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Original Article

Comparison of Some Anthropometric Parameters and Blood Pressure between Adolescents with Down Syndrome and Healthy Ones

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Abstract

Background: Most of the people with Down syndrome have short stature compared to general population. There is also a high prevalence of overweight and obesity, mainly in the adolescence and in the adult life. The aim of this study was to compare some anthropometric parameters, heart rate and blood pressure of children with Down syndrome and those with normal development. Down syndrome is among the most commonly classified categories of mental sub normality, with the incidence at birth being around 1: 700 and 1: 750 in live births in most countries worldwide, with the risk of increasing with mother's age.

Methods: The sample consisted of 82 children, 32 with Down syndrome and 50 healthy children, male, aged 14-15 yr from the population of Kosovo in 2022. There were no health problems present in the healthy children.

Results: About 53% of children with Down syndrome have normal body mass, 15.62% are overweight, and 21.8 are obese. In terms of blood pressure, Down syndrome children have higher systolic pressure (121.94mm/hg), sd ±21.69 than healthy children (111.18mm/hg, sd ±10.88).

Conclusion: Children with Down syndrome had significantly higher body mass index, heart rate, and systolic pressure at rest compared to healthy children. However, after short physical activity, healthy children exhibited greater diastolic pressure than children with Down syndrome.

Keywords: Healthy adolescents; Down syndrome; Anthropometry; Blood pressure; Heart rate

Introduction

Down syndrome is among the most commonly classified categories of mental sub normality, with the incidence at birth being around 1: 700 and 1: 750 in live births in most countries worldwide, with the risk of increasing because of the mother's age (1).

Growth occurs differently in children with Down syndrome characterized by an early impairment and reduced linear growth rate, which results in shorter stature than the general population (2).

Increased stagnation is also encountered after birth from the age of 3-6 yr (3, 4). Body growth is a good indicator of childhood health and well-being and gives information about possible pathologies. Because of differences in growth rates between healthy children and those with Down syndrome, different standards are used to estimate the rates of children with Down syndrome. Among the many growth impairments in children with Down syndrome are also cranial features. The skull of children with Down syndrome is

said to have a sloping forehead, flat occipital bones, large closed fontanelles, brachycephaly, and microcephaly with smaller head circumference than that of normal children (5).

Most of the people with Down syndrome have short stature (6). Average body height is mostly under third centile comparing to the people with normal development. There is also a high prevalence of overweight and obesity, mainly in the adolescence and in the adult life (7). For assessment of Down syndrome growth in height, weight and head circumference the method of grow charts is used. The US growth charts produced by Cronk et al. (8) were used for long time. Because growth rate differs to different ethnicities, particularly in body height, many Countries like, United Arab Emirates (9), China (10), Netherland (11), Turkey (12), Sweden (13) and Great Britain (14) have produced their own growth charts.

Increasing differences between healthy children and those with Down syndrome also appear in the parameters of heart rate and blood pressure. Past reports suggest that BP in adults with Down syndrome may be lower, although these studies are limited by small sample size, heterogeneous population, and reliance on institutionalized individuals in an era of limited medical intervention (15, 16).

Based on the fact that no researches have been done with down syndrome population in national level we were attracted to do this research knowing that this will be only a small contribution to this matter.

We aimed to compare some anthropometric, heart rate, and blood pressure parameters of children with Down syndrome and those with normal development.

Methods

The study was conducted during the period from February to April 2022.

The sample was taken from the population of Kosovo, 82 children, 32 with Down syndrome and 50 healthy children, all male, aged 14-15 years. The sample of entities was taken from the population of healthy children and children with Down syndrome from cities: Pristina, Prizren, Ferizaj and Mitrovica. The criterion for choosing the sample of children with Down syndrome was that they had no other pathologies, while healthy children were chosen randomly.

The study was conducted during the period from February to April 2022. We got the approval of Ethics Committee of UBT College, with protocol number 13667. The testing was done by respecting principles of Helsinki Declaration (17).

All tested children were healthy. Morphological parameters were measured according to the guidelines of the International Society for the Advancement of Kinanthropometry (18), while cardiac work parameters and blood pressure were measured before and after submaximal physical exertion. The physical exertion was stimulated by running in place for the duration of one minute in consideration of the treated groups. Participants performed warm-up of 5 min (light walking) before the exercise, and 3 min of recovery by light walking Morphological measurements were made before submaximal physical exertion.

Anthropometric assessment was done as follows: Weight was measured with Seca digital scales with accuracy up to 100 grams. Individuals have stood on scales without shoes and with as little clothes as possible. Height was measured with a Seca stadiometer. Individuals have stood with their heels, rear, back and head as close to the wall as possible and looked straight ahead. The result was read at the end of the expiration with an accuracy of 0.1 cm. The length of the leg was measured with an anthropometer placed with its base in a flat position on the ground, while the horizontal arm of the anthropometer is placed on the anterior iliac spine. The result was read with 0.1cm accuracy. Biacromial width was measured with a caliper. The individual stands upright with his arms folded near the trunk, while the caliper arms are placed in the processus acromialis on both sides of the shoulders. The result is read with 0.1 cm accuracy. The head circumference was measured with a millimeter tape. The subject was in a sitting position. The tape was placed

around the subject's head, specifically at the widest part behind it, and approximately two fingers above the eyebrows from the front.

The calculation of body mass index (BMI) was obtained from the ratio of body mass to height squared expressed in kg / m^2. Limits for normal weight (percentile <85), overweight (percentile> 85) and obesity (percentile>97) as a criterion for evaluation are based on BMI values according to the WHO (19).

Statistical Analysis

Descriptive statistics was presented as mean ±standard deviation, chi-square test was used to evaluate differences in body mass index, t-test for indipendent samples was used for comparison of two groups, while paired t-test was used to compare pre and post exercise variables. The SPSS ver. 26 (IBM Corp., Armonk, NY, USA) was used with the significance level set at $P<0.05$.

Results

Table 1 gives the results of the body mass index of children with Down syndrome and normal children. About 68% of healthy children had normal body mass, 30% were overweight, while only 2% were obese. On the other hand, children with Down syndrome are more likely to be overweight, where 53% of them are of normal weight, 15.62% are overweight, and 21.8% are obese. Presented differences were statistically significant ($P<0.05$).

Table 1: BMI index for Down syndrome and normal adolescents

Variables		*Healthy*	*%*	*Down Syndrome*	*%*
	Participants	50	60.97	32	39.02
BMI	Normal	34	68	17	53
	Overweight	15	30	8	15.62
	Obese	1	2	7	21.8

Chi-square=8.768, $P<0.05$

Table 2 gives the descriptive parameters and differences between the two groups in anthropometric variables. The height of healthy children is about 13 cm greater (159.6 cm) than that of children with Down syndrome (146.26 cm).

Table 2: Descriptive statistics and differences for anthropometric variables

Variables		*N*	*Mean*	*t*	*P-value*
Height	Healthy	50	159.46±3.67	8.59	.000
	Down Syn	32	146.26±9.87	7.24	.000
Weight	Healthy	50	55.22±5.59	2.76	.007
	Down Syn	32	49.03±14.21	2.34	.024
Leg length	Healthy	50	78.74±8.24	-2.50	.016
	Down Syn	32	74.76±4.52	-2.82	.006
Head circumference	Healthy	50	52.34±2.86	3.16	.002
	Down Syn	32	50.5±1.99	3.42	.001
Biacromial width	Healthy	50	38.16±4.19	.545	.587
	Down Syn	32	37.55±5.94	.506	.615

The weight of normal children is greater (55.22 kg) than that of children with Down syndrome (49.03 kg). Even in other anthropometric variables normal children had higher values than those with Down syndrome. Statistically significant differences were confirmed through T-test for independent samples, such as height (P<0.01), weight (P<0.01), leg length (P<0.05), and head circumference (P<0.01). There are no statistically notable differences in biacromial width between the two groups. For the head circumference variable, healthy children produced higher values (52.34 cm) than children with Down syndrome (50.50 cm), which counts as important data.

Table 3 gives the results for blood pressure and heart rate before and after exercise. Before exercise, normal children have lesser numbers in heart rate (80.12 bpm) than children with Down syndrome (85.16 bpm). In terms of blood pressure, normal children have lower systolic blood pressure (111.18mm/hg) than children with Down syndrome (121.94mm/hg), whereas in diastolic pressure the values are identical (75.78 mm/hg) and children Down syndrome (75.80 mm/hg). Noteworthy differences were found only in systolic pressure in favor of children with Down syndrome (P<0.05). Meanwhile, diastolic pressure is completely identical, and heart rate values have no statistical significance despite all the systematic difference in favor of children with Down syndrome. The results of heart rate and blood pressure had similar flow after exercise, but there was a difference in diastolic blood pressure where normal children presented greater values (82.94mm/hg) than children with Down syndrome (76.16mm/hg).

Table 3: Descriptive statistics and differences for heart rate and blood pressure

Variables		*N*	*Mean&Sd*	*T*	*P-value*
HR	Healthy	50	80.12±12.56	-1.92	.058
	Down Syn	32	85.16±10.88	-1.86	.067
Sistolic	Healthy	50	111.18±21.69	-2.97	.004
	Down Syn	32	121.94±8.45	-2.60	.013
Diastolic	Healthy	50	75.78±13.8	-.008	.994
	Down Syn	32	75.8±17.107	-.007	.994
HRLoad	Healthy	50	94.62±14.137	-.092	.927
	Down Syn	32	94.95±10.769	-.096	.924
Sistolic Load	Healthy	50	123.76±19.894	-1.863	.066
	Down Syn	32	130.08±14.292	-1.649	.107
Diastolic Load	Healthy	50	82.94±10.477	2.313	**.023**
	Down Syn	32	76.16±10.477	2.473	**.016**

HR-heart rate; P-value<.05

Discussion

The aim of this study was to compare some anthropometric parameters, heart rate and blood pressure of children with Down syndrome and those with normal development.

The sample consisted 32 children with Down syndrome and 50 children with normal development, all male, aged 14-15 yr. Normal children showed better values in body mass index than children with Down syndrome who are overweight and obese in almost 50% of our sample (P<0.05). Down syndrome children and adolescents have higher values of BMI (8,20). With our sample this can certainly reflect lower physical activity, as these children tend to engage less in exercise because society in general has not developed sufficient mechanisms and policies for the

inclusion of this category of children in recreational physical activities. In anthropometric parameters children with normal development have higher values than children with Down syndrome, especially emphasized in body height of over 13 cm. This big difference in body height, could have been come because of a small sample of children with Down syndrome and the healthy children. Very similar body height with our sample has been found to the sample of Down syndrome children of Hong Kong (10). The differences have also been statistically significant for body mass (P<0.05), leg length (P<0.05) and head circumference (P<0.05). Children with Down syndrome have a smaller head circumference than healthy children (5,21). In terms of heart rate and blood pressure parameters, the groups differ only in systolic blood pressure (P<0.05) where children with Down syndrome had higher blood pressure than normal children, a similar result obtained (22). Heart rate and blood pressure parameters were stimulated by a submaximal physical activity, and post-activity measurements showed a similar trend as before the exertion with the only difference being that diastolic pressure (P<0.05) was higher in healthy children. The cause for such behavior may be sought in the short time of the exertion (only one minute of running in place) where the cardiovascular system may not have been sufficiently stimulated at the submaximal level.

Conclusion

Children with Down syndrome are characterized by a significantly higher body mass index than healthy children. Children with Down syndrome have lower values in the measured morphological parameters, higher heart rate and systolic pressure at rest, whereas after short physical activity, healthy children have exhibited greater diastolic pressure than children with Down syndrome.
As this is the first research with Down syndrome adolescents in national level, further researches with bigger samples are needed in order to establish normative values for anthropometric parameters and for other features of Down syndrome population.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of interest

The authors declare that there is no conflict of interests.

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