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Original Research Article

Neurobiological developmental disorders in preschool girls are associated with obesity

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ABSTRACT

Background: The prevalence of abnormal weight in young children with neurobiological developmental disorders is not known. Children with abnormal weight are at risk for both mental health problems now and in their future. Moreover, abnormal weight can have a detrimental effect on their treatment. This prospective study examines the length and weight in preschool children with neurobiological developmental disorders requiring special day care.
Methods: Trained medical employees measured height and weight of children aged 3 till 5 years old with developmental disorders, who started special youth day care between 2019 and 2021 in the province of Drenthe in the Netherlands.
Results: A total 73% of the children had normal weight, 16% had overweight, 12% were underweight. Girls had more often overweight (28%) and underweight (14%), compared to boys.
Conclusions: Our results suggest that pre-school children and especially girls with psychological problems, have already a significant increased risk of an abnormal body mass index (BMI). Although studies with a larger study population are needed to ascertain this conclusion, screening for an abnormal BMI should be conducted as a standard procedure in this group of children, since it can affect their therapy and future health.

Keywords: Children, Neurobiological developmental disorders, Overweight, Underweight, Obesity

INTRODUCTION

The early years of a child's life are a critical phase of growth and development, laying the groundwork for their future physical and mental well-being. The indicators of growth not only serve as markers for physical health, but also reflect the state of their mental health. In recent times, the spotlight on childhood obesity has intensified within the healthcare discourse, due to its well-documented adverse effects on both physical and mental well-being.[1] Equally significant, the issue of underweight in young children holds its own set of concerns, with repercussions that extend beyond physical health, impacting overall well-being.[2]

In the Netherlands, the prevalence of overweight among young children aged 4 to 12 has exhibited a relatively stable trend, fluctuating between 11 and 16% over the past two decades, as reported by the Central Bureau of Statistics.[3] Simultaneously, the prevalence of underweight remains notably high, although there has been a slight decrease in from 9.2% in 2001 to 7.9% in 2022.[3] Both numbers of overweight and underweight peaked in 2020 and 2021, probably due to the COVID-pandemic.

Studies by Donkor, Anderson, Cimino, and Mackenbach underscore the interconnectedness between abnormal weight and psychological issues during the time of measurement in young children.[4-7] Cimino also confirmed this association in their future years, with permanently

higher amounts of internalizing and externalizing problems in young children with underweight.[6] Logan et al confirmed the relationship between BMI and motor proficiency in the preschool population.[8]

Despite the likely impact on treatment and the fact that they already have a poorer psychosocial outcome, young children in the Netherlands with severe psychosocial problems requiring specialized day care are not routinely screened for length and weight. The prevalence of abnormal weight in this group is therefore not known.

This prospective study examines the length and weight in children aged 3 to 5 years old, with general developmental delay or emotional and behavioral problems requiring special day care. We hypothesized that emotional and behavioral problems are negatively related to growth.

METHODS

Study design and population

Data were obtained through a prospective chart review. The inclusion criteria included children aged 3 till 5 years old, who started between June 2019 and September 2021 at youth healthcare in Drenthe in the Netherlands, at the Medical Orthopedagogical Centre of Yorneo. The children were referred to this center, because of general developmental delay or emotional and behavioral problems.

Children were excluded if they refused the measurements for height and weight.

Since 2019, measuring height and weight has been a standard procedure in these centers at the start of the program. These data are kept in an anonymous database.

Measures

Trained medical employees measured height and weight of the participants. Weight of children was measured wearing underwear only, and height was measured in a barefooted standing position. Length was compared to the Dutch population based on the The Fifth Dutch Growth Study.[9] The children's individual body mass indexes (BMIs) were calculated as weight/height (kg/m^2). To define underweight, normal weight and overweight, we used international age- and sex-specific cutoffs.[10,11]

Statistical analysis

Data were analyzed using social science statistics. Descriptive statistics are presented as counts and per cents for categorical variables and as means and standard deviation (SD) for continuous variables. Continuous variables where tested by the Kolmogorov-Smirnov test. The differences in characteristics were explored by using Chi-square calculator.

RESULTS

Of 130 participants, 128 (98%) were assessed in the study. Two children were excluded because they refused the measurements. Clinical characteristics of these participants are presented in Tables 1 and 2, all variables had a normal distribution.

Table 1: Characteristics of study population (n=128).

Characteristics	Total	Male	Female
Gender (%)	128 (100)	92 (71.9)	36 (28.1)
Age (in years)	4 (0.55)	3.9 (0.53)	4.1 (0.56)

Values are shown as the mean±SD for continuous variables or frequency (%) for categorical variables

Table 2: Measurements of study population (n=128).

Measurements	Total
BMI	16.3 (1.7)
BMI z-score[1]	0.4 (1.3)
Length (in cm)	104.6 (5.9)
Length z-score[2]	-0.1 (1.2)
Normal weight	93 (73%)
Underweight	15 (12%)
Overweight	20 (16%)

Values are shown as the mean±SD for continuous variables or frequency (%) for categorical variables; [1]sex- and age-adjusted BMI z-score, calculated using Dutch reference growth curves; [2]length calculated using The Fifth Dutch Growth Study

Length of the children was mostly normal (93%) (Figures 1 and 2). The majority (73%) had normal weight, 12% were underweight, 16% had overweight (Figure 3). Five of the seven tall children (71%) had also overweight.

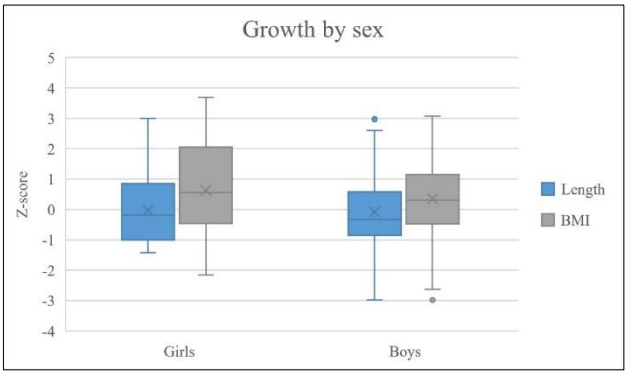

Figure 1: Distribution of length and BMI by Z-score, categorized for sex.

Six boys (6.5%) were taller as expected (Z-score >2), two of the boys (2.2%) were shorter than expected (Z-score <2). 78% of the boys had a normal weight, 11% had overweight and 11% was underweight.

One girl (2.8%) was taller as expected, none of them were shorter as expected. Girls had significant less often a

normal weight (58%), more often overweight (28%) and underweight (14%), compared to boys.

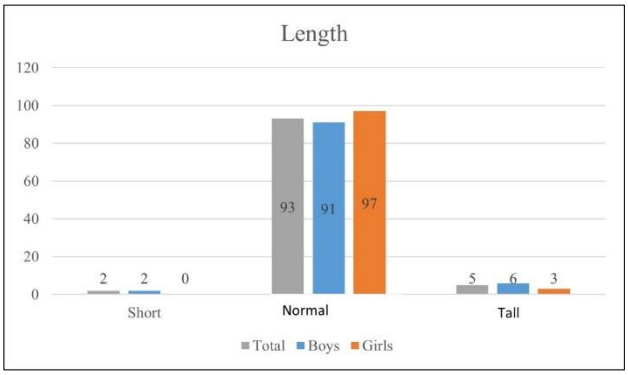

Figure 2: Length categorized by Z-score and sex in %.

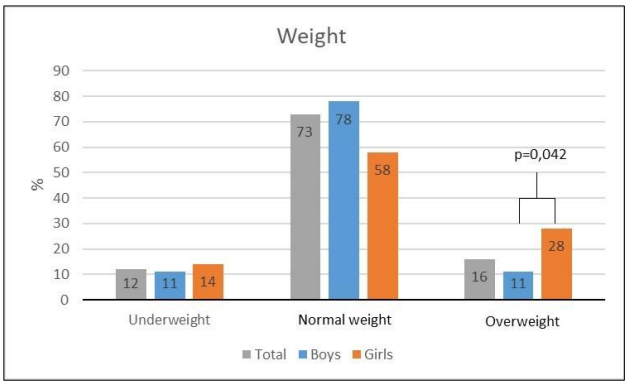

Figure 3: Weight categorized by BMI and sex in %.

DISCUSSION

This study aimed to examine the growth in preschool children with general developmental delay or emotional and behavioural problems requiring special day care.

We found a high number of girls with overweight (28%) and slightly more girls with underweight (14%) compared to the expected normal distribution in childhood (10% overweight and 10% underweight in the general population with Dutch girls aged 4-12 years old in 2020).[3]

Boys were more likely to be underweight compared to the general Dutch boys (11% versus 8% general) and were less likely to have overweight (11% versus 16%).[3]

Our results implicate that especially girls with a neurobiological developmental disorder, have a bigger risk for abnormal weight gain. The female gender is a known risk factor for overweight.[12] However, the high number of overweights might be partially explained by the low socioemotional status of the caregivers of our participants, psychological stress, shortened sleep duration, more screen time, poverty and a low IQ, that are expected in our population.[13-16] The socioeconomic status in the province of Drenthe, where all measurements took place, is low compared to other regions in the Netherlands. Though, the found percentages of both underweight and overweight were also higher than in a population-based study in an area with a similar low socioeconomic status (11% overweight and 8% underweight).[17]

The increased risk of being underweight in our population compared to the general population, is in line with previous studies, confirming the relation between underweight and psychological symptoms and eating behaviours, like emotional undereating, satiety responsiveness and fussiness of children.[4,18]

Most of the tall children were also overweight. This is consistent with the theory of growth acceleration by increased levels of insulin and insulin-like growth factor-1 in children with obesity.[19] Another explanation could be genetic, as in well-known syndromes involving developmental problems and tall height, such as fragile x syndrome.

This study findings are clinically relevant, since the adverse effects of abnormal weight at physical and psychological wellbeing at moment of testing, as well for the future, are well-known.[4-8] These effects also influence the effect of the programs in special day-care, since overweight preschool children have a lower motor proficiency and more externalizing behaviour problems.[5,8] Our results emphasizes the need for BMI-screening in this population and incorporating an intervention program targeting abnormal weight in these children's treatment program.

The strengths of our study include our selected population-based design of young children with psychosocial problems, standard based measurements of growth by a medical professional, a high participation rate and the use of the same BMI cut-off values as used in comparable studies.

Obviously, our study also knows several limitations.

Given the rising trend for children with overweight during the COVID pandemic in the Netherlands, this might be a confounder for the children with overweight compared to the population of Drukker et al.[17] Although the female gender is a known risk factor for overweight, the big difference between boys and girls in our study population, is difficult to fully explain.[12] This might also partially have caused by our small study population and low number of girls. Another limitation is the fact that we also used the general Dutch growth chart for children with another ethnic background. Moreover, data were compared to measurements in other studies with slightly different populations.

CONCLUSION

Our results suggest that especially pre-school girls with developmental or psychological problems, have an already

significant increased risk of an abnormal BMI. Screening for an abnormal BMI should be conducted as a standard procedure in pre-school children with developmental or psychological problems, as it is known that abnormal BMI is associated with both mental health problems now and in their future. Moreover, abnormal weight can have a detrimental effect on treatment and therefore interventions aimed at normalizing weight should be incorporated in their biopsychosocial treatment regimen. Studies with a larger study population are needed to confirm our conclusion and to evaluate possible prevention strategies. Since many interventional trials for childhood and adolescent obesity have been proven ineffective, identifying other risk factors and even earlier identification is necessary to improve the health of these children.

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