

# Prevalence of Overweight and Obesity in Down Syndrome

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## ABSTRACT

**Objectives:** To correlate whether the individuals with Down syndrome are at increased risk of overweight or obesity and is there any difference in BMI between male and female Down syndrome.

**Study designs:** The study was conducted on 96 cases (59 males and 37 females) of Down syndrome with the age ranging from one year to 40 years. All 96 cases were randomly selected from various special schools of Tamilnadu state of India. The participant's weight and height were measured using digital weighing scale and stadiometer respectively. BMI ( $\text{Kg/m}^2$ ) was calculated. Data were compiled on SPSS version 16.0 and unpaired t- test were used for comparing variables.

**Results:** There were significant differences in BMI of males and females Down syndrome cases. As per National Center for Health Statistics (NCHS) Charts for Down syndrome from birth to 18 years of age, BMI percentile between 85<sup>th</sup> and 95<sup>th</sup> were observed in 12% of males and 35% of females Down syndrome. Since National Center for Health Statistics (NCHS) Charts are limited only to Down syndrome up to the age of 18 years, WHO categories was used from 19 years to 40 years of cases, BMI above  $25\text{kg/m}^2$  were observed in 13% males and 20% females. BMI above  $30\text{kg/m}^2$  were present only in 2% of male Down syndrome.

**Conclusions:** Our study indicates that there is no question of obesity up to the age of 18 years of Down syndrome, but many of them were found to be overweight. Only 2 % of cases were observed in obesity category that too between 19 to 40 years. Hence physical activity based intervention should be strictly followed in preventing overweight gain in all Down syndrome cases. Development of various other associated diseases due to overweight and obesity could be prevented with strict physical activity under supervision.

**Keywords:** Down syndrome; body mass index; obesity; overweight

## INTRODUCTION

Down syndrome is the most common chromosomal disorder, with an incidence of one in 920 live births in Indian population. The mental and physical developments in Down syndrome are slower. Infants of Down syndrome may be born of normal average size, but grows slower and remains smaller than same age normal group. The common physical sign

includes, flat face with mongoloid slant, short neck, microcephaly, Simian crease in the hand with brachydactyly. [1] Down syndrome is also affected by variety of health disorders like congenital heart diseases, thyroid dysfunction, celiac diseases, eye problem and dementia etc. [2,3] All the above mentioned health disorders influence the weight and nutritional status of the Down syndrome individuals. [4]

The most important cardinal feature in Down syndrome cases is short stature. [5] The velocity of growth among Down syndrome between 6 months to 3 years of age is mostly reduced. [5,6] Hence there is vast difference in the growth and final height between Down syndrome and healthy normal child. [7]

The risk factor for overweight includes hypothyroidism, decreased resting metabolic rate, increased energy intake, lack of physical activity and consuming of high fat diet. [8-13] In a study of individuals with intellectual disabilities, 70% of men and women consumed high –fat diets and less than 10% consumed recommended fruits and vegetables. [14] Many studies said that the Down syndrome cases usually lead sedentary life. [15] There is only one survey report showing 60% of adult Down syndrome doing exercises daily. [15]

**OBJECTIVES OF THE STUDY:**

- To assess whether the individuals with Down syndrome in Tamilnadu state of India are at increased risk of overweight or obesity.
- To find out whether there is any difference in BMI between both male and female Down syndrome.

**MATERIALS AND METHODS**

The study was conducted on 96 cases (59 males and 37 females) of Down syndrome with the age ranging from one year to 40 years. All the cases were randomly selected from various special schools of Tamilnadu state of India. Exclusion criteria included were autism, other chromosomal disorders, oedematous Down syndrome and Down syndrome of other states of India. Brief explanation of

the study was given to the participants parents and obtained consent for participation of their children. The participant’s weight and height were measured using digital weighing scale and stadiometer respectively. The measurement of height and weight are then plotted on the National Center for Health Statistics (NCHS) growth chart that is specially designed for Down syndrome children. [16,17] BMI (Kg/m<sup>2</sup>) was calculated.

**Statistical analysis:**

Data were compiled on SPSS version 16.0 and unpaired t- test were used for comparing variables. Percentage calculations were done to find the prevalence of overweight and obesity between males and female Down syndrome cases. The participants were grouped into 4 age groups as given in the table -1 with 10 years interval between each group. A child BMI between 85<sup>th</sup> and 95<sup>th</sup> percentiles is considered to be overweight and greater than 95<sup>th</sup> percentile to be obese.

**RESULTS**

Males with Down syndrome had a higher mean height and lower weight and showed there was significant difference in BMI compared with Down syndrome females. There were significant difference in BMI of males and female Downs among group 1(14.2 ± 2.1 and 17.7 ± 4.7), group 2 (22 ± 2.7 and 24.5 ± 2.5) and group 3(23.3 ± 2.9 and 28 ± 0.1) having p value 0.01\*, 0.02\* and 0.003\*\* (Table 1). There were no significant differences among male and female age group 4 (27.3 ± 2.9 and 25.1 ± 2.0).

**Table - 1: Comparison of Body Mass Index between male and female DS cases using unpaired t- test**

Groups (Age range)	No. of Males	No. of females	Mean ± SD of male	Mean ± SD of female	P value
Group 1 (0-10)	18	12	14.2 ± 2.1	17.7 ± 4.7	0.01*
Group 2 (11-20)	25	16	22.0 ± 2.7	24.5 ± 2.5	0.003**
Group 3 (21-30)	10	3	23.3 ± 2.9	28.0 ± 0.1	0.02*
Group 4 (30-40)	6	6	27.3 ± 2.9	25.1 ± 2.0	0.1#

SD – Standard deviation; \* significant; \*\* highly significant; # not significant.

The BMI was calculated using World Health Organisation (WHO) categories and National Center for Health Statistics (NCHS) growth chart. Women with Down syndrome were more likely to be overweight than male groups. As per National Center for Health Statistics (NCHS) Charts for Down syndrome from birth to 18 years of age, BMI percentile between 85<sup>th</sup> and 95<sup>th</sup> were observed in 12%

of males and 35% of females Down syndrome (Table - 2a). Since National Center for Health Statistics (NCHS) Charts are limited only to Down syndrome up to the age of 18 years, WHO categories was used from 19 years to 40 years of cases, BMI above 25kg/m<sup>2</sup> were observed in 13% males and 20% females. BMI above 30kg/m<sup>2</sup> were present only in 2% of male Down syndrome (Table – 2b).

**Table - 2a: Percentage of BMI percentile (1 - 18 years) among both sexes of Down syndrome according to NCHS**

BMI percentile (1 year -18 years)	No. of males	Percentage (%)	No. of females	Percentage (%)
<P5	8	14	3	8
P25- P85	27	45	10	27
P85 - P95	7	12	13	35
>P95	Nil	0	Nil	0

**Table- 2b: Percentage of BMI (19 - 40 years) among both sexes of Down syndrome according to WHO**

BMI=weight (Kg)/height (m <sup>2</sup> )	No. of Males	%	No. of Females	%
<18.5	Nil	0	Nil	0
18.6-24.9	7	14	4	10
25-29.9	8	13	8	20
>30	2	2	0	0

**Table - 3: Prevalence of Overweight and Obesity in Down syndrome cases Worldwide**

Age group	No. of Down syndrome cases	Overweight -BMI >25kg/m <sup>2</sup>		Obese - BMI above >30kg/m <sup>2</sup>		Authors
		Male	Female	Male	Female	
Birth to 18 years	354	31%	36%	Nil		Myrelid et al [17]
16-59 years	49 (28 men, 21 women)	32%	67%	25%	43%	Fujiura et al [13]
2 -18 years	303	Nil		47.8%		Basil et al [18]
≥ 16 years	181	19%	21%	25%	27%	Melville et al [22]
13-21 years	32 (20 boys, 12 girls)	35%	33%	25%	8%	Bandhini et al [23]
1-40 years	96 (59 males, 37 females)	25%	55%	2%	NA	Present study

\* = Table - 2a and 2b percentage of increased BMI (overweight) of our study are grouped together to compare with other researchers study.

## DISCUSSIONS

In the present study, the female with down syndrome had a mean BMI increase in age group 1, 2 and 3 except the age group 4 (30 - 40 years), showing lesser BMI 25.11 ± 2.0 than males 27.3 ± 2.9 with no significant difference between both sexes (Table - 1).

Basil et al 2016 evaluated 303 Down syndrome individuals and reported 47.8 % of them were obese (MBI ≥ 95<sup>th</sup> percentile) and majority of children also had Obstructive Sleep Apnea Syndrome (OSAS) due to obesity (P=0.0015). [18]

In a retrospective study conducted by Koshy et al 2012 showed BMI for children with Down syndrome progressively increased with age however the difference was not statistically significant. [20]

Melville et al (2005) case control study in adults of Down syndrome reported

that women were more likely to be overweight than their matched intellectual disabilities pairs (odd ratio = 2.17) and but not men. [21] Myrelid et al 2002 observed that the BMI > 25 kg/m<sup>2</sup> at 18 years in 31% of males and 36 % of the females.

In all Down syndrome cases the major difficulty encountered is lower muscle tone which prevents normal activity and causes overweight and obesity. Hypotonia may make physical activity more difficult and also prevents them from doing effective exercise thereby increasing the muscle mass and also it is more difficult to increase their metabolism. [19] Inappropriate eating habits with high fat diets may lack proteins and other quality nutrition, resulting in obesity of Down syndrome. [22]

Considering all these factors the dieticians should prepare a special diet chart for Down syndrome cases as per their

requirements and provide necessary tips to their care taker in making Down syndrome cases healthier.

The present study showed that both male and female had increased BMI greater than 25kg/m<sup>2</sup> as the age increases but BMI greater than 30Kg/m were only in 2% of male Down syndrome cases. The differences were statistically highly significant between both sexes. In our study the decrease in obesity percentage among Down syndrome may be due to the participant's easy access to gym and physical activities, in Special School Curriculum.

## CONCLUSIONS

Our study indicates that there is no question of obesity up to the age of 18 years of Down syndrome, but many of them were found to be overweight. Only 2 % of cases were observed in obesity category that too between 19 to 40 years. Hence physical activity based intervention should be strictly followed in preventing overweight gain in all Down syndrome cases. Development of various other associated diseases due to overweight and obesity could be prevented with strict physical activity under supervision.

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