, in the period between June 1st of 2016 and May 29th of 2017. In addition, the project was promoted through posters, social media, phone calls, and home visits.

The parents or legal guardians of the children signed a free and informed consent form for the children to begin participating in the project and the children were also asked for verbal consent.

The inclusion criteria used were: children aged between 7 and 10 years old and presenting a medical certificate clearing them to perform

physical exercise. The exclusion criteria were: presenting a medical condition, including joint problems, that could prevent them from carrying out the tests and training sessions; not having a legal guardian to accompany the training sessions; and having more than 25% absence in the training sessions.

The music was previously selected and classified into three musical speeds (slow, moderate, and fast) according to the beats per minute (bpm), determined by a Wittner brand metronome, where a slow speed varied from 40 bpm to 72 bpm, medium ranged from 73 bpm to 120 bpm, and fast from 121 bpm to 208 bpm¹⁰.

The steps were arranged during the weeks of class according to their complexity, that is, the number of parts or components involved in mastering them, as well the informational processing required to execute them. The steps used during the training period were divided according to the rhythm involved (frevo, samba, or forró).

To compose the choreographies an addition method was used, in which the components of the task can be included gradually. After learning the first component of the ability (step), the second is included and both are executed. The other components follow the same proposal¹¹. Thus, after 10 minutes the choreography was put together and being executed by everyone.

The warm-up lasted 5 minutes at 60% maximum heart rate (HRmax), considering the maximum heart rate of the ergometric test carried out¹². The speed of the music used in this stage was slow. This phase was composed of recognizing the movements used during the main part of the class. The main part lasted 40 minutes at 70% to 80% maximum heart rate (HRmax), considering the maximum frequency of the ergometric test carried out¹².

The musical speeds used in this stage were medium and fast. In this phase the choreographies were structured (addition method) and after 10 minutes they were executed, using all the steps that composed them.

Recovery lasted 10 minutes (divided into five 2-minute periods each) at 60% maximum heart rate (HRmax). The musical speed used in this stage was slow. To compose this phase, the intervals between one choreography and another (Figure 1), one or two steps that composed the choreographies executed in the blocks were chosen and executed during the music at that moment. To guarantee that the children trained within the desired intensity during all the stages of the training sessions their heart rate was continuously monitored using the Polar Team² system (Finland).

All the evaluations were carried out in the weeks before and after the 13 weeks of physical training. To evaluate the participants' level of physical activity an adapted questionnaire was used evaluating physical activity and inactivity in children and adolescents. The questionnaire assesses the physical activities carried out and classifies the individuals based on the volume of physical activities practiced in the week prior to its application¹³.

Somatic maturation (peak growth velocity)

Peak growth velocity (PGV) is a resource for monitoring anthropometric variations, in which the age of the peak height growth velocity

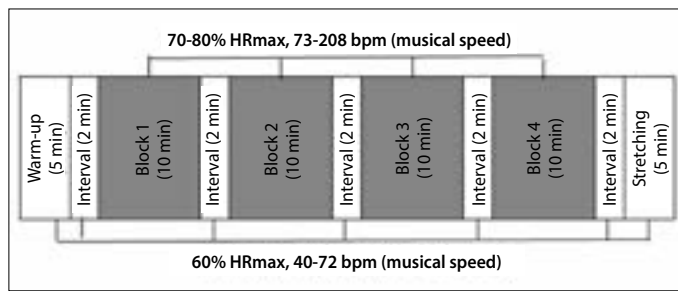


Figure 1. Structure of the training session.

is a very important indicator of maturation. This model considers brainstem height (sitting height in centimeters), leg height (stature minus brainstem height in centimeters), age (years), stature (cm), and body mass (kg)¹⁴.

Anthropometric and blood pressure evaluation

Body mass was expressed in kilograms and height in centimeters, measured by a Welmy digital scale/stadiometer, model W200ALCD, with 0.1 kg and 0.01 m precision, respectively.

The height measure was carried out with the children standing, with their legs together, their heels, buttocks, and upper part of their backs against the scale, and their arms loose by their sides. They were orientated to hold the air in their lungs and their heads in the anatomical position - the Frankfurt Disease Control and Prevention plan¹⁵ was used as a reference.

After calculating the BMI given by body mass divided by height squared (kg/m^2), and the age in full years and months, the data were plotted on z-score curves (BMI by age) for boys and girls between five and 19 years old, according to the reference values established by the World Health Organization².

The abdominal circumference measurement was made with a metric, non-elastic tape measure from Sanny[®], with 0.1 mm precision. The measure was taken with the children standing, at the end of expiration, with the tape positioned horizontally at the midpoint between the lower back arch and the iliac crest¹⁶.

For the body fat percentage analysis a bioelectrical impedance analysis (BIA) was carried out and a Maltron BF[®], model 906 device and disposable Sanny electrodes were used¹⁷. Blood pressure was evaluated using an Omron[®] blood pressure monitor (model HEM-7113, Brazil)¹⁸.

Lipid profile, glycaemia, insulin, and HOMA-IR

For the glycaemia, insulin, and lipid profile analysis, blood was collected after 12 hours of fasting. The analyses were carried out by the Clinical Analyses Laboratory of the Faculty of Pharmaceutical Sciences of Ribeirão Preto of the University of São Paulo, in the biochemistry and hormones/immunology sector. The biological material was evaluated using a laboratory technique and BT 3000 plus self-analyzer device from Wiener Lab. The methods used were the enzymatic method for total cholesterol and triglycerides¹⁹, glucose²⁰, and selective inhibition for cholesterol HDL. The plasmatic insulin dosage was analyzed at the same aforementioned laboratory and evaluated by a pharmacist and BT 3000 plus self-analyzer from Wiener Lab using the chemiluminescence method²⁰.

Ergometric test

The ergometric test was carried out on a conveyor belt following the phased protocol validated for this age group, lasting from 8 to 12 minutes and continuously recording the heart rate using the Polar Team² system (Finland). The parents were told to dress the children in comfortable clothes for practicing physical exercises and when the children and parents or legal guardian arrived at the laboratory all of the test procedures were explained to them. The test was interrupted when the child was unable

to continue exercising despite continuous verbal encouragement. Before conducting the test a familiarization session was carried out, also described in detail in the protocol, along with its velocities, inclinations, and criteria for the test to be considered the maximum¹².

Statistical analysis

The result of each test was classified according to the tables of normative values and then analyzed using the SAS program (version 9.2), employing the PROC MIXED procedure. First an exploratory analysis of the data was carried out, described in means and standard deviations. Then the mixed effects linear regression model was used to evaluate the effect of the dance training protocol, considering a 5% level of significance.

RESULTS

90 possible participants were initially recruited. After home visits, telephone contact, clarifications about the stages of the project, and exclusions, 30 children managed to achieve at least 75% presence in the training sessions and were kept in the analyses (Figure 2). The mean age was 9 ± 1.1 years old, the mean PGV was 1.73 ± 0.99 years, and the mean body mass was 54.60 ± 15.86 kg.

Tables 1 and 2 present the results of the linear regression relating to the anthropometric, clinical, and blood evaluations before and after the 13 weeks of Afro-Brazilian dance training.

According to the data presented, the height values, BMI z-score, and weight-to-height ratio (WHR) presented statistically lower values after the training period ($p < 0.0001$, 0.0001 , and 0.002 , respectively) (Table 1).

The data contained in Table 3 show, in descriptive terms, a 41.3% ($\Delta\%$) increase in the weekly time spent practicing physical activity and a 30.2% ($\Delta\%$) decrease in the time of no physical activity - there was a significant difference for both variables.

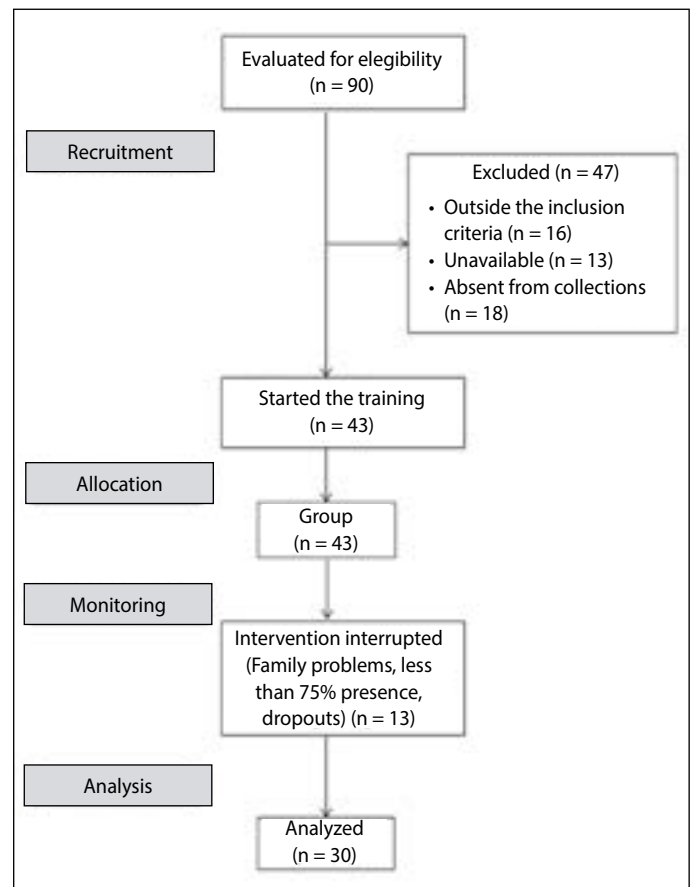


Figure 2. Flowchart of the experimental design.

Table 1. Values relating to the anthropometric and clinical evaluations before and after 13 weeks of Afro-Brazilian dance training.

Variable	Before	After	Δ%
Age (years)	9.00 (1.11)	9.34 (1.17)*	3.7
BM (kg)	54.6 (15.86)	55.08 (16)	0.08
Height (m)	1.40 (0.10)	1.43 (0.10)*	2.1
BMI (kg/m ²)	27.27 (4.86)	27.52 (4.97)	0.09
BMI z-score	3.18 (0.74)	2.97 (0.78)*	-6.6
SBP (mmHg)	105.07 (12.68)	106.20 (12.21)	1.1
DBP (mmHg)	63.20 (6.41)	67.87 (9.77)	7.3
HRrest (bpm)	99.06 (24.85)	87.50(11.66)	-11.7
AC (cm)	86.4 (15.1)	84 (14.2)	-12.8
Waist-to-height ratio	0.62 (0.09)	0.59 (0.08)*	-4.8
Fat (%)	37.37 (4.51)	36.45 (5.23)	-2.4
BMR (kcal)	1306.30 (151.75)	1328.73 (158.70)	1.7

The data are presented as means (SDs). BM: Body mass; BMI: Body mass index; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; HRrest: Resting heart rate; AC: Abdominal circumference; WHR: Waist-to-height ratio; BMR: Basal metabolic rate. *p < 0.05 after versus before the intervention. Mixed effects linear regression model.

Table 2. Values relating to the blood evaluations before and after 13 weeks of Afro-Brazilian dance training.

Variable	Before	After	Δ%
Triglycerides (mg/dl)	89.20 (43.63)	96.07 (51.44)	7.7
HDL (mg/dl)	47.63 (10.16)	46.57 (10.07)	-2.2
LDL (mg/dl)	106.79 (27.89)	104.52 (22.2)	-2.1
Total cholesterol (mg/dl)	172.27 (31.89)	170.30 (27.74)	-1.1
Insulin (μIU/ml)	15.35 (9.55)	15.01 (9.07)	-2.2
Glucose (mg/dl)	84.40 (7.24)	82.07 (7.32)	-2.7
HOMA-IR	3.31 (2.22)	3.27 (2.31)	-1.2

The data are presented as means (SDs). HDL: High density lipoprotein; LDL: Low density lipoprotein. Mixed effects linear regression model.

Table 3. Values relating to the time practicing physical activity before and after 13 weeks of Afro-Brazilian dance training.

Variable	Before	After	Δ%
TWPE (min)	278.00 (200.73)	393.00 (132.79)	41.3
TWNPE (min)	2246.86 (4829.86)	1566.32 (1566.32)	-30.2

The data are presented as means (SDs). TWPE: Time with physical exercise; TWNPE: Time with no physical exercise. Mixed effects linear regression model.

DISCUSSION

This study aimed to verify the effects of 13 weeks of physical training involving Afro-Brazilian dances on the body mass, BMI z-score, waist circumference, waist-to-height ratio, fat percentage, basal metabolic rate, lipid profile, glycaemia, insulin, HOMA-IR, blood pressure, and resting heart rate of overweight or obese children.

According to the data presented in Table 1, no reduction in BMI and fat percentage was observed, however there was a significant reduction in BMI z-score and WHR. In the study by Chrivia and collaborators²¹, despite a reduction in descriptive terms, there was no significant difference in BMI values before and after the training, which also occurred in the study developed by Klakk and collaborators²². This may be explained by the lower precision of the BMI percentage in identifying small alterations in body composition when compared to the z-score percentage. The study by Antunes and collaborators²³ also showed a significant reduction in BMI z-score values after 20 weeks of concurrent training.

With relation to fat percentage, no statistically significant results were found in this sample. This result supports those of a study carried

out in 10 state schools using 632 children between eight and 13 years old. The schools participating in the program added 4.5 hours to their school activities, divided into at least three days a week. No significant alteration was found in the fat percentage values, but there was a reduction in the prevalence of overweight and obese pupils after two years of intervention²².

The WHR value presented a significant improvement after the training period, indicating an improvement in the children's body composition and an attenuation of risk factors, since this is used as a body adiposity indicator and an increase in it is associated with higher blood pressure values²⁴. A study carried out with children between six and nine years old in Brazil also showed the correlation between this measure and the presence of central obesity, as well as an anthropometric indicator associated with dyslipidemia²⁵.

Regarding lipid profile, in this study there was no significant difference in the blood variables after the training period. A study carried out using children and adolescents subjected to a 20-week concurrent training protocol showed a significant reduction in LDL, triglyceride, and total cholesterol values²³.

A study carried out in Kyoto (Japan) using obese (percentage higher than 95) children between 10 and 17 years old sought to investigate the influence of training sessions over eight weeks on stationary bicycles at 60 to 80% reserve heart rate. Their heart rate was monitored during the sessions, which lasted up to 25 minutes, aiming to evaluate a possible improvement in their physical aptitude and insulin resistance. The study revealed a significant reduction in HOMA-IR, but without significant values for glucose, with the HOMA-IR being related to the increase in cardiovascular aptitude²⁶.

What may explain such divergences in the results, besides the difference in training carried out, volumes, and intensities, are the values of the variables investigated in this study being close to or within the normality values before the intervention.

According to the data presented in Table 3, after participating in the training program the weekly time practicing physical activities can increase by 41.3%. These results support a study conducted with adolescents between 11 and 18 years old, which sought to evaluate the impact of dancing on the sedentary behavior of this population, with the use of accelerometers. The adolescents participated in at least one dance class per week at dance schools. The physical activity level was compared between the day on which the sample participated in the dance classes and the day on which they did not participate in the program⁷. At all the physical activity levels dancing caused a significant modification (light, moderate, and vigorous - 20.5%, 31.2%, and 42.6%, respectively), resulting in an 8% reduction in general sedentary behavior²⁷. Finally, we recognize limitations in our study, such as the 3-month intervention time, meaning that our findings cannot be extrapolated to longer time intervals.

CONCLUSION

The elaboration of an Afro-Brazilian dance training protocol was described, which after 13 weeks was shown to have positive effects on health parameters of overweight and obese children, especially on BMI z-score and waist-to-height ratio.

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All authors declare no potential conflict of interest related to this article

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