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BMI of male Down Syndrome patients in Punjab

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ABSTRACT

Down syndrome is the most common chromosomal disorder which involves trisomy for chromosome 21. This disorder is usually diagnosed at the time of birth or shortly thereafter by its phenotypic features in which hypotonia is one of the common abnormality. Individuals with Down syndrome have learning disability, mental retardation, brachycephalic head and eyes with epicanthic folds. The objectives of the study were to provide the height, weight and body mass index of males with Down syndrome. The cross-sectional data on 25 Down syndrome subjects and 25 healthy controls, ranging in age from 18 to 40 years were collected during 2014-2015 from September 2014 to March 2015. The controls were age and sex matched individuals with no health complications. Anthropometric measurements of height and weight were taken using standard methods and BMI was also calculated from these two measurements. There were significant differences in height, weight and BMI of males with Down syndrome and controls. Out of the total sample, 18 (72%) individuals with Down syndrome were obese, whereas 7 (28%) of them were normal. Similarly, among controls, 5(20%) were obese and 20 (80%) were normal. Chi-Square value was calculated for individuals with Down syndrome and age and sex matched controls. The difference was statistically significant with p value 0.0002. The individuals with Down syndrome were shorter in height but heavier in weight and had higher values of BMI. There were statistically significant differences in the mean height, weight and BMI of males with Down syndrome than the controls.

Keywords: *Height, Weight, Down syndrome, BMI, Punjab.*

INTRODUCTION

Down syndrome is the most common chromosomal disorder which involves trisomy for chromosome 21. An individual with Down syndrome has 47 chromosomes in which there is an extra copy of chromosome 21. 95% cases of Down syndrome have Trisomy 21(extra

chromosome 21) and the other 5% includes 3% of Translocation and 2% mosaicism (National Down syndrome Society, 2019). It is a genetic condition that causes delay in physical and intellectual development. Down syndrome is usually diagnosed at the time of birth by its phenotypic features in which hypotonia is one of the common abnormality. People with Down syndrome have learning disability, mental retardation, short stature and are obese.

The individuals with Down syndrome have small sized flattened head, round and slightly widened face. Their eyes have epicanthic folds, brushfield spots on iris with vision defects. The older name of Down syndrome was mongolism because of the epicanthic folds, which gave the eye a slanting appearance (Bull MJ.,2001). Down syndrome individuals have small and flattened nose, their ears are small and collapsed. They have flaccid jaw muscles, along with tongue that cause mouth to be open. The nose has a low bridge and the tongue usually protrudes forward and is furrowed, lacking a central fissure. The hands are short and broad and there may be a single crease on the fifth finger. There is often a wide gap in the first and second toe. Teeth are misshaped and abnormal. They have short and wide hands and feet with rough and cracked skin (Sadowska *et.al* 2019).

Down syndrome individuals were earlier expected to survive up to the age of 9 years only but due to the advancement in treatment and technology, their survival rate increased. Now, 80% of Down syndrome adults reach to the age of 60 years or more with the advances in technologies and better lifestyle.

Various screening and diagnostic tests give information about the confirmation of Down syndrome in the child. First trimester screening (at 8-9 weeks) includes the measurement of Pregnancy Associated Plasma Protein-A (PAPP-A) and Free beta Human Chorionic Gonadotrophin (FβhCG) in serum by specific immunoassay. An ultrasound scan is performed to measure the Nuchal Translucency (at 11-13weeks) that is measurement of fold under the muscles of cervical spine (collection of lymphatic fluid). Second trimester screening includes the four serum markers that are Alpha-fetoprotein (αFP), Human Chorionic Gonadotrophin (intant hCG), Unconjugated estriol (uE3) and Inhibin-A. Amniocentesis (between 15-20 weeks) and Chorionic villus sampling (CVS between 11-13 weeks) are the confirmatory tests for Down syndrome (Newborn Screening Portfolia, 2009, Wald *et.al.*,1998 and Wald *et. al.*,1996).

The individuals with Down syndrome usually have heart defects, high risk of hearing and vision problems and an affected speech which may be difficult to understand. Risk of having child with Down syndrome increases with maternal age, because conceiving child after 35

years of age cause improper cell division. (Mayo Clinic, 2018). But in India, the incidence of having Down syndrome child is more in young mothers. The mean maternal age of having child with Down syndrome in Punjab is 27.6 years, 26.8 years in Mumbai and 30.2 years in Hyderabad (Malini *et.al*, 2011).

According to WHO (1996), the estimate incidence of Down syndrome is between 1 in 1,000 to 1 in 1100 live births worldwide. Approximately 3000 to 5000 children are born with Down syndrome every year. It is estimated that about 250,000 families in United States of America are affected by this disorder (Control of hereditary disorders: Report of WHO Scientific group, 1996). The prevalence of Down syndrome at birth increased by 31 percent from 9 to 12 per 10,000 live births. (Centers for disease control and prevention, 2017).

Table-1 Prevalence of live birth cases of Down syndrome.

Country	Year	Live births	Study
India	2015	1 in 800	*Down syndrome Prenatal testing*, 2015
United States	2008	1 in 1200	*Centers for disease control and prevention*, 2017
Canada	2013	1 in 750	*Down syndrome surveillance in Canada 2015-2013*, 2017
Ireland	2019	1 in 546	*Down syndrome Ireland*, 2019
UK	2019	1 in 1000	*Down syndrome Association*, 2019
Australia	2014	1 in 1100	*Down syndrome Australia*, 2014
Pakistan	2014	1 in 700	Nasir *et. al*, 2014
Iran	2017	1 in 1000	Pasha *et. al*, 2017

The present study was designed to investigate the anthropometric measurements of individuals with Down syndrome in the Malwa region of Punjab. Such type of study has not been reported earlier on this population. It would be the first study of its kind to report the anthropometric measurements of the Down syndrome subjects in the Malwa region of Punjab. The aim of the study was to distinguish Down syndrome patients from general population on the basis of height, weight and body mass index.

MATERIALS AND METHODS

The sample was collected from the different areas of Punjab. A total of fifty male subjects (25 cases and 25 controls) aged 18 to 40 years were studied. The controls were age matched individuals with cases. This data was mainly collected from the various schools and institutions for physically and mentally challenged individuals and for controls from the individuals with lower socio economic status. The study was approved by Institutional Ethical Committee of Punjabi University, Patiala, Punjab **(ICEC no: ICEC55)**.

The body measurements were taken on each individual to measure the obesity in the Down syndrome individuals (Singh and Mehta, 2009). Height and weight were measured according to technique given by Lohman *et.al*,1988. and further body mass index (BMI) was calculated by the following formula

$$\text{BMI}= \frac{weight(kg)}{height^2(m)^2}$$

Student t-test and Chi Square were calculated to assess the difference between the two studied groups.

RESULTS

The mean height of the subjects with Down syndrome was smaller (149.63 cm) as compared to that of the controls (170.54 cm) **(Table 2)**. The difference in height was statistically significant with t-value of 10.75. The mean weight of the persons with Down syndrome was 66.6 kg and that of controls was 62.53 kg. This difference in weight was also statistically significant with t value of 3.39. The mean BMI of the subjects with Down syndrome and control were 33.65 and 18.56, respectively. The values of S.D and S.E.M were 5.28 and 1.15 in persons with Down syndrome and 4.24 and 0.60 in control group respectively.

Table-2 Mean, S.D and S.E.M of Height, Weight and Body Mass Index (BMI) of Males with Down syndrome and controls.

Variables	Down Syndrome			Controls			
	MEAN	S.D	S.E.M	MEAN	S.D	S.E.M	t-value
Height (cm)	149.63	7.69	1.67	170.54	6.58	0.98	10.75*
Weight (kg)	66.6	5.20	3.20	62.53	4.23	1.76	3.39*
BMI	33.65	5.28	1.15	18.56	4.24	0.60	12.75*

* Statistically Significant ($p < 0.001$)

There were statistically significant differences in the mean height, weight and BMI of the males with Down syndrome and controls (p-values 10.75, 3.39 and 12.75, respectively).

Table-3 Chi-Square for individuals with Down syndrome and age and sex matched controls

Chi Square	Normal	Obese	χ^2	p-value
Down syndrome	7(28%)	18(72%)	13.6	0.0002*
Controls	20(80%)	5(20%)		

According to international classification of BMI (WHO 2000), the present study reported that 18(72%) of Down syndrome subjects were obese, whereas only 7(28%) persons with Down syndrome were normal. On the other hand, in case of controls, only 5(20%) persons were obese whereas 20(80%) were normal **(Table 3)**. The chi-square value by comparing obese and non-obese individuals with Down syndrome and controls is 13.6. The results were

The chi-square value (13.6) showed statistically significant difference between Down syndrome subjects and controls in respect of normal and obese subjects (p-value 0.0002) **(Table 3)**.

A comparison **(Table 4)** of height, weight and BMI of individuals with Down syndrome has been made with that of various other studies. on the basis of

represents that the Down syndrome males were heavier in weight and shorter in height. The BMI of the males of Punjab is comparatively higher i.e. 33.65 than the other countries. The results of present study show the conformity with the earlier studied studies.

DISCUSSION

Down syndrome subjects were shorter in height than their control counterparts. The results were in conformity with those reported earlier by different investigators from other populations (Aguero *et. al.*, 2011). Similarly, a study by Chavez *et.al.*, **(**2012) reported that the height of individuals with Down syndrome was shorter than the control peers. A study by Asha *et.al.* (2014), Melville *et.al.* (2005) and Peeri *et.al.* (2013) confirmed that the individuals with Down Syndrome were shorter in stature than the general population. The individuals with Down syndrome of the present study were heavier in weight than the control ones. It is important to note that there is a great paucity of comparative data on individuals

with Down syndrome and their age matched controls. Most of the earlier studies show a great difference in the number of individuals and their ages in Down syndrome and controls in the comparative studies reported by Melville *et.al.* (2005).

Table-4: Comparison of height, weight and BMI of individuals with Down syndrome of various studies.

Studies	Age	Height	Weight	BMI
Punjab, Present Study, 2019 (n=50)	17-40	149.63	53.66	33.65
Iran, Peeri *et.al*, 2013 (n=9)	26-30	154.33	70.14	29.73
Venezuela, Chavez *et.al*, 2012 (n=20)	28-35	148.2	67.2	30.8
Turkey, Savucu *et.al*, 2010 (n=50)	14-20	129.00	46.39	31.92
Spain, Guijarro *et.al*, 2007 (n=27)	18-45	151	60	26.3
England, Melville *et.al.*,2005 (n=378)	18+	156	66	27.03
Karnataka, India (Asha *et.al*.,2014)				24
Chicago (USA), (Stephen *et.al*.,1997)	-	-	-	27.8
Iran, (Dehghani *et.al*.,2012)	-	-	-	30.76
New Castle, (Henderson *et.al*.,2007)	-	-	-	30.9

The present study revealed that the BMI of the males with Down syndrome was much higher as compared to that of the controls and the difference was statistically significant. Findings on BMI of Down syndrome subjects of the present study endorse those of earlier studies (Asha *et.al.,* 2014, Melville *et.al.*, 2005, Peeri *et.al.*, 2013 and Chavez *et.al* 2012).

According to the study by Buday and Eiben (1982), the mean value of height in males with Down syndrome was 154.3 and their mean weight was 60.6 kg. Similarly, a study by Anderson (1985) revealed that in males with Down syndrome, mean value of height was 156.1 and mean value for weight was 63.5 kg respectively. Whereas according to the present

study, the males were shorter and heavier than the males from the above studies. These differences in mean value of height and weight between the males of present and earlier studies may be due to differences in ethnicity.

Conclusion

The subjects with Down syndrome in present study are shorter in stature and heavier in weight as compared to their control counterparts. There were statistically significant differences in the mean height and weight of persons with Down syndrome and controls. Similarly, statistically significant differences are found in the BMI upon comparison of the person with Down syndrome and controls.

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