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RHYTHMIC GYMNASTICS IN PULMONARY FUNCTION AND ANTHROPOMETRY OF A FIBROCYSTIC CHILD: CASE REPORT

Fernanda Nascimento Barbosa
https://orcid.org/0000-0002-1855-6934

Adriana Leite de Sousa
https://orcid.org/0000-0002-2787-4395

Abstract: Introduction: Little is known about the practice of Rhythmic Gymnastics (RG) by children with Cystic Fibrosis (FC). **Goal:** to report the case of a child diagnosed with CF class I with a GLN 1100 PRO intronic mutation that has no classification, GR practitioner and its evolution in spirometric and anthropometric parameters. **Material and Methods:** This study is characterized as a case report, retrospective, descriptive and analytical. The case in question refers to an 8-year-old child, diagnosed with CF, practicing RG. The instruments used for collection were data from the pulmonary function test and the patient's medical records. The study was restricted to spirometric parameters (Forced Vital Capacity (FVC), Forced Expiratory Volume in the first second and Forced Expiratory Flow in the range between 25% and 75% of FVC) and anthropometric parameters (Weight, Height and Body Mass Index). **Results:** Anthropometric parameters were kept within the normal range expected for the child's age group, following the growth curve. However, the spirometric parameters decreased. **Conclusion:** To report the case of a child with CF class I practicing RG and its evolution in spirometric and anthropometric parameters is extremely important to adequately meet the needs of patients with the disease. It is worth inferring the relevance of the research in the contribution of the formation of Physical Education teachers, giving a theoretical support that subsidizes the realization of the practice of RG and the relationship with future students with cystic fibrosis. Therefore, we suggest that RG with all its technique and playfulness is a sport of great contribution to the maintenance and/or improvement of the body mass of the fibrocystic child, keeping the anthropometric parameters of this population very close to normality.

Keywords: Cystic fibrosis, Rhythmic gymnastics, Kid.

INTRODUCTION

Cystic Fibrosis (CF) is a genetic, autosomal recessive, chronic disease with systemic manifestations (ROSA ET AL, 2008). As Franco (2011) points out, as it is a hereditary and recessive disease, the possibility of the birth of a child with the disease is 25%, if each parent has a gene to develop it. Although statistics show a mortality rate between 15-20% before the tenth year of life, in recent years, with greater knowledge about the disease, about 35% of children affected by CF reach adulthood (FRANCO, 2011).).

According to Schindel (2013), the main dysfunction caused by CF is the abnormal transport of ions across the epithelial membrane and as a response there is a loss of function of the CysticFibrosisTransmembraneRegulator (CFTR) protein. This protein is essential for the transport of ions across the cell membrane. Considering the types of CF manifestation, there is a wide variability of disease mutations, divided into 6 classes. Class I CF is characterized by "defects in the synthesis of CFTR, resulting in the absence of its production" (FRANCO, 2011).

Patients with this disease have a dysfunction of the exocrine secretion glands, compromising the digestive, respiratory and reproductive systems (ROSA ET AL, 2008). In addition, due to the thick mucous secretions, the ducts of the exocrine glands are obstructed, which contributes to the appearance of the characteristic triad of the disease: chronic obstructive pulmonary disease with changes in pulmonary secretions, high levels of electrolytes in sweat and pancreatic insufficiency with poor digestion, malabsorption and secondary malnutrition (SCHINDEL, 2013).

In this perspective, Lima (2016) states that the evolutionary course of the disease leads to a marked deterioration of the lungs, pulmonary hypertension and the consequent impairment of respiratory function. This progressive picture especially affects maximal oxygen consumption (VO2Max), the physiological reference indicator for cardiorespiratory capacity, forced expiratory volume in one second (FEV1), a powerful clinical indicator of life expectancy and survival rate, and the ability to Forced vitality (FVC) which is the maximum volume of air that is exhaled with maximum effort, from a maximum inspiration.

The literature points out and recommends the continuous practice of physical exercises and respiratory physiotherapy in cystic fibrosis patients (LIMA, 2016). Currently, there is a growing number of researchers interested in relating and verifying the contribution of physical exercise to CF. Among the described benefits of this regular practice are: decreased joint stiffness, maintenance of muscle strength and a feeling of well-being (LIMA, 2016). However, scholars point out that CF patients usually have low resistance to physical exercises. This is because the impairment of pulmonary functions causes greater fatigue and generates muscle fatigue more quickly during effort, keeping children and adolescents with CF away from exercising (FRANCO, 2011; LIMA, 2016).

Thus, the regular practice of physical activity by cystic fibrosis patients is a challenge due to the time required and lack of information, from parents and patients, regarding the gains provided by this practice (LIMA, 2016). Massery (2005) in his study estimates that the ideal age group to minimize and prevent musculoskeletal deformities in cystic fibrosis patients is from 8 to 12 years of age.

In this sense, Rhythmic Gymnastics (RG) can be seen as a possibility of physical activity for children affected by CF. According to Viebig, Polpo and Correa (2006) RG is a sport practiced only by females and the average age to start the practice is around 6 years old. At this age, children are in the sensitive period for learning basic motor skills and developing fundamental physical abilities.

In this modality, the gymnast can express character and harmony between rhythm and movements. In addition, they convey emotions to the audience through choreography, where "the plasticity of the movements together with their artistic form, grace, beauty and creativity allow viewers to feel a sense of pleasure and satisfaction when watching (TOLEDO et al., 2018; SAMPAIO and VALENTINI), 2015).

For Barros and Barros (2005) the structures referring to the motor and psychic responses in the initiation of RG are elaborated by the execution of natural movements with the objective of implementing the technical movements of the modality, aiming at the experimentation of body language, based on natural movements. sparked by creativity.

The literature signals playfulness as a resource used for the introduction of devices used in the practice of RG, as well as for obtaining the physical capacities necessary for the practice of the modality, such as: muscular strength, flexibility, agility, motor coordination, resistance, capacity cardiorespiratory, balance and speed (VIEBIG, POLPO and CORREA, 2006). This way, the improvement in the growth and development of children and adolescents depends directly on the relationship between sport and adequate nutrition.

Searching the previous literature, a study was identified analyzing children and adolescents with CF who practiced trampoline gymnastics. Curran and Mahony (2008) applied a questionnaire to patients asking them about their preference between trampoline

gymnastics and chest physiotherapy. The results encourage continued use of trampolines with the introduction of clear safety guidelines, reinforcing that trampoline is an adjunct and not a substitute for regular formal physical therapy (CURRAN and MAHONY, 2008). It is worth mentioning that the authors did not assess the patients' spirometric or anthropometric indicators.

Therefore, considering the low rate of studies available in the literature on Rhythmic Gymnastics and specific diseases, the present study aims to report the case of a child with CF class I practicing RG and its evolution in anthropometric parameters. From this descriptive study, it is intended to contribute to the training of Physical Education teachers offering a theoretical support that subsidizes the relationship of RG with cystic fibrosis students.

MATERIAL AND METHODS

A retrospective, descriptive and analytical study was carried out. The case in question refers to an 8-year-old child with Cystic Fibrosis (CF) Class I. The child in question is a student of an Extension Project for Initiation to Rhythmic Gymnastics, registered at the Pro-Rectory of Extension of the Federal University of Juiz de Fora (UFJF).

ETHICAL ASPECTS

The achievement of this project was approved by the Ethics and Research Committee of the University Hospital of the Federal University of Juiz de Fora (HU-UFJF) according to the substantiated opinion 2,979,090. The parents of the child practicing GR agreed to carry out the research by signing the informed consent form.

THE SPECIFIC CASE – DIAGNOSIS

According to the Technical Manual of Biological Neonatal Screening (2016) the "Teste do Pezinho" (PT) is a test that is part of the National Neonatal Screening Program (PNTN), of the Ministry of Health, which determines the free and mandatory performance of the test. of tests for neonatal diagnosis of various diseases by the Unified Health System. Its objective is a preventive action that enables the diagnosis of diseases and monitoring by multidisciplinary teams in specialized services, aiming at comprehensive health, reducing morbidity and mortality and improving quality of life.

The child did the PT and the result showed a change. Thus, the sweat test was performed, which according to Athanazio et al. (2017) quantitatively and qualitatively analyze sweat in order to determine electrolyte levels or their conductivity or osmolarity to confirm the diagnosis of CF. The diagnosis was confirmed at 7 days of life of the child practicing RG, therefore, she is a carrier of Class I CF, with a GLN 1100 PRO intronic mutation. Juiz de Fora (HU-UFJF).

The child in the case report, a RG practitioner, needs nutritional monitoring and supplementation, using liquid and powder supplements, each twice a day, in addition to the multivitamin once a day, made available and maintained by the SUS. The child's entry into the Rhythmic Gymnastics Initiation Extension Project took place at 7 years and 3 months. For the practice of Rhythmic Gymnastics, strict monitoring of supplementary medication is necessary due to the increase in energy demand and physical activity load. This medication is regulated by a multidisciplinary team from the HU-UFJF, with specific assessments for each area, every 3 months.

THE STUDY ENVIRONMENT

The Initiation to Rhythmic Gymnastics Extension Project is offered on a regular basis by the Faculty of Physical Education

and Sports at UFJF. It is aimed at the external community, serving around 100 female children from different neighborhoods of the city. The classes are divided by age groups with the objective of providing children with a sporting body experience, that is, offering quality physical exercise and gymnastics to children in the community and around the UFJF. In addition, the Project is also a space for the completion of the Mandatory Curricular Internship of the Physical Education course at UFJF, thus covering the pillars of the University: teaching, extension and research.

Classes are taught by academics, under the supervision of the Coordinator teacher responsible for the Project, at the Gymnastics Gymnasium of the Faculty of Physical Education of the UFJF, twice a week, with a duration of one hour and thirty minutes of practice per session. The activities are carried out with the project's gymnastics uniform, hair tied and without the use of shoes. Class descriptions and proposed objectives are based on studies by Araújo and Lebre (2006).

Classes are divided into 3 stages. The warm-up is characterized by the performance of movements in specific displacements of the RG, accompanied by selected music, where the cardiorespiratory capacities of the practicing children are worked. In the physical preparation stage, body movements are worked on with the aim of increasing muscle strength and flexibility. The specific part focuses on the handling of official GR apparatus and pre-acrobatic movements. Moments of rehydration occur throughout the workout.

During the period of data collection, the child in the study who practiced GR had 65% of presence in the project. During the training sessions, the child's normal behavior was observed. She performed the proposed movements together with the other children, without any differentiation. The only symptom manifested was the facilitated loss of water, as a consequence there was a need for water replacement more frequently than the other students.

PROCEDURE

Data from two consultations were analyzed for comparison. At the first consultation (Moment 1), the child had not started RG practice. The second consultation, called Moment 2, took place approximately after one year and five months of RG practice. The data of the present study were collected during the multidisciplinary consultations of the child practicing RG at the HU-UFJF. Both consultations followed the same procedures.

Initially, the child was welcomed by the nursing team, responsible for the initial anamnesis. The child had his anthropometric parameters (body mass and height) measured. Vital parameters (heart rate, respiratory rate, oxygen saturation, blood pressure and body temperature) were also verified. All data were recorded in the child's medical record and made available by the medical team.

Then, the child was referred to physiotherapy where a sputum test and a pulmonary function test (spirometry) were performed. Subsequently, the child underwent a medical consultation, at which point the history of the disease was questioned, how the patient has been since the last consultation, if there were any complications, respiratory and gastrointestinal symptoms characteristic of CF, hospitalization and use of medications other than those prescribed.

The last professional who attended to the child was the nutritionist who analyzed the anthropometric measurements performed by the nursing staff and compared them graphically with the previous consultations to see if there was malnutrition and if he gained or lost weight. After that, the professional

prescribed, according to the need, the use of supplementation.

INSTRUMENTS

Anthropometric Data

Body mass was measured using a Filizola scale with a precision of 100 grams and a maximum capacity of 200 kilograms (kg). The following criteria were adopted: individual standing, barefoot, wearing clothes used for physical activity, positioned in the center of the platform with arms extended along the body and looking straight ahead.

Body height was measured using a Welmy portable stadiometer, with an accuracy of 0.5 cm and a maximum capacity of 2.20 m. For the standardization of measurements, the following criteria were adopted: individual standing, barefoot, with feet together, heels, buttocks, torso and head leaning in the vertical plane and looking straight ahead. The stadiometer piece was positioned over the top of the patient's head at a right angle and measurements were taken on inspiration.

Body Mass Index (BMI) was calculated by dividing body mass by height squared (kg/m2). For the interpretation of this indicator of nutritional status, the age classifications recommended by the World Health Organization (ONIS et al., 2007) must be taken into account. After the calculation, the individual can be classified into four classifications (underweight, normal weight, overweight and obese), based on age percentiles: <5th percentile = underweight; >5th percentile and <85th percentile = normal weight; >85th percentile = overweight; >95° = obese.

Sspirometry

Spirometry is a fundamental respiratory functional tool for respiratory diagnoses and for prognostic follow-up. For Costa and Jamami (2001) spirometry means the measurement of the entry and exit of air in the lungs and is performed by a responsible physiotherapist. Currently, there are several software to graphically measure spirometry values, according to normality tables. The examination was performed at all times by the same physical therapy professional, with the Kokospirometer software following the American Thoracic Society (1987) standards. The type of spirometry adopted in the present study was Simple Dynamic Spirometry (COSTA E JAMAMI, 2001).

To perform the test, the child remained seated, the head was in a neutral and fixed position. A nose clip was used to prevent air leakage during expiration. In addition, careful observations were made for the proper positioning of the mouthpiece in order to avoid air leakage or obstruction. The child was instructed to perform the test by demonstrating the appropriate technique. The patient was asked to take a deep breath as far as possible and then exhale all the air with maximum effort. The exam analyzed the measure of the air entering and leaving the lungs. It made it possible to measure the volume of inspired and expired air and respiratory flows, used for analysis of data derived from the forced expiratory maneuver.

The spirometric variables measured were: 1) forced vital capacity (FVC), that is, the maximum volume of air exhaled with maximum effort after a maximum inspiration; 2) the forced expiratory volume in the first second (FEV1), comprised of the volume of air expired in the first second of the forced expiration maneuver; and 3) forced expiratory flow (FEF25-75), which means forced expiratory flow between 25% and 75% of FVC. For the analysis of the results, the highest values of FVC, FEV1 and FEF25-75, recorded from at least three acceptable measurements, were considered.

The predicted value of spirometry was

calculated for the child in question, as recommended by Costa and Jamami (2001), since the predicted value for spirometry depends on each individual, as personal variables, weight, height and age are also required for its definition.

RESULTS

Data analysis shows that, prior to Moment 1, the child had not been hospitalized for a year. In both moments the child presented colonization of the bacteria: *Oxacillin Sensitive Staphylococcus Aureus*. However, in the consultation at Moment 2, it was diagnosed as chronic colonization, as it was present in more than 50% of the patient's cultures. Allied to this, it presented accumulation and thickening of mucous secretion.

It is also noteworthy that between the assessments at Moments 1 and 2, the child was hospitalized for two days, due to distension and abdominal pain.

Anthropometric and spirometric data of the fibrocystic child practicing RG at Moments 1 and 2 are shown in Table 1.

DISCUSSION

The possibility of studying a rare hereditary disease, where 2% of the world population are asymptomatic carriers of mutations in the gene associated with CF, was motivating and intriguing. Knowing that children are most affected by this disease and that life expectancy is approximately 15 years (MONTALTI, 2012) made us reflect on what and how our share of contribution to this population can be, as Physical Education teachers.

Reporting the case of a child with CF class I practicing RG in an Extension Project, free of charge, at UFJF and its evolution in spirometric and anthropometric parameters is extremely important to understand and adequately meet the needs of children and adolescents with of FC. It is worth inferring the relevance of the study in the contribution of

	Moment 1		**Moment 2**	
Age	7 years and 2 days		8 years, 8 months and 12 days	
Anthropometric data				
Body mass	22.9 kg		27.4kg	
Stature	1.19 m		1.23 m	
BMI	16.17 g/m²		18.11 kg/²	
Apirometry (PréBD-%)	Predicted value		Predicted value	
CVF	1.39 -114%	1.22 -100%	1.42 -96%	1.47 – 100%
VEF1	1.21 -106%	1.14 – 100%	1.19 -87%	1.36 – 100%
FEF25-75	1.38 -93 %	1.49 – 100%	1.28-74 %	1.73 – 100%
Spirometry (Post BD-%)	Predicted value		Predicted value	
CVF	1.27 -104%	1.22 – 100%	1.45 -99%	1.47 – 100%
VEF1	1.19 -104%	1.14 – 100%	1.24 -91%	1.36 – 100%
FEF25-75	1.47 -99%	1.49 – 100%	1.47 -85%	1.73 – 100%

Caption: BD = Bronchodilator; FVC = forced vital capacity; FEV1 = forced expiratory volume in the first second; FEF25-75 = forced expiratory flow between 25% and 75% of FVC.

Table 1: Anthropometric and spirometric data of the fibrocystic child practicing Rhythmic Gymnastics.

the formation of Physical Education teachers, offering a theoretical support that subsidizes the practice and future teacher/student relationships with cystic fibrosis, in order to contribute to the survival and improvement of the quality of life of these children. There are many possibilities and variables to be studied, leading us to reflect and consider prudence and caution in the interpretation of the data collected, as it is a case report.

The present study aimed to report the case of a child with CF class I practicing RG and its evolution in anthropometric and spirometric parameters.

From the findings found, it is possible to infer that in the two evaluated moments, the anthropometric parameters weight and BMI of the child in question are within the normal range according to the age group, following the growth curve (MINISTÉRIO DA SAÚDE, 2016).

Height showed a deviation below the curve, but remained within the expected standard for his age group. According to Franco (2011) a recurrent complication of CF is malnutrition, and in this case this situation is not present. Analyzing the anthropometric data, we verified that progressively increasing weight, height and BMI according to age, spirometry would have the great possibility of increasing the parameters, according to Hauschild et al. (2018) "The benefit of higher BMI in improving lung function can be attributed to muscle mass. In a study of 208 children, lean mass index was associated with better lung function."

The results referring to the spirometry parameters decreased due to the development of the disease. The parameters analyzed in spirometry (FVC, FEV1 and FEF 25-75) decreased as a function of disease progression. As stated by Andrade et al. (2001) "Over a few years, lung function declines exponentially..." Medical records indicated a lack of nebulization in the two-week period prior to the Moment 2 consultation and according to Adde (2018) "the more viscous mucus that forms in the respiratory tract requires the child to take inhalations every day." Therefore, the child practicing RG had as a consequence the accumulation and thickening of mucous secretion that generated an obstruction in the airways, impairing the air outflow in the pulmonary function test, decreasing the values of the spirometry parameters.

The pre-bronchodilator values of the variables FVC, FEV1, FEF25-75 were analyzed, since the bronchodilator for CF patients does not have a significant effect on spirometry as seen in the study by Muramatu, Stirbulov and Forte (2013) "the pharmacodynamic response to the bronchodilator was significant in a few pulmonary function tests."

The FEF25-75 is the variable that presents the most significant change, which is in line with the research carried out by Andrade et al. (2001) "as expected, the FEF25-75 showed the earliest reductions, probably reflecting the onset of obstruction in the smaller airways".

An 18% drop in the FVC variable was observed between the consultations studied. Despite this decline, the value obtained by the child in question remains satisfactory and within the normal range.

According to Andrade et al. (2001),

> the evolutionary pattern of the pulmonary functional alterations found in the patients is in agreement with that described in the literature, where obstructive ventilatory disorder predominates with early reduction of terminal flows and late involvement of the FVC. (p.136).

According to Adde (2018) "Studies have shown that FEV1 is fundamental to assess the evolution and prognosis in CF, as well as for the early detection of acute pulmonary exacerbations, correlating with quality of life". Thus, we observed a drop from 106% to

87% in the FEV1 values of the studied child, which is within the normal range expected for a cystic fibrosis child in this age group, as seen in the study by Andrade et al. al (2001), where "the average FEV1 from four to six years was 112.25%, with a drop below 80% at ten years".

Most of the prescribed medication was kept in the consultation from Moment 1 to Moment 2, with changes only in the withdrawal of the 7% hypertonic saline mucolytic, as it was lacking at the Regional Health Management (GRS) in Juiz de Fora. After hospitalization with constipation, the pancreatic enzyme was adjusted from 10000 to 25000 and the use of corticosteroids was discontinued. This suspension was due to lack of need and chronic use is not recommended due to the risk of significant adverse effects, such as increased risk of diabetes and growth retardation (ATHANAZIO et al., 2017).

The study has some limitations that must be considered. The child practicing RG showed a frequency of 65% of participation in the Extension Project classes. We believe that with a more robust frequency we will be able to obtain better results, since CF is a disease with a chronic and progressive evolution and that the continuous practice of physical exercises contributes to obtaining benefits in the muscular, postural, bone condition and feeling of fatigue. well-being (LIMA, 2016).

Future studies in the context of CF and the practice of RG are extremely relevant for a more detailed investigation of spirometric and anthropometric parameters. Considering that RG is a predominantly aerobic sport and with great potential for the development of physical capacities, we suggest this sport modality for patients with CF.

CONCLUSION

The literature shows that the balance between nutrition, medication, physical exercise and multidisciplinary follow-up is of paramount importance for the good physical development of cystic fibrosis patients, contributing to their survival and improved quality of life. The study showed that the child with CF who practiced RG had anthropometric parameters close to normal for their age group at the two evaluated moments.

The practice of RG, even at satisfactory rates, contributed to the child in question showing a progressive increase in normal anthropometric values, which are directly related to the pulmonary function test, where weight, height and age are considered.

As it is a rare disease with specific mutations and little-known gymnastics, we suggest further in-depth studies. We found that RG is a sport that contributes to the maintenance and/or improvement of the body mass of the fibrocystic child. However, there are many variables that need to be considered in such a specific study. Associating a fibrocystic child with gymnastics as specific as GR is not an easy task. But there are indications of good results for this very rare population.

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