The hydrotherapy in respiratory function of the Down Syndrome bearer

A hidroterapia na função respiratória de portadores de Síndrome de Down

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Abstract

Objective – To investigate the effects of hydrotherapy in respiratory function in patients with Down syndrome. **Methods** – The sample consisted of 7 individuals with Down syndrome, aged between 12 to 37 years (24 ± 8 years), 71,4% female. The participants performed a pre and post treatment in hydrotherapy. The evaluations consisted of manometer, circumference measurements, peak expiratory flow and test to sit and stand for a minute. The hydrotherapy treatment lasted on hour, once a week for ten weeks. **Results** – The analysis of results showed that treatment had positive influence on increase in maximum inspiratory pressure (51±13 x 59±11 cmH_2O, *P*=0,06, 95%CI) improvement in the values of expiratory flo peak (207±54 x 243±71, P = 0,01, 95%CI) and increased muscular endurance of the lower limbs (21±6 x 24±6, p=0,01, 95% CI). **Conclusion** – Hydrotherapy has proven effective in increasing muscle strength, peak expiratory flow and muscular endurance in individuals with Down syndrome.

Descriptors: Hydrotherapy; Down syndrome

Resumo

Objetivo – Investigar os efeitos da hidroterapia na função respiratória em pacientes com síndrome de Down. **Métodos** – Amostra constituída de 7 indivíduos com Síndrome de Down, com idade entre 12 e 37 anos (24±8 anos), 71,4% do sexo feminino. Os participantes realizaram um pré e pós-tratamento na hidroterapia. As avaliações consistiam de manômetro, medidas de circunferência, pico de fluxo expiratório e teste de sentar e levantar em um minuto. O tratamento de hidroterapia teve duração de uma hora, uma vez por semana em dez semanas. **Resultados** – A análise dos resultados mostrou que o tratamento teve influência positiva no aumento da pressão inspiratória máxima (51±13 x 59±11 cmH_2O, *P*=0,06, 95%CI) melhora nos valores do pico de fluxo expiratório (207±54x243±71, P=0.01, 95% CI) e aumento da resistiencia muscular de membros inferioes (21±6 x 24±6, *P*=0,01, 95% CI). **Conclusão** – A hidroterapia mostrou-se efetiva para o aumento da força muscular, pico de fluxo expiratório e resistência muscular nos indivíduos com Síndrome de Down.

Descritores: Hidroterapia; Síndrome de Down

Introduction

Down syndrome (DS) has an incidence of 1:660 live births[1] and may increase from 12 to 13 times the cost of health in relation to non-patients[2]. It is considered a common chromosomal abnormality, which is usually caused by the presence of an extra chromosome 21[1], causing variable degree of delayed motor development, physical and mental. These changes in the systems increase the risk of clinical complications[3]. Infections of the upper airways and/or pneumonia cases come to affect 77,0% of patients with DS[4].

Besides chromosomal abnormality, anatomical abnormalities favor the development of respiratory infections in this population, which is the leading cause of hospitalization and hence mortality. Prospective study conducted from 1990 to 1999, found among 45 individuals with DS assessed the occurrence of recurrent respiratory infection, the most common being pnemonia and nasopharyn (31 individuals), in addition to finding a significat percentage of heart defects in children with pneumonia relapsers (62.2%)[6].

Due to chronic disease, one of the goals of treatment should be on prevention of respiratory diseases by means of adjuvant therapy to treatment.

Hydrotherapy has been used as non-pharmacologial treatment in various diseases[7], resulting in an improvement in physical function of individuals, including muscle strength[8]. The technique can be regarded as the exercises in a liquid medium, using the physical properties of water for recovery of movement and may be beneficial in individuals with Down syndrome. Thus, it can be considered the need to investigate the effects of hydrotherapy, muscle strength, dynamic mobilization of the chest and respiratory peak flow, in individuals with DS.

In the literature we have few studies about the effects of hydrotherapy as rehabilitation technique in patients with respiratory function in the DS. This study shows the results of a proposed therapeutic hydrotherapy and assesses lung function making contributions in this area for professional who work with these patients.

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Methods

Design

This is a prospective case study, designed in accordance with the Gidelines and Norms of Regulating Research Involving Human Subjects of the National Health Council an submitted to the Brazilian Committee of Ethics in Research Committee.

Subjects

It was considered eligible for the study individuals with Down Syndrome diagnosed by karyotype. We excluded individuals with severe mental disabilities, with limited understanding of valuation techniques, with a diagnosis of congenital heart defects not treated and any other associated pathology which affects the safety of the work. Were included in the sample only those individuals who had a term of consent signed by their mothers.

Interventions

The hydrotherapy sesseions (Table 1) was composed of exercises in an upright position with water at 110cm tall, with water temperature between 33°C and 34°C and room temperature between 22°C and 25°C. Were used during the exercise devices such as buoys and/or weights, spaghetti, leggins and dumbbells in the work of muscle toning exercises, bubbles with straws and/or assisted diving. Breathing was crafted with recreational activities such as pushing a straw to blow a bubble with air. The therapeutic exercises used in hydrotherapy sessions were stretching, aerobic exercises such as walking, stationary gait, and resistance exercises for upper and lower limbs with or without dumbells. Training was conducted static balance, dynamic and aerobic training through activities such as walking on water, squat. Relaxation was also measured using the end of specific techniques of hydrotherapy.

Outcomes measures

At the beginning and the end of three months of treatment,were performed anthropometric measurements (weight, height and body mass index), respiratory (pressure transducer, thoracic expansion and peak expiratory flow) and muscular endurance of the lower limbs.

I – Anthropometric

We assessed the body mass index (BMI) which is calculated by dividing body weight (kg) by height (cm) squared. Body weight was measured using a digital scale and height using a tape measure.

II – Assessment of Respiratory

Manometer – For the measurement of maximal respiratory pressures was used a class B analog manometer, calibrated in cmH_2O. The manometer was connected to a plastic trachea. At the end of the trachea was connected to a Nevoni's face mask silicone, which facilitated the testing due to hipomobility submitted by participants.

Table 1. Composition of hidrotherapy sessions, according to the time of treatment

First month	Second month	Third month
5 min of global stretching	10 min aerobic exercise (walking)	10 min of breathing exercises
10 min to strengthen UL	10 min to strengthen LL	10 min of breathing exercises
5 min of relaxation		

min: minutes; UL: upper limbs; LL: lowers limbs.

The measurements were performed with subjects seated and had established a range of approximately 1 minute between each maneuver, maneuvers being held six of six maximal inspiratory pressure (MIP) and maximal expiratory pressure (MEP) maneuvers. We calculated the predicted values for MIP and MEP, according to the equations of reference, according to genre and age[6].

Thoracic expansion: the chest expansion was measured by the circumferences of the chest in points axillary and xiphoid nipple with the use of tape, both made from a quiet inspiration, while seated.

Peak expiratory flow (PEF): for the measurement of PEF was used a peak flow meter. The individual was asked to remain standing upright, flexing the spine and hold the phone horizontally to keep the exits clear. Next, he takes a deep breath, puts the radio in your mouth between your teeth and closes his lips around the mounthpiece. He expires strong and fast. We recorded 3 measurement of each individual.

Muscular endurance of the lower limbs (MELL): the subject was instructed to perform the test to sit and stand for a minute, where he should sit in a chair with his back resting on the back of the chair and soon after getting up and extending the knees after sitting back playing again in the back of the chair, the individual should perform the most repetitions in on minute.

Statistical analysis

Data were analyzed on the PASW Statistical 18.0 (version 18.0, PASW, Chicago, Illinois). The data were expressed as the mean and standard deviation. To check the normality we used the Kolmogorov-Smirnov and the comparison between the variables was performed using the *t* test. It was considered significant $P<0,05$ in a confidence interval 95%.

Results

As shown in Table 1, participants were 12 to 37 years (24±8 years), 71,4% female. The individuals had 1,50±0,12m, with no difference before and after treatment in the IMC (68,11±21,37 x 68,49±22,71, $P=0,58$, 95% CI).

We also no differences in measures of chest expansion ($P>0,05$, 95% CI). Most of the individuals tested showed

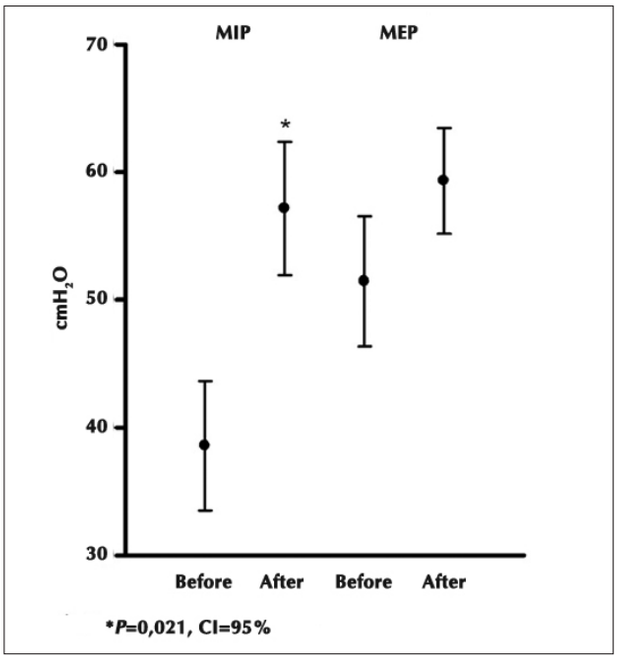
Table 2. Anthropometric characteristics and mobility of the chest cavity of individuals with Down syndrome

	Pre-treatment Average (DP)	Post-treatment Average (DP)	p*
Body weight (kg)	68,11±21,37	68,49±22,71	0,58
BMI (kg/m²)	29,98±6,43	30,08±6,69	0,71
Axillary dynamic cirtometry (cm)	1,4±0,53	2,0±0,45	0,36
Mammary dynamic cirtometry (cm)	1,4±0,24	1,6±0,60	0,69
Xiphoid dynamic cirtometry (cm)	1,4±0,24	1,2±0,50	0,53

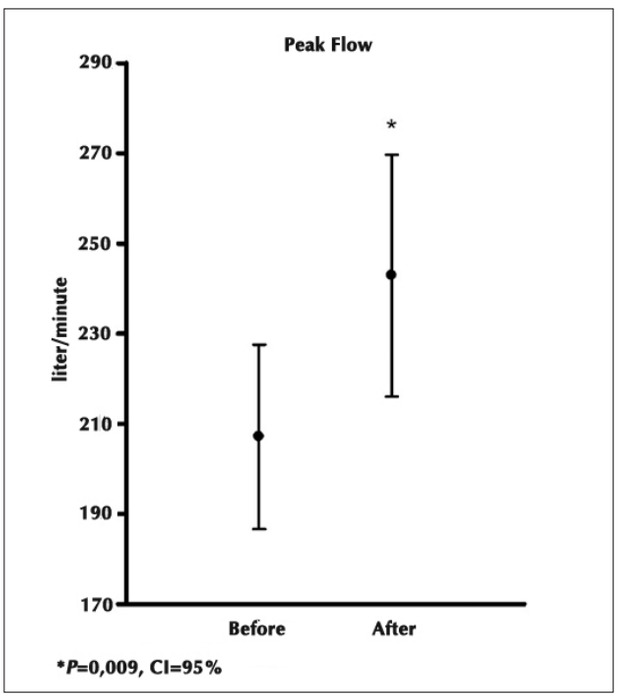
SD: standard deviation; Kg: kilograms; m: meters; BMI: body mass index. *CI: 95%.

a BMI above de normal range established by the World Health Organization (3 individuals) and after treatment, no significant different in mean BMI (29,98 ± 6,43 x 30,08 ± 6,69, *P*=0,71, 95% CI) (Table 2).

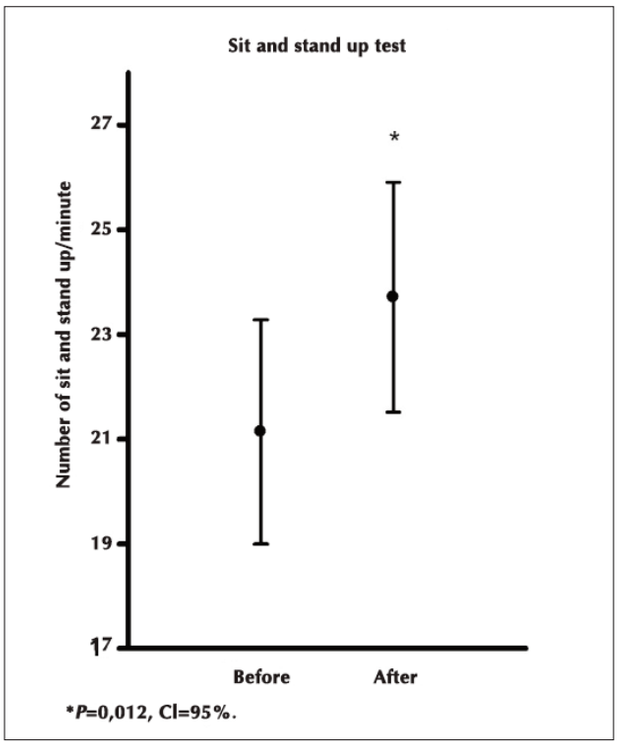
The hydrotherapy treatment resulted in an increase in MIP (39±13 x 57±14cmH_2O, *P*=0,021, 95% CI), However, despite the increase in the average, it did not significantly alter the MEP (51±13 x 59±11cmH_2O, *P*=0,06, 95%CI) (Figure 1).



Regarding the data of peak expiratory flow, we can see that in Figure 2, it increased after hydrotherapy treatment (207±54 x 243±71, P=0,009, 95% CI).



In the analysis of RML showed that the treatment hydrotherapeutic also exerted positive influence by significantly increasing the number of repetitions performed by the individuals (P=0,012, 95% CI) (Figure 3).



Discussion

In this study we demonstrate that hydrotherapy can increase muscle strength (Figure 1), peak expiratory flow (Figure 2) and RML (Figure 3) in individuals with Down syndrome. The importance of this finding is due to the fact that respiratory muscle weakness contributes to the onset of respiratory disease in these individuals[4].

Regarding the profile of the sample, we found that most individuals met the BMI values above the normal range, confirming the findings in the literature for this population[4]. However, although obesity be considered a risk factor for respiratory disorders[9-10], hydrotherapy treatment did not exert influence on this characteristic.

In dynamic cirtometry auxiliary and xiphoid nipple values were lower than expected, showing a decrease in thoracic mobility in these individuals. This can be explained by the high occurrence of hypotony for individuals with Down syndrome who, at birth, can reach about 93,0% of cases. Thus, it is necessary to the application of therapies that aim to improve the dynamic optimizing circumferences, so the mobility of the chest.

Noting the findings of respiratory muscle strength, one finds that depicts the sample values well below the limit for MIP and MEP for both pre, 34,9% and 46,5% of predicted, and after treatment, 53,2% and 53,8%, respectively, showing alterations in the integrity of the respiratory muscles. We therefore reaffirm the importance of application of therapy to increase muscle strength of these individuals.

As reported in the literature[10], in our sample had an improvement in MIP, demonstrating the effectiveness of treatment used for lung function. This effectiveness may be related to the activities assigned to the individual during the session, such as conscious breathing, maintaining buoyancy, propulsion maneuvers and use of functional capacity during some exercises. This increase in MIP may also be due to greater resistance existing in the midst of which were carried out exercises in the water. In the aquatic environment is an increase of approximately 60,0% in respiratory work. This increase occurs by the action of hydrostatic pressure, which resists the chest expansion and increased blood volume in the chest because of the effects of cancellation of gravity by the buoyancy of the water.

For obvious increase in MIP found in this study, it is assumed that the aspiratory muscles can be trained with hydrotherapy. Agreeing with the literature findings, which say that the respiratory muscles can be trained to improve their strength and endurance[11].

The peak expiratory flow increased after treatment with hydrotherapy. This endpoint is commonly used in services that work with respiratory rehabilitation as a reference for evaluation of treatment used[12-13] and as a criterion for diagnosis of diseases[14], referring to the idea that treatment with hydrotherapy can be effective in individuals with Down syndrome. But despite the increase in peak respiratory flow, individuals did not reach its intended, perhaps by the time of treatment applied in the sample.

The assessment of muscular endurance (Figure 3) showed a beneficial effect of hydrotherapy in over this parameter. Study on elderly people undergoing hydrotherapy, corroborated with the findings of our study, referring to the effectiveness of hydrotherapy, too, in the endurance of the lower limbs[15].

Thus, hydrotherapy improved the respiratory muscle strength, peak respiratory flow and muscular endurance of the lower limbs in individuals with Down syndrome. It can be considered a good alternative treatment for patients with DS.

Conclusion

Hydrotherapy has proven effective in increasing muscle strenght, peak expiratory flow and muscular endurance in individuals with Down syndrome.

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