

The Relationship Between Body Mass Index (BMI) and Balance in Down Syndrome Children at the X Depok Foundation

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Submission Date 11 October 2023 ; Receipt date: 1 November 2023

ABSTRACT

Introduction: In Indonesia, there are more than 300,000 children with Down syndrome. Down syndrome is a chromosomal abnormality that occurs while still in the womb. Children with Down syndrome have a high risk of being overweight or even obese. This increase in BMI causes various problems, one of which is the weakening of strength and loss of balance.

Purpose: To determine the relationship between body mass index (BMI) and balance in children with Down syndrome at Yayasan X.

Method: This study used a correlational study design with a cross-sectional approach with a sample of 89 children with Down syndrome. This research was conducted offline by using the pediatric balance scale and measuring body mass index (BMI).

Result: This study used SPSS 23 and the results obtained $p = 0,000$ on balance with the correlation coefficient between BMI of 0.559 conclusion there is a unidirectional relationship between BMI and balance.

Conclusion: There is a relationship between body mass index and balance in the same direction in children with Down syndrome at Yayasan X.

Keywords: BMI, Balance, PBS, Hypotone, Obesity

ISSN 2722 – 9610
 E –ISSN 2722 - 9629

INTRODUCTION

Down syndrome is a disorder that occurs when a person is still in the womb and before a person is born. Usually, children with *Down syndrome* have 47 chromosomes from their parents, this is because children with *Down syndrome* experience an error in embryo cell division which produces 3 copies of chromosome 21, while normal children usually have 23 pairs or 46 chromosomes from their parents. Until now the incidence of *Down syndrome* is not known. The exact cause of children with *Down syndrome* is currently unknown. Until now, children with *Down syndrome* have often been the centre of attention because of their distinctive

appearance, sometimes they look at them with surprise (Renawati et al., 2017).

According to the Indonesian Center for Biodiversity and Biotechnology (ICBB) Bogor, there are more than 300,000 children with *Down syndrome* in Indonesia. The birth of children with *Down syndrome* is estimated to reach 8 million people worldwide. It is said that the birth rate of children with *Down syndrome* is almost 1:1,000. In Indonesia, the prevalence exceeds 300,000. A woman's age has been shown to have a significant impact on the likelihood of her child having *Down syndrome* at birth. These results show that the possibility of having a child with *Down syndrome* increases due to the mother's age during pregnancy (Ayuningrum & Afif,

2020).

The period of child development and growth is very risky in every child's life. Children experience a process of growth and development that begins in the womb, during infancy and early childhood. Each stage of a child's growth and development process has its characteristics. Thus, if a problem arises during the growth and development period, it will have an impact on subsequent life. Not all children experience growth and development naturally, so there are children who need special treatment. Some health problems of children with special needs are usually present from birth or are congenital, for example, children with *Down syndrome* (Yulianti, 2017).

Children with *Down syndrome* experience various congenital physical and motor problems related to their physical condition, such as hypotonia, *hypermobile joints* and delayed neurological development. If this problem is not treated with appropriate stimulation, it is feared that it will cause problems with further motor development, for example, body balance. Most children with *Down syndrome* experience decreased muscle strength and muscle tone (hypotonus), excessive joint mobility or *hypermobile joints*, and delays in neurological, *motor* and *cognitive* development. One of the problems that occurs in children with *Down syndrome* is balance disorders which hinder cognitive development, motor perception and *proprioception*. In this case, it is very limiting and affects the quality of life of children with *Down syndrome* which can complicate many daily activities, limit physical work and increase dependence on other people (Saraswati & Ulfa, 2020).

Children with *Down syndrome* have a high risk of being overweight or even obese. Based on studies conducted abroad, various journals show that the majority of children with *Down syndrome* are overweight and obese. Not much research has been conducted on the nutritional status of children with

disabilities, especially children with *Down syndrome*, in Indonesia. The results of Marin and Graupera's research show that the prevalence of children with *Down syndrome* who are overweight and obese is 73.6%, whereas according to Oosterom et al. show that the prevalence of obese children with *Down syndrome* is twice that of normal children (Rahmawati & Irawan, 2020).

Based on 2013 RISKESDAS data, it shows that the prevalence of children with nutritional problems in Indonesia between the ages of 5 and 12 years is still quite high, namely 10.8% overweight and 8.8% obese. Being *overweight* in children with *Down syndrome* is a factor that can trigger health problems, such as heart disease and muscle hypotonia. Based on data from several studies, the number of overweight and obese children has increased significantly over the last three decades, namely approximately 170 million children under the age of 18 in the world (Sa'pang et al., 2020).

Lack of physical activity causes a lot of energy to be stored as fat, so people who do less physical activity tend to become fat. Children who do light physical activity are significantly related to being overweight. Changes in body mass index can occur in people of different ages and genders. Everyone needs a normal body mass index to facilitate daily activities and avoid disease (Daniati, 2020).

Decreased muscle tone can be caused by changes in increased body mass index. Decreased muscle strength and increased body mass cause balance problems when standing or walking, as well as cardiovascular problems. Low muscle strength can cause failure of muscle working strength in the working body position, direction of work movement and loss of body balance mechanisms (Ilyasin et al., 2018).

METHOD

The type of research used is a descriptive study using correlation research methods with a *cross-sectional* approach. This research is intended to determine the relationship between Body Mass Index and Balance in *Down Syndrome* Children at Foundation and height, then the balance was measured using the *Pediatric Balance Scale* according to the procedure. The population of this study were children with *Down syndrome* at Foundation X. Samples were taken from a population that met the following inclusion and exclusion criteria:

- a. Inclusion Criteria:
 - 1) Samples aged < 18 years
 - 2) Willing to be a research respondent
 - 3) Children with *Down syndrome*
- b. Exclusion Criteria
 - 1) Not cooperative during the research
 - 2) The sample is sick

RESEARCH RESULT

To be able to provide comprehensive information and improve the interpretation of the results of the hypothesis test, data analysis is provided to determine the frequency of variables such as nature and age.

Table 1. Characteristics of the Research Sample

Characteristics	Frequency (n)	Percentage (%)
Gender		
Man	52	58,4%
Woman	37	41,6%
Age		
Children (5 – 11 Years)	7	7,9%
Early Teenagers (12 – 16 Years)	78	87,6%
Teenagers (17 – 25 Years)	4	4,5%
Total	89	100%

Based on the data in Table 2 above, it can be concluded that the sample of male sexual characteristics is the largest, namely 58.4% of female sexual characteristics, while the sample of female sexual characteristics is

only 41.6%. The largest age category, namely in the early teenage age category with a percentage of 87.6% and the largest sample is in the childhood age category with a percentage of 7.9%.

Table 2. Frequency Distribution of BMI and Balance

Body Mass index	Balance Category							
	Low Fall Risk		Medium Fall Risk		Fall Risk Tall		Total	
	n	%	n	%	n	%	n	%
Not enough	0	0%	0	0%	0	0%	0	0%
Normal	12	13,5%	22	24,7%	0	0%	34	38,2%
Excessive	1	1,1%	48	53,9%	0	0%	49	55,1%
Obesity I	0	0%	2	2,2%	3	3,4%	5	5,6%
Obesity II	0	0%	0	0%	1	1,1%	1	1,1%
Total	13	14,6%	72	80,9%	4	4,5%	89	100%

Based on Table 3 above, it can be seen that the results of the body mass category, the highest results are in the high-level category, namely with a percentage of 55.1% and the lowest is in the obesity category II with a percentage of 1.1%.

Meanwhile, the category with the highest percentage of balance is the category with a low risk of falling, namely with 49.4% visibility and the category with the lowest percentage is the lower risk of falling with 4.5% visibility.

As a result of the data above, it can also be concluded that as large as the body mass index is, the balance is likely to be in the category of risk of falling and falling, whereas if it is in the category of body mass index for obesity Ii and obesity III then the balance is likely to be The odds will be in the categories of risk of falling higher, which means that the balance is getting lower and the risk of falling is getting higher.

Table 3. Correlation Test Analysis Results

Variable	Test – Chi-Square P
Body mass index	0.00
Balance	0.00

This *chi-square* test was carried out to determine the relationship between body mass index and balance. The *chi-square* test is used in hypothesis testing because the data in this study is included in an ordinal scale.

Based on the data in Table 3 above, it has been achieved by Asimp. Sig is 0.000 because of the Asimp. The sig value is $0.000 < 0.05$, and the result is significant, which means H_a is accepted and H_o is rejected. Thus, it can be interpreted that there is a "relationship between Body Mass Index and balance in *Down Syndrome* Children at Foundation X". This can be interpreted as meaning that the higher a child's body mass index, the worse the balance in children with *Down syndrome* and the higher the risk of falls.

DISCUSSION

Children with *Down syndrome* have a greater chance of experiencing excess weight or obesity. The population of children with *Down syndrome* experienced increased weight loss and higher obesity (19.3% and 9.7%) compared to normal children (6.5% and 6.5%). The prevalence of excess weight in adolescents with *Down syndrome* reached 33.3% and this group had a 3.21 times greater risk of experiencing obesity compared to people with other disabilities (Sa'pang et al., 2020).

According to Ilyasin (2018), changes in body mass index have an impact on decreasing muscle tone. Muscle tone refers to the state of tension or relaxation in a muscle when it is at rest. Decreased muscle strength and increased body mass can trigger balance disorders when walking or walking, as well as cardiovascular problems. Lack of muscle mass can cause the muscles to maintain the body's position when carrying out activities, keep the direction of movement, and lose body balance mechanisms.

The results of this experiment are also in line with previous experiments where the results indicate a correlation between body mass index and balance. The cause is an increase in body mass index which results in problems with the musculoskeletal system, such as loss of muscle strength due to muscle replacement. This results in the use of body

energy being higher than the energy used for daily activities, so that the remaining energy is stored in the form of fat (Srianti Dewi et al., 2019).

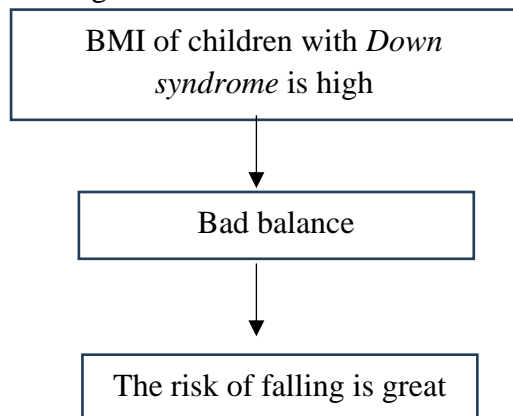
Changes in body fat composition, leg size and leg circumference can influence changes in stride length. As a result, the *heel strike* phase that occurs as the *swinging* phase can become unstable and the *navicular* position becomes more beautiful so that the footing environment becomes flatter than usual. This can cause changes in the body's stress points. This can affect the centre of rotation and centre of gravity of the human body, which can affect the balance of the human body in daily activities. The higher the body mass index value (BMI), the greater the balance of the human body (Srianti Dewi et al., 2019).

The results of this study are also in line with previous research by Ghaur et al., (2015) where the research showed a relationship between body mass index and balance. This is because obesity can affect adaptation and mobility by limiting an individual's ability to motor plan. Poor motor skills cause a lack of body performance in response to existing stimuli and affect the process of adaptation or adjustment of individual actions to the surrounding environment. This means that in the obese population, poor motor planning and the inability to adjust the motor plan during actions can lead to more frequent loss of balance.

According to research conducted by Galli et al. said that children *with Down syndrome* have delayed motor development related to the presence of muscle *hypotonus* and joint flexibility (*laxity*) which is characteristic of *Down syndrome*. The role of physiotherapy as early as possible should focus on movement control and coordination to reach the developmental stage. When standing, of course, you have to have a good *base* in terms of overall muscle, *proprioceptive*, tactile and *vestibular* maturity. *Down syndrome* children have

problems maintaining their balance both while standing and walking caused by *hypotonic* and excessive joint mobility. Apart from disturbances in balance, the development of postural reactions from posture and movement patterns is also not good enough in children with *Down syndrome*.

The research results can be displayed in the following chart:



CONCLUSION

The results of the study showed that there was a relationship between body mass index (BMI) and balance in children with *Down syndrome*. The higher the body mass index of a child with *Down syndrome*, the lower the balance value he will have and the higher the risk of falling.

ACKNOWLEDGEMENT

The researcher would like to thank the lecturers in the physiotherapy study program in the third diploma program for their guidance. Apart from that, to friends who have helped in conducting research, starting from collecting data to processing the results.

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