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## PREVALENCE OF OVERWEIGHT AND OBESITY IN PEDIATRIC SURGICAL POPULATION

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### ABSTRACT

**Background:** Obesity has become one of the most significant public health problems in the world in recent decades. It is associated with an increased incidence of postoperative complications, and there is a cause-and-effect relationship between obesity and increased prevalence of injury in children. Although there are studies in the world that indicate an increased incidence of obesity among surgically treated children, no such research has been conducted in Croatia so far.

**Materials and methods:** This study aimed to determine the nutritional status of children treated at the Department of Pediatric Surgery at two samples in the time lag of eight years (2010 and 2018). In 2010, 1205 children were treated in hospital, 790 children fulfilled the inclusion criteria. In 2018, 1316 children were treated in hospital, and 790 children met the inclusion criteria. The collected data were compared with the existing health statistics.

**Results:** The proportion of obese children was 29.7% in patients treated in 2010 and 29.7% in patients treated in 2018. In 2010 the highest prevalence of obese children was in pre-school age (23.8%) and overweight in school-age (16.7%). In 2018 the highest incidence of obesity in school children was 38.9%, in preschool-age 31.6%, in puberty 28.3%, and the lowest in adolescents 23.3%.

**Conclusion:** The prevalence of obesity in children undergoing hospitalization for surgical illness is higher than in the general population. There was no trend of increasing the incidence of obesity over a 10-year time lag.

### Keywords:

obesity, pediatric surgery, pre-school, puberty, adolescents

### INTRODUCTION

Over the last decade, obesity has become more obvious public health problem both in the world and in our country [1]. According to the International Classification of Diseases (ICD-10 edition), obesity is considered a disease (code E65 and E66), and for some time there has

been a continuous increase in obesity in all age groups, regardless of the level of development of the social environment [2,3]. Obesity in children is determined by standardized gender and age-specific normograms. Children whose body mass index (BMI) is equal to or greater than the 85 percentile for their age and gender are considered obese. The lighter form of obesity we call an overweight, which is defined by BMI  $\geq 85$ ,  $< 95$ . percentiles. A severe form of obesity we call obesity and is defined by a BMI  $\geq 95$  percentile.

In the Republic of Croatia (RH), nutrition status data are not part of the routine health statistics of children or adults. Data on the prevalence of obesity in a healthy population of the Republic of Croatia is known from the Croatian Health and Statistics Yearbook for 2009 (Croatian Institute for Public Health). The European Office of the World Health Organization has been implementing the child nutrition monitoring Initiative since 2006, and the Republic of Croatia has entered into a program for continuous monitoring of nutritional status of children, in a uniform methodology, from 2015/2016, therefore these results can be compared with the other 35 countries that are part of this program [4].

The negative consequences of obesity in children are manifested in childhood, and growing up, fat children are at high risk of developing cardiovascular, endocrine, gastrointestinal, renal, respiratory, and psychosocial disorders.

Surgical patients undergo preoperative anesthetic examination, which records the parameters of perioperative risk, and obesity is one of the factors that carries the risk of developing perioperative complications. The main activities of pediatric surgery include the treatment of acute and chronic diseases, injuries and malformations, through an elective and emergency program, including preoperative, operative and postoperative aspects. Children are mostly operated under general anesthesia, and in obese children there are special features in pharmacokinetics and dynamics of anesthetic. As there is no standardized protocols, the effects of anesthetic in children, due to the fat content in body weight, can be altered and lead to prolonged

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awakenings and other perioperative complications. To what extent obesity affects the postoperative results of surgical treatment is not completely clear and is the subject of research [5]. In addition, some studies have confirmed the cause-and-effect relationship of obesity and the prevalence of injuries in children, as the incidence of obesity and the incidence of injuries increase [6,7]. Obesity in children and its prevalence among surgically treated children, and its impact on treatment outcomes, is a completely new problem, of which there are few studies [8]. It is known that in the USA, among surgically treated children there is the prevalence of increased body weight [9] and we have no knowledge about the prevalence of obese children among surgical patients, nor what trend is.

The aim of this study is to determine the nutritional status of children treated at the Department of Pediatric Surgery (malnutrition, normal body weight, overweight and obesity) in two samples in the time lag of eight years (2010 and 2018). The collected data will be compared with the existing health statistics of the Republic of Croatia.

## MATERIALS AND METHODS

This is a retrospective study of collected data from medical records of children treated at the Department of Pediatric Surgery, Clinical Hospital Centre Zagreb in the period 1.1.-31.12.2010., and 1.1.-31.12.2018. The inclusion criterion is from the age of two to eighteen years of age. Exclusion criteria are secondary causes of obesity and diseases that directly interfere with the growth of children. Children who were hospitalized multiple times for the same diagnosis in the same year were included in the analysis only at the first hospitalization, and when they were hospitalized multiple times with a different diagnosis in the same year, each hospitalization was analysed as a new case. Data were collected on age, gender, height, weight, final diagnosis, surgery (elective or emergency) The examined children were divided into four standardized groups: preschool (2-6 years), school (7-11 years), puberty (12-16 years) and adolescent group (17-19 years). Body mass index was calculated for all subjects, and based on the standard percentile curves of the body mass index by age and sex of the CDC, were classified into four groups: malnourished (below the fifth percentile), normal body mass (between the fifth and eighty-fifth percentiles), increased body weight (from 85 to 95 percentile), obesity (95 percentile and up). In 2010, 1205 children were treated in hospital, 790 children fulfilled the inclusion criteria. In 2018, 1316 children were treated in hospital and 790 children fulfilled the inclusion criteria. The Hospital Information System (HIS) computer database was used to collect the data, and Microsoft Office Excel was used for the table data processing.

## RESULTS

The first survey period 2010. The age range was 2-18 years and the average was 9 years. A detailed overview by gender and age group is shown in Table 1.

In the study group of children, 59.5% of children were normal body weight, malnourished 10.8%, and obese 27.7%. In terms of gender, girls are slightly more, but the difference is not statistically significant ( $\chi^2 = 1,060$ ). A detailed review of the nutritional status by gender can be seen in Table 2.

The highest prevalence of obese children is in pre-school age (23.8%) and overweight in school age (16.7%).

There are 32.6% of obese preschool children, 36.7% of school children, 28.3% at puberty and 23.9% of adolescents. By analysing the distribution of BMI by age group, the  $\chi^2$  test is positive for male children ( $\chi^2 = 45.95$ ,  $p < 0.001$ ), and it is reliable for male children ( $\chi^2 = 35.05$ ,  $p < 0.001$ ), and for female children, because of the small sample, the test was not reliable. There were 609 operatively treated and 181 non-operated. The difference in the prevalence of obesity in the operated and non-operated was not statistically significant ( $\chi^2 = 1.93$ ,  $p = 0.58$ ).

The second research period is 2018. The age range was 2-18 years and the average was 9.1 years. A detailed overview by gender and age group is shown in Table 3.

A detailed overview of the nutritional status by gender is presented in Table 4.

The highest prevalence of obesity in school children is 38.9%, in preschool age 31.6%, in puberty 28.3%, and the lowest in adolescents 23.3%. By analysing the distribution of BMI by age group, the  $\chi^2$  test is positive for male children ( $\chi^2 = 43.1$ ,  $p < 0.001$ ), and it is reliable for male children ( $\chi^2 = 33.0$ ,  $p < 0.001$ ) and for the female due to the small sample, the test was not reliable.

The biggest prevalence of obese children in the preschool age is (23.9%) and overweight in school age (14.9%). There were 622 surgically treated and non-operated 179. The difference in the prevalence of obesity in the operated and non-operated is not statistically significant ( $\chi^2 = 1.89$ ,  $p = 0.56$ ).

## DISCUSSION

In 2010, the prevalence of obese children treated in paediatric surgery was 30%. Obese girls are 31.2%, of whom 17.7% are overweight and 13.5% are obese. Obese boys are 29%, of whom 17% are overweight and 12% are obese.

At the eight-year time lag (2018), a second group of surgically treated children was analysed. The apportionment by age and sex is very similar, but also to representation by age groups.

It is interesting that the 2010 and 2018 years the percentage of obese children has no growth trend. For both groups, the apportionment by age is similar, that is, there is no significant difference in the prevalence of

obese children treated at the Department of Paediatric Surgery, KBC Zagreb in 2010 and 2018.

In the general child population, according to the Croatian Statistical Yearbook for 2009, there were 21.5% obese female children, 12.8% overweight and 8.7% obese. There were obese male children 24.8%, of which 13.6% were overweight and 11.2% were obese.

By comparison with our results, it is evident that the prevalence of obese children is higher in children treated in paediatric surgery. Similar results are reported by a group of authors (Naifu and associates) who, in an analysis involving 6017 surgically treated children aged 2-18 years in the United States, found that the prevalence of obese children was 31.6% of which, 14.4% increased body weight and 17.2% were obese [9].

According to a study on the nutritional status of patients aged 3-20 years of life at the Clinical Hospital Centre Split, Clinic for Paediatric Diseases, conducted in 2004, on 632 children, there were 7.9% of malnourished children, 73.7% of normal body weight, 74% overweight and 10.9% obese [10]. This study analysed a group of children that is different from our group in terms of demographics, but a smaller incidence of obese children in this study is certainly noticeable. The causes of this difference are not the subject of this study. That same year, a nutrition analysis study was conducted in ten counties (1997-2002), at 4924 students, aged 7-15.

They reported an increased body weight in 11, 2% of boys, and 9.8% of girls, and obese were 5.7% of boys and 5.4% of girls [11]. This means that they recorded 16.9% of obese male and 15, 2% of female children. In the period 2005-2009, 13.6% of boys and 12.8% of girls were overweight, and 11.2% of boys and 8.7% of girls were obese (CIPH 2010). According to research by CIPH, in 2018 as part of the EU survey "European Initiative for Observing the Obesity of EU Children", in 5664 children, 73.2% of boys were normal weight and 81.7% of girls, while less than 1% of children were malnourished [4].

Overweight boys are 21.3% and obese are 17.2%, and overweight girls are 20.3% and 10.7% are obese. This study was conducted in three HR regions, and the least of the overweight and obese children are in the city of Zagreb.

Therefore, according to the latest survey in the population of school children in the Republic of Croatia, 38.5% of boys and 31.5% of girls are obese. However, from this and Antolić-Degač and associates study from 2004 of a healthy child population in the Republic of Croatia, it seems that the trend of increasing incidence of obese children in the Republic of Croatia is clearly expressed. In the analysis of hospital-treated children, in the paediatric surgery department in the analysis of groups of school children in the 2010 survey, there were 36.7% obese children and in 2018 little more, 38.9%. This is a statistically insignificant increase, i.e. there is no trend of a significant increase in the prevalence of obese surgically treated

children. However, when comparing the prevalence of obese children in the general population and surgically treated children, the prevalence of surgically treated children remains higher, although the methodology for research and data collection is not identical. Therefore, this comparison should be taken with a limit. Overall, we can conclude that the proportion of obese children is higher in surgically treated children, but the reasons for this were not analysed in this paper.

## CONCLUSION

The prevalence of obesity in children undergoing hospitalization for surgical illness is higher than in the general population. There was no trend of increasing the prevalence of obesity over a 10-year time lag.

## CONFLICT OF INTEREST:

The authors declare that there is no conflict of interest.

## REFERENCES:

1. Musić Milanović S, Bukal D. *Epidemiologija debljine-javnozdravstveni problem*. *Medicus* 2019;27:7-13.
2. Devaux M, Sassi F. *Social inequalities in obesity and overweight in 110 ECD countries*. *Eur J Pub Health* 2013;23:464-9.
3. Hrvatski zdravstveno-statistički ljetopis. HZJZ. Ur. Baklajić Ž, Zagreb, 2010. [https://hzjz.hr/wp-content/uploads/2013/11/Ljetopis\\_2009.pdf](https://hzjz.hr/wp-content/uploads/2013/11/Ljetopis_2009.pdf)
4. *Europska inicijativa praćenja debljine u djece*. Ur. Capak K. HZJZ, Zagreb, 2018.
5. Nafiu OO, Reynolds PI, Bamgbade OA, Tremper KK, Welch K, Kasa-Vubu JZ. *Childhood body mass index and perioperative complications*. *Paediatr Anaesth* 2007;17(5):426-30.
6. Cordelle E, Saman S, Avery B et al. *Obesity in pediatric trauma*. *J Pediatr Surg*. 2017;52:628-32.
7. Annette A, Jeffrey K, Krikor D et al. *Associations between childhood obesity and upper and lower extremity injuries*. *Inj Prev*. 2013;19:191-7.
8. Brian P. Blackwood, Colin D et al. *Overweight and Obese Pediatric Patients Have an Increased Risk of Developing a Surgical Site Infection*. *Surg Infect (Larchmt)*. 2017;18(4):491-497.
9. Nafiu OO, Ndao-Brumlay KS, Bamgbade OA, Morris M, Kasa-Vubu JZ. *Prevalence of overweight and obesity in a U.S. pediatric surgical population*. *J Natl Med Assoc*. 2007;99(1):46-8, 50-1.
10. Dropulić N, Meštrović J, Krželj V, Šonjić M, Kratović D. *Uhranjenost bolesnikahospitaliziranih na klinici za dječje bolesti KBC Split*. *Pediatr Croat*. 2006;50:173-77.
11. Antolić-Degač K, Raić-Rak A, Mesaroš-kanjski E, Petrović Z, Capak K. *Stanje uhranjenosti i prehrane naviske školske djece u RH*. *Pediatr Croat*. 2004;48:9-15.

**Table 1.** Age and gender apportionment of children, 2010

		Male	Female	Total
PARTICIPANTS	n	524	266	790
	%	66,3	33,7	100
AGE GROUPS				
Preschool	n	191	83	274
	%	36,5	32,3	31,5
School	n	173	53	226
	%	33	19,9	28,6
Pubertal	n	149	103	252
	%	28,4	38,7	31,9
Adolescent	n	11	24	35
	%	2,4	9	4,4

**Table 3.** Age and gender apportionment of children, 2018

		Male	Female	Total
PARTICIPANTS	n	530	260	790
	%	66,6	33,3	100
AGE GROUPS				
Preschool	n	192	83	274
	%	36,6	32,1	31,5
School	n	176	51	227
	%	34	19,2	28,6
Pubertal	n	151	100	251
	%	28,6	38,5	31,9
Adolescent	n	14	23	37
	%	2,5	8,9	3,9

**Table 2.** Children nutrition status, 2010

		Male	Female	Total
Malnourished	n	60	25	85
	%	11,5	9,4	10,8
Normal body weight	n	312	158	470
	%	59,5	59,4	59,5
Overweight	n	63	36	99
	%	12	13,5	12,5
Obese	n	89	47	136
	%	17	17,7	17,2
TOTAL	n	524	266	790
	%	100	100	100

**Table 4.** Nutritional status of children by gender, 2018

		Male	Female	Total
Malnourished	n	65	20	85
	%	9,5	8,4	8,8
Normal body weight	n	322	158	470
	%	60,5	59,4	59,5
Overweight	n	60	36	96
	%	12	13,5	12,5
Obese	n	92	47	136
	%	18	17,7	17,2
TOTAL	n	530	260	790
	%	100	100	100