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Original article

IMPROVING THE PHYSICAL CONDITION OF PEOPLE WITH DOWN SYNDROME, BY USING EXERCISES SPECIFIC TO THE COLPBOL GAME

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Abstract

Aim. The purpose of our research consisted in the realization and implementation of a special training program for a group of 12 people with Down syndrome, who participated, for a period of 6 months, in physical education activities, by using exercises specific to the Colpbol game.

Methods. Among the tests used, the following were found: the Matorin Test, the coxo-femoral mobility measurement, the Flamingo test, the Y Balance Test, as well as anthropometric measurements. All the data were collected before and after the participation of people with Down syndrome in the training program and were processed using the SPSS program.

Results. All measured variables improved, as a result of the participation of people with Down syndrome in the program specially created for them, with physical exercises specific to the Colpbol game.

Conclusions. Our conclusions draw attention to the importance of the presence and constancy of physical activity among people with Down syndrome, and the results obtained by us highlight this finding, in the sense that they do not simply participate in sports programs, but significantly improve their physical condition and anthropometric characteristics.

Keywords: Down syndrome, Colpbol game, anthropometric measurements, sports training program

Introduction

The studies in the specialized literature are quite promising regarding the description of the anthropometric characteristics and specific aspects of adults with Down syndrome. As their life expectancy has increased and is now approaching the life expectancy of a person without any disability, research in this direction has also been much more detailed.

A significant number of adults with intellectual disabilities (N= 45803), from the USA, were involved in a study between the years 2009-2014. They were divided into five age groups, between 18 and 29 years, 30 and 39 years, 40 and 49 years, 50 and 59 years, and over 60 years, and adults with DS were compared with those with intellectual disabilities. The conclusions of the research were the fact that all the characteristics related to BMI, height and weight of adults with DS began to decrease, temporally and faster, compared to the other people who had disabilities (Agiovlasitis, Jin & Yun, 2020). The conclusions of this study should be very important for relatives and professionals working with people with DS, so that intervention and support activities with them have continuity, regardless of their age and, of course, to be started as early as possible possible. Among the defining characteristics of adults with DS, an inversely proportional direction can be found between the anthropometric data related to height and weight, that is, people with DS have a lower height and a higher body weight, an aspect that predisposes them to various comorbidities, and obesity is one of them (Rubin et al., 1998, Pueschel et al., 1985).

The specialized literature also attributes a higher percentage of the presence of obesity among people with DS, compared to people with other intellectual disabilities. In this sense, at the level of a study, a research was even carried out that brought together 247 pairs consisting of an adult person with DS and a person who had intellectual disabilities. The results they recorded drew attention to the fact that, although people with DS had lower height and weight, their BMI was much higher compared to people with disabilities, but only in the case of women, not men. the male ones. However, it remains a subject open to research, and such answers require caution in interpretation (Melville et al., 2005).

A study that compared, this time, people with DS, with the same age category, namely between 7 and 35 years, but with the normal population reached similar results, namely the fact that they reach an increasing latency significantly faster, compared to people without DS, and, in addition to growth, and not conditional on chronological age, they register an increased somatosensory latency (Ferri et al., 1996).

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A similar comparison also concerned De Asua, in 2014, with a group of 51 adults with DS and 51 adults without DS, regarding their obesity. Sociodemographic and anthropometric data were compared between the two groups, as well as pre-existing clinical conditions. The results highlighted the much higher prevalence of obesity, especially abdominal fat, in the DS population sample compared to the other sample (De Asua et al., 2014).

The walking patterns of adults with DS were the subject of a study conducted in 2008. 12 participants with DS, aged between 35 and 62 years were included in the study, and the group they were compared to were 12 adults without DS. In addition to walking patterns, the strategies used by people with DS to help them find their stability more quickly were also analyzed. People with SD had a much heavier, more difficult gait, with much shorter and wider steps, compared to people without SD. The laxity of their ligaments and early aging lead to different adaptive strategies on the part of people with DS to maintain their functional mobility, and in this sense, intervention and movement programs specific to their needs could be made (Smith & Ulrich, 2008).

In this sense, the practice and involvement of people with DS in sports activities is a crucial factor in maintaining their health and weight, but also the quality of life and improving well-being through group activities, with an emphasis on socialization and optimization on all levels.

Colpball and its utility in adapted physical education activities are described at the level of several studies that measured the results of the impact of the Colpbol game on people with Down syndrome, and these were exclusively positive, in the sense that the adults with DS involved showed a rapid adaptability in the game, they managed to understand and respect the rules of the game, and, from an emotional point of view, positive feedback from them was recorded, as well as a desire to continue training (Barbu et al., 2021, Chiracu et al. al., 2023).

COLPBOL is a powerful tool for improving the quality of life of people with intellectual disabilities, due to its simplicity in terms of technical moves and rules, which makes it easy to play, and its ability to allow the involvement of people with Down syndrome, to be able to play with people without any disabilities, which increases their social inclusion.

COLPBOL is defined as a "collective invasion sport played by two mixed teams of 7 players in a clearly defined space, the aim of which is to drive a ball into the opponent's goal by handball"

This sport aims for the participation of everyone, regardless of gender or physical condition (Hernández Martínez, Martínez Urbanos & Carrión Olivares, 2019).

The purpose of our research is the validation of a work programs that can contribute to optimizing the physical condition of people with Down syndrome.

At the same time, the research aims to highlight some activities aimed to make the local community aware of the importance of the social inclusion of people with Down syndrome in the Oltenia area.

Methods

Participants and procedure

The present study was attended by adults with Down syndrome (N=12), both female and male, aged between 17-45 years (M=31,33 years), with an average height of 1.51m and an average weight of 60.65kg.

In 2022, for 6 months, 12 young people with DS participated 2 times/week in Colpbol training with young volunteers. The duration of the lesson was 2 hours, and its structure depended on the condition and state of the subjects, usually 120 minutes, structured in 3 parts.

Hypotheses

H1. Following the participation of people with Down syndrome in the training program based on exercises specific to the Colpbol game, the values of the measured variables improved.

H1a. Following the participation of people with Down syndrome in the training program based on exercises specific to the Colpbol game, anterior movement improved.

H1b. Following the participation of people with Down syndrome in the training program based on exercises specific to the Colpbol game, lateral movement improved.

H1c. Following the participation of people with Down syndrome in the training program based on exercises specific to the Colpbol game, their posterior improved.

H1d. Following the participation of people with Down syndrome in the training program based on exercises specific to the Colpbol game, their median improved.

H1e. Following the participation of people with Down syndrome in the training program based on exercises specific to the Colpbol game, the results of Matorin Test improved.

H1f. Following the participation of people with Down syndrome in the training program based on exercises specific to the Colpbol game, their sit and reach movement improved.

H1g. Following the participation of people with Down syndrome in the training program based on exercises specific to the Colpbol game, their balance improved.

H1h. Following the participation of people with Down syndrome in the training program based on exercises specific to the Colpbol game, their abdomen improved.

H1i. Following the participation of people with Down syndrome in the training program based on exercises specific to the Colpbol game, their hitting the ball from below improved.

H1j. În Following the participation of people with Down syndrome in the training program based on exercises specific to the Colpbol game, their hitting the ball from side improved.

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Instruments

Sociodemographic data were measured based on a list of questions regarding age, gender, class (level of education), duration of sport practiced, number of coaches, perceived level of preparation.

Between the tests and samples used, we tracked the measurement:

• Height;
• Weight;
• Matorin test;
• Coxo-femoral mobility;
• Flamingo test;
• The balance test Y Balance Test

The research was carried out within the Faculty of Physical Education and Sport, University of Craiova and balance testing was used using the Y Balance Test Platform. The starting position for the lower limb, is standing on one foot on the board, with the toes of the base foot on the red line, the active leg lightly touching the red side of the board with the tip of the toes. The active leg is taken in the desired direction, pushing the pointer as far as possible while maintaining balance. The free leg must be returned to the starting position, under control, without touching the ground.

Results

Descriptive statistics

The means and standard deviations of all measured variables are included in table 1, both those obtained in the pre-test (T1) and those obtained in the final testing (T2).

Table 1**.** *Means and standard deviations of measured variables*

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Height	12	1.44	1.74	1.5192	.08295
Weight	12	45.60	85.00	60.6583	12.73210
Age	12	17.00	45.00	31.3333	8.76287
Anterior_T1	12	30.00	80.00	45.9167	15.95709
Anterior_T2	12	33.00	86.00	51.0000	17.56546
Lateral_T1	12	31.00	88.00	46.6667	16.38921
Lateral_T2	12	40.00	90.00	54.9167	14.40618
Posterior_T1	12	41.00	80.00	57.5833	11.57944
Posterior_T2	12	50.00	90.00	65.0833	10.03139
Median_T1	12	35.00	80.00	51.7500	14.12364
Median_T2	12	40.00	85.00	55.7500	15.66771
MatorinLeft	12	45.00	180.00	121.6667	39.27371
MatorinLeft_2	12	60.00	200.00	134.8333	38.94479
MatorinRight	12	45.00	180.00	110.0000	33.09765
MatorinRight2	12	45.00	200.00	130.4167	40.70170
SitandreachT1	12	-20.00	9.50	1.1250	8.05133
SitandreachT2	12	-10.00	13.00	4.0000	6.35324
BalanceLeft	12	1.00	14.00	6.9950	4.21680
BalanceLeft_2	12	4.00	18.00	9.8333	4.58918

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BalanceRight	12	1.00	12.00	5.5983	4.15207
BalanceRight 2	12	4.00	15.00	8.0000	3.43776
ABD_1	12	4.00	12.00	7.5000	3.08957
ABD_2	12	6.00	16.00	10.5000	3.65563
Hittingtheball_Down_1	12	3.00	15.00	8.0000	3.27525
Hittingtheball_Down_2	12	6.00	20.00	11.3333	3.62650
Hittingtheball_side_1	12	6.00	20.00	11.3333	3.67630
Hittingtheball_side_2	12	8.00	22.00	13.5833	3.94181
Valid N (listwise)	12				

Inferential statistics – hypothesis testing

In order to organize the data and test the hypotheses, the statistical analysis program IBM.SPSS.25 (IBM Corp, 2016) was used.

H1. Following the participation of people with Down syndrome in the training program based on exercises specific to the Colpbol game, the values of the measured variables improved.

Tabel 2**.** *Ranks for all the variables measured before and after the participation of people with Down syndrome in the physical training program*

Ranks

		N	Mean Rank	Sum of Ranks
Anterior_T2 - Anterior_T1	Negative Ranks	0[a]	.00	.00
	Positive Ranks	12[b]	6.50	78.00
	Ties	0[c]		
	Total	12		
Lateral_T2 - Lateral_T1	Negative Ranks	0[d]	.00	.00
	Positive Ranks	12[e]	6.50	78.00
	Ties	0[f]		
	Total	12		
Posterior_T2 - Posterior_T1	Negative Ranks	0[g]	.00	.00
	Positive Ranks	12[h]	6.50	78.00
	Ties	0[i]		
	Total	12		
Median_T2 - Median_T1	Negative Ranks	0[j]	.00	.00
	Positive Ranks	10[k]	5.50	55.00
	Ties	2[l]		
	Total	12		
MatorinLeft_2 - MatorinLeft	Negative Ranks	0[m]	.00	.00
	Positive Ranks	12[n]	6.50	78.00
	Ties	0[o]		
	Total	12		
MatorinRight2 - MatorinRight	Negative Ranks	0[p]	.00	.00
	Positive Ranks	10[q]	5.50	55.00
	Ties	2[r]		

	Total	12		
SitandreachT2 - SitandreachT1	Negative Ranks	0[s]	.00	.00
	Positive Ranks	12[t]	6.50	78.00
	Ties	0[u]		
	Total	12		
BalanceLeft_2 - BalanceLeft	Negative Ranks	0[v]	.00	.00
	Positive Ranks	12[w]	6.50	78.00
	Ties	0[x]		
	Total	12		
BalanceRight_2 - BalanceRight	Negative Ranks	2[y]	1.50	3.00
	Positive Ranks	10[z]	7.50	75.00
	Ties	0[aa]		
	Total	12		
ABD_2 - ABD_1	Negative Ranks	0[ab]	.00	.00
	Positive Ranks	11[ac]	6.00	66.00
	Ties	1[ad]		
	Total	12		
Hitting_the_ball _Down _2 - Hitting_the_ball _Down_1	Negative Ranks	0[ae]	.00	.00
	Positive Ranks	12[af]	6.50	78.00
	Ties	0[ag]		
	Total	12		
Hitting_the_ball _Side _2 - Hitting_the_ball _Side_1	Negative Ranks	0[ah]	.00	.00
	Positive Ranks	12[ai]	6.50	78.00
	Ties	0[aj]		
	Total	12		

It is noted that out of a total of 12 people with Down syndrome, 12 scored higher in forward step, side step, back step, Mantorin test, left leg, mobility, left leg balance, bottom and side kick, after completing the physical training and Colpball training program. Only 2 people with DS had equal scores on the Median test, on the Matorin test, the right leg, MRg = 10.00 and one person on the abdomens, MRg = 11.00. And two people participating in the program, obtained lower balance scores, after completing the program, MRg= 10.00.

Table 3. *Wilcoxon test for paired samples*

Test Statistics[a]

	Anterior_T2 - Anterior_T1	Lateral_T2 - Lateral_T1	Posterior_T2 - Posterior_T1	Median_T2 - Median_T1	MatorinLft_2 - MatorinLft	MatorinRight 2 - MatorinRight	Sitand reachT2 - Sitand reachT1	BalanceLeft_2 - BalanceLeft	BalanceRight_2 - BalanceRight	ABD_2 - ABD_1	Hitting theball_Down_2 - Hitting theball_Down 1	Hitting theball_side_2 - Hitting theball_side_1
Z	-3.00[b]	-3.07[b]	-3.06[b]	-2.89[b]	-3.08[b]	-2.86[b]	-3.12[b]	-3.06[b]	-2.82[b]	-2.97[b]	-3.07[b]	-3.16[b]
Asymp. Sig. (2-tailed)	.002	.002	.002	.005	.002	.005	.002	.002	.005	.003	.002	.002

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

The differences are statistically significant for all dimensions measured as follows: for forward step, Z = -3.00, p < .05, for side step, Z = -3.07, p < .05, for rear, Z = -3.06, p < .05, for median, Z = -2.89, p < .05, for Matorin test, left leg, Z = -3.08, p < .05, for Matorin, right leg, Z = -2, 86, p < .05, for mobility test, Z = -3.12, p < .05, for balance test, left leg, Z = -3.06, p < .05, for balance test, left leg straight, Z = -2.82, p < .05, for sit-ups, Z = -2.97, p < .05, for lowball, Z = -2.97, p < .05, for lowball from the side, Z = -3.16, p < .05.

Taking into account these results, we can state that hypothesis H1 is supported by the analyzed data.

The work programs proposed and applied to the subjects

Acquiring the basic elements of the Colpbol sport, following the didactic rules "from known to unknown" and "from simple to complex". Example of exercises:

• Two by two, face to face at a distance of 1.5 m, serve the ball from one to the other x10 repetitions each

• Serving with one hand above the head

• Form columns of 3-4 children and serve with one hand above the head to a representative of the group sitting in front, then move to the end of the line (x10 repetitions each).

• Hitting the ball at ground level towards the goal (x10 repetitions, noting successes)

• Serving with one hand from below, touching the circle positioned in front at a distance of 1.5 m or even putting the ball inside it (x 10 repetitions, noting the successes).

• Performing on the spot, without the ball, the movements that make up the kicking process, by positioning the feet, moving the arms, etc.

• From the spot, hitting the ball from the hand and sending it to a partner or to a smooth wall, from which it bounces back. It can be performed at the coach's command

• Hitting the ball from the hand, after a swing of two or three steps executed by a light run. The ball can be sent to a partner or to a wall.

• The player throws the ball slightly forward, after which he will follow it in a light run, hitting it in the direction of a partner.

• Development of basic physical qualities. Improving life skills and abilities by teaching outdoor games, physical exercises and technical actions in basic sports

• Development of strength skills: dynamic exercises with modification of support on arms and legs, for local development of trunk muscles using body weight.

• Organizing and conducting outdoor games with elements of competitions and arbitration.

• Exercises to relax certain muscle groups; walking, running, jumping in different directions according to designated landmarks and on signal, stretching.

Discussions

Participation in different sports activities generates common interests and values and the development of social skills that are necessary for democratic practice. Sport encourages social and cultural life, uniting people and communities. Initial testing of subjects with Down syndrome identified performance problems on certain tests. Also, differences in laterality were identified in all samples that tested balance. Since the individual characteristics are extremely different, we propose that in a next step we will carry out case studies, the conditions associated with Down syndrome being different. The positive results recorded by us are consistent with those of other studies that piloted various entertainment and training programs with adults with DS. For example, Rimmer, in 2004, proposed cardiovascular exercise training on 52 adults with DS, over a period of three months, with a frequency of three times a week, sessions of 45 minutes each. Results compared to a control group showed improvements not only in the muscular strength and endurance of people with DS, but also a slight decrease in their weight (Rimmer et al., 2004). Another 52 adults with DS had their physical activity tested, by measuring sedentary time. The results recorded about 400 minutes per day of sedentary time, with an average number of steps per day of 3000, and the fact that people who lived alone did better than those who lived with someone else (Oreskovic et al., 2020). Another study investigated the attitude of adults with DS about their physical condition and participation in sports programs. A number of 13 family members were involved in the conducted qualitative study, and their answers were grouped around several topics of interest, namely: family support, the availability of coaches and the difficulty of sports exercises for people with DS. Thus, it becomes very important to involve the extended family and people who live with or take care of adults with DS, in order to involve them in sports activities or vice versa (Alesi & Pepi, 2017).

Another research, at the level of four focus groups, also recorded very good feedback about the perception of parents and relatives of people with DS, which had as conclusions positive aspects about sports activity, namely its impact on the health of the person with DS, socialization and inclusion, the importance of an individual sport, for increasing the independence of the person with DS, as well as the need for support in the physical activity carried out (Menear, 2007). Thus, where the specifics of the person with DS require it, perhaps practicing an individual sport, with a personal trainer, could be a plus in the development of that person, but team sports also have enormous qualities for optimizing the condition of adults with DS. Another research directly surveyed 30 adults with DS to analyze how they perceive physical activity. Respondents translated sport through terms such as interaction, enjoyment and the activity itself. They appreciated the interaction with the coaches, with the other colleagues, the activity, through interactivity and by the fact that they felt that they were part of a team, thus, that these things should always be taken into account in making and running a program that involves activity and physical education with adults with DS (Love & Agiovlasitis, 2016).

Another experimental program involved 68 adults with DS who trained twice a week for two and a half months using weights with a specialist trainer. The group tested in this way increased their strength in the lower and upper limbs, as well as the level of physical activity, but did not significantly improve their performance in carrying out the tasks (Shields et al., 2013). The same researcher, Shields, in 2018, set out to compare physical activity levels in adults with and without DS. Each group consisted of 15 participants, and the results between the groups were statistically significant, in the sense that adults with DS had a much lower physical activity than those without DS, an aspect that once again underlines the importance of their involvement in physical activities, even light and moderate, but most importantly, constant (Shields et al., 2018).

One study benefited from the participation of an active group of Special Olympians with DS, N=13, which was compared to a sedentary group (N=7). Testing took place under laboratory conditions and involved treadmill running, isometric endurance tests, explosive strength tests, and body composition was measured. All measured parameters had better results in special Olympians, so the results of continuous and sustained training can be quantified and have a positive impact on people practicing sports (Balic et al., 2000). Another study, this time a review of research that tested aerobic exercise programs on adults with DS, concluded that there is more evidence to support improvements in physiological and psychological aspects from programs that use mixed activities of physical education, than those aimed exclusively at aerobic exercises (Andriolo et al., 2005). The number of people over the age of 60 with lifelong developmental delays is expected to double by 2030. Exercise programs appear to have the potential to positively impact the overall health of adults with DS, thereby increasing the quality of life and years of healthy life for these individuals (Barnhart & Connolly, 2007).

Conclusions

Our conclusions draw attention to the importance of the presence and constancy of physical activity among people with Down syndrome, and the results obtained by us highlight this finding, in the sense that they do not simply participate in sports programs, but significantly improve their physical condition and anthropometric characteristics.

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