

NUTRITIONAL STATUS (BMI) IN CHILDREN SUFFERING FROM ASTHMA

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Abstract - The research encompassed 708 children of both genders, aged 6 to 15. Three hundred and fifty four of the total number had been diagnosed with *Asthma bronchiale*, whereas the other half of the children were healthy and served as a control group. Their nutritional condition was determined on the basis of the percentile value of their BMI. Recent studies on the level of nutrition and its connection to asthma have shown contradictory results. This paper was aimed at estimating the nutritional level of sick children in relation to healthy ones. The data were analyzed in relation to group, gender and age by means of descriptive methods, univariate (analysis of variance – ANOVA) and multivariate (multivariate analysis of variance – MANOVA), whereas the results were tested by Roy's test (Pearson contingency coefficient χ , coefficient of multiple correlation R). It was determined that male children more frequently suffer from this disease than female children do. Both healthy and sick children were normally nourished. However, as regards the sick, the number of normally nourished was considerably lower, whereas the number of underweight was considerably higher, as well as those that were overweight. Intergroup differences in the distribution of certain levels of nutrition of male and female children occurred in only two non-sequential age groups, being later in boys than in girls. This uneven distribution is probably a consequence of the joint effects of environment factors, sickness and therapy.

Key words: Children, asthma, nutritional condition, BMI

INTRODUCTION

Biological and medical literature describe the effects of numerous agents, asthma among others, that impact the growth and development of children. Asthma is a chronic lung disease that may occur at any age, but is most frequent in childhood. The frequency of asthma in children was examined during 2001 and 2002 on a large sample of children aged 6/7 and 13/14, in most former Yugoslav towns. The research showed a frequency of 6% of asthma in Serbia, and around 5-7% in schoolchildren in Podgorica. The research also showed that boys suffered from asthma more often than girls

(Živković, 2002; Martinović, 2008). There are numerous, but still insufficient data showing the risks of using inhalation corticosteroids to keep asthma under control. Leone et al. (2003) claimed that therapy may lead to a temporary slowing in a child's growth, which has no consequences on adult period. In addition, asthma itself may cause a slowdown in growth, especially in late childhood and early adolescence. As the WHO recommends, the key indicator of growth, development and health is the level of nutrition – body mass index (BMI). Recent studies on body mass index and its connection to asthma show contradictory results. Reis et al. (2009), in a study comprising 231 children, did

not find a difference in the BMI of healthy children and children diagnosed with asthma. In addition, Moudiou et al. (2003) in a study comprising 436 children suffering from asthma and 710 healthy children pointed out that there is no statistically significant difference in BMI. On the contrary, Vignolo et al. (2005) claimed that obesity is more frequent in a healthy population rather than the sick. Silva et al. (2007) emphasize that the prevalence of overly nourished and obese children aged 5-16 was higher in the asthma group of children. A one-year study carried out in Serbia showed that boys with uncontrolled asthma were at the lower level of the range indicated as normal. After a one-year therapy, the level of nutrition was improved (Kostić et al., 2010). Since obesity has acquired the status of an epidemic in developed countries, there have emerged studies indicating a possible connection between the two illnesses (Beuther, 2010). The objective of this paper was to determine the nutritional condition of children diagnosed with *Asthma bronchiale* in Montenegro.

MATERIALS AND METHODS

The research encompassed 708 children of both genders, aged 6 to 15. Three hundred and fifty four of the total number were diagnosed with *Asthma bronchiale*, and the other 354 examinees were healthy children. The research of the experimental group was carried out in the pulmonary medical clinic of the Institute for Children's Illnesses in the Clinical Center of Montenegro, and the subjects were chosen by a method of random sampling in elementary schools in Podgorica. The research was carried out according to the guidelines from the International Biological Program (IBP) and World Health Organization (WHO), using original anthropological instruments according to Martin (Siber Hegner production, Switzerland).

A nutritional condition is defined by BMI (body mass index) percentile values, representing a ratio of body mass in kg/(height)² in m². Based on the BMI percentile values, categories of nutritional condition are provided.

Data were analyzed in relation to the group, gender and age by means of descriptive methods, univariate (analysis of variance – ANOVA) and multivariate (multivariate analysis of variance – MANOVA), and the results were tested by Roy's test (Pearson contingency coefficient χ , coefficient of multiple correlation R). Decimal values of the subjects' age made the basis for forming four age categories. Results obtained by statistical data processing are given in the tables.

RESULTS

Data on the total sample show that the examined group has a higher percentage of male children (59.6%) compared to female children (40.4%).

The BMI descriptive statistical results of the sick and healthy children are provided in Table 1.

The examined groups were homogenous (coefficient of variation) and did not indicate significant mutual differences in basic statistical parameters. Increased values of skewness found in both groups indicate that the distribution is *negatively skewed*. The lower values of kurtosis found in the asthmatic group indicate that the curve is flattened, whereas in the healthy group the curve is peaked. Distribution of values deviates from normal distribution (p) in both groups.

In order to determine whether there are differences in the BMI distribution according to the nutritional categories, Table 2 shows the percentile values of different nutritional categories in the examined groups.

Most of the children in both groups were normally nourished. However, if compared to healthy children, there were considerably less normally nourished children among the sick, and considerably more underweight, as well as those that were overweight. There were considerable differences between the examined groups in the distribution of the categories underweight, physiologically nourished and overweight: $F=11.016$, $p=0.001$ (MANOVA) i $\chi=0.123$, $R=0.124$ (ANOVA).

Table 1. Basic statistical parameters of BMI

| BMI | average | St.dev | min | max | coef.var. | confid.interval | sk | ku | p | |
|----------|---------|--------|------|------|-----------|-----------------|-------|-----|------|------|
| Exper. | 18.26 | 3.48 | 11.5 | 29.8 | 19.07 | 17.90 | 18.63 | .56 | -.03 | .016 |
| Control. | 18.02 | 3.12 | 12.6 | 30.7 | 17.34 | 17.69 | 18.34 | .88 | .96 | .050 |

Table 2. Distribution categories of BMI in relation to the group

| Categories %BMI | underweight $\leq P_5$ | | moder. mal nutrit. $>P_5 \leq P_{15}$ | | normal nutrition $>P_{15} < P_{85}$ | | overweight $\geq P_{85} < P_{95}$ | | obesity $\geq P_{95}$ | |
|-----------------|------------------------|------|---------------------------------------|------|-------------------------------------|-------|-----------------------------------|-------|-----------------------|-----|
| group | n | % | n | % | n | % | n | % | n | % |
| Exper. | 23. | 6.5* | 35. | 9.9 | 232. | 65.5 | 45. | 12.7* | 19. | 5.4 |
| Control. | 12. | 3.4 | 36. | 10.2 | 264. | 74.6* | 26. | 7.3 | 16. | 4.5 |

Table 3. Distribution of BMI categories in relation to the age groups of boys and girls

| categ. BMI% | undeweight $\leq P_5$ | | moder. malnutrit $>P_5 \leq P_{15}$ | | normal nutrition $>P_{15} < P_{85}$ | | overweight $\geq P_{85} < P_{95}$ | | obesity $\geq P_{95}$ | |
|--------------------|-----------------------|-------|-------------------------------------|-------|-------------------------------------|------|-----------------------------------|-------|-----------------------|-------|
| group | n | % | n | % | n | % | n | % | n | % |
| boys | | | | | | | | | | |
| 6-7 years | | | | | | | | | | |
| experim. | 4. | 8.3 | 13. | 27.1 | 29. | 60.4 | - | - | 2. | 4.2 |
| control. | 2. | 7.4 | 5. | 18.5 | 20. | 74.1 | - | - | - | - |
| 8-9 years | | | | | | | | | | |
| experim | 4. | 7.4 | 8. | 14.8 | 37. | 68.5 | 5. | 9.3 | - | - |
| control. | 2. | 4.7 | 6. | 14.0 | 33. | 76.7 | - | - | 2. | 4.7 |
| 10-12 years | | | | | | | | | | |
| experim | - | - | 1. | 1.7 | 42. | 72.4 | 8. | 13.8 | 7. | 12.1 |
| control. | - | - | 4. | 5.3 | 58. | 77.3 | 6. | 8.0 | 7. | 9.3 |
| 13-15 years | | | | | | | | | | |
| eksperim | - | - | - | - | 29. | 56.9 | 16. | 31.4 | 6. | 11.8 |
| control. | - | - | 1. | 2.4 | 30. | 71.4 | 8. | 19.0 | 3. | 7.1 |
| girls | | | | | | | | | | |
| 6-7 years | | | | | | | | | | |
| experim | 6. | 17.6* | 6. | 17.6 | 22. | 64.7 | - | - | - | - |
| control. | - | - | 3. | 17.6 | 13. | 76.5 | 1. | 5.9 | - | - |
| 8-9 years | | | | | | | | | | |
| experim | 9. | 19.6 | 6. | 13.0 | 26. | 56.5 | 5. | 10.9 | - | - |
| control. | 6. | 15.0 | 5. | 12.5 | 26. | 65.0 | 2. | 5.0 | 1. | 2.5 |
| 10-12 years | | | | | | | | | | |
| experim | - | - | - | - | 22. | 71.0 | 5. | 16.1* | 4. | 12.9* |
| control. | 2. | 2.7 | 11. | 15.1* | 56. | 76.7 | 3. | 4.1 | 1. | 1.4 |
| 13-15 years | | | | | | | | | | |
| experim. | - | - | 1. | 3.1 | 25. | 78.1 | 6. | 18.8 | - | - |
| control. | - | - | 1. | 2.7 | 28. | 75.7 | 6. | 16.2 | 2. | 5.4 |

Data on nutritional level distribution in the age-matching groups of sick and healthy children are provided in Table 3.

Based on Table 3, it can be observed that the nutritional level distribution in sick and healthy children was equal at an early age. In the two younger groups of sick children, there were more underweight children, and among the healthy children more were either normally nourished or overweight. In the oldest group (13-15) nutrition distribution differed in relation to gender. A greater number of obese boys and normally nourished girls may be found among the sick. There were considerable differences in the distribution of BMI categories among the examined groups of boys aged 8 and 9 ($F=7.416$, $p=0.008$ -MANOVA i $\chi=0.260$ i $R=0.269$ -ANOVA) and 13 – 15 ($F=3.929$, $p=0.050$ -MANOVA i $\chi=0.199$ i $R=0.203$ -ANOVA). There were considerable differences in the distribution of BMI categories among the examined groups of girls aged 6 and 7 ($F=5.597$, $p=0.022$ -MANOVA i $\chi=0.305$ i $R=0.320$ -ANOVA) and 10-12 ($F=18.168$, $p=.000$ -MANOVA i $\chi=0.362$ i $R=0.389$ -ANOVA).

Interestingly enough, considerable differences between the sick and the healthy occurred exclusively in the two non-sequential age groups, with boys later than with girls.

DISCUSSION

Our country does not recognize national standards for the growth and development of children, which makes it more difficult to monitor it. The results obtained and presented in this paper show that there are more boys among children suffering from asthma, which also confirms the data found in literature (Ljuština-Pribić, 2010). The basic statistical parameters of BMI of the experimental and control groups did not differ mutually, which was determined in the studies by Reis et al. (2009) and Moudiou et al. (2003).

The analysis of the nutritional level in the total sample indicated that both groups contained most

normally nourished children. However, if compared to healthy children, there are considerably less normally nourished children, and considerably more underweight and overweight, showing that the two groups differ in the level of growth and development to a certain extent. Research carried out in Spain showed that the prevalence of overweight and obese children aged 5-16 was higher in the asthma group (Silva, 2007), while Vignolo et al. (2005) determined that there is a higher presence of obese in the healthy population.

Detailed statistical analysis of the age categories of boys and girls showed a difference in the distribution of the nutritional level, however, these do not have a regular and balanced distribution. Interestingly enough, considerable differences between the sick and the healthy occurred exclusively in the two non-sequential age groups, with boys later than with girls. Boys differed considerably at 8-9, 13-15, whereas girls differed at 6-7, 10-12, i.e. differences with girls could be observed even earlier, which is probably related to their earlier maturing. To et al. (2004) indicated that asthma itself may cause a growth slow-down, especially in late childhood and early adolescence.

Within the examined populations of healthy and sick children, most were normally nourished. However, inter-group differences could be noted in the distribution of certain nutritional levels in boys and girls. The uneven distribution is probably a consequence of the joint effects of environment factors, sickness and therapy.

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