

Original Article

## An Examination of Pre/Post-Adenotonsillectomy Obesity Indices in 3-10 Year Old Children in Mashhad, Iran

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### Abstract

#### Introduction:

Adenotonsillectomy is one of the most frequent surgical operations on children, which may result in weight gain in a number of ways, for instance, by increasing IGF-1 or decreasing respiratory hyperactivity.

#### Materials and Methods:

This was an intervention study with a control group, conducted on fifty 3-10-year-old children who had undergone adenotonsillectomy and on fifty children as the control group. The intervention and control groups were identical in terms of age and sex. Height, weight, mid-arm muscle circumference, waist circumference, and percent body fat measures were performed on the intervention group before and six months after the surgery. The same measurements were also performed on the control group at zero time and six months later. Ultimately, the results were examined and compared.

#### Results:

The body mass index (BMI) and percent body fat in the intervention group showed a significant change after six months, with P values of 0.002 and 0.024 respectively. There were no significant correlations for other variables.

#### Conclusion:

Based on the findings of this study, children who had undergone adenotonsillectomy for various indications showed a gradual postoperative increase in their BMI and percent body fat.

#### Keywords:

Adenotonsillectomy, Body mass index, Children, Obesity, Weight gain

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### **Introduction**

In modern, industrial life, obesity is a major problem in developed and developing countries (1), and one consequence of this is the emergence of adult diseases in early years, the most major of which include non-insulin dependent diabetes mellitus (2-4), hypertension (2,5), increased blood fat, cardiovascular conditions, and, ultimately, increased mortality (2,6). Some studies, nonetheless, have shown no correlation between mortality and obesity (7).

According to studies conducted in the U.S., 15-17% of 5-12-year-old children are overweight (8,9). Further, according to WHO statistics, the number of overweight children under five more than doubled between 2005 and 2010 (10,11).

A history of childhood adenotonsillectomy is said to be one of the contributing factors to obesity in children, youths and adults (12,13). What is more, inflammatory and infectious diseases of the pharynx, tonsils and adenoids account for a large portion of pediatric diseases, which in the majority of cases lead to two of the most prevalent surgeries in children, i.e. adenoidectomy and tonsillectomy (14).

The present study examines such anthropometric indices as body mass index (BMI), mid-arm muscle circumference (MAC), waist circumference (WC) and percent body fat, pre- and post-adenotonsillectomy.

### **Materials and Methods**

This was an intervention study with a control group to examine obesity indices pre- and post-adenotonsillectomy in 3-10-year-old children. The reason for the selection of this age group was the fact that a large proportion of children undergoing adenotonsillectomy belongs to this range.

Thus, seventy children in this age group who had undergone adenotonsillectomy in Imam Reza (A.S.) Hospital and Ghaem (M.G.H.H.R.) Hospital from Fall 2007 to Spring 2008 [between September 2007 and

March 2008] were selected for this study. Since this was a longitudinal study, twenty children were excluded from the study for different reasons, including lack of participation. In this study, for every adenotonsillectomy case, a healthy child of the same sex and age was selected as a member of the control group.

The children who had had the surgery had no accompanying congenital or acquired diseases. Height, weight, MAC, WC and percent body fat were measured in the intervention group before and six months after the surgery and twice in the control group with a six-month interval.

A digital scale with a 0.1 kg (100 g) precision were used to weigh the children, which was performed after defecation and urination, with light-weight clothing, without any accessories or shoes. A stadiometer was used to measure their heights, in such a way that the headpiece was at the top, perpendicular to the stadiometer's plane and touching the head; the heels, the buttocks and the back of the head were facing the device, and the arms hung on the sides.

BMI was measured by dividing the weight (kg) by the square of the height (m) (15).

To measure MAC, a non-elastic plastic tape measure with a 0.1 cm precision was used, the mid-arm point (midway between the elbow and the acromion process) was marked, and measurement was made at this point (15).

To measure WC, too, a non-elastic plastic tape measure with a 0.1 cm precision was used, and the waist circumference was measured from the superior border of one iliac crest to that of the other side and round to the superior border of the first iliac crest (15).

Body fat percent was measured with a Bioimpedance Analyzer (Bodystat 1500 MDD, made in UK) at both times. The child stood on the device, barefoot, holding its handle with both hands, holding down its button, and body fat percent was measured in about 30 seconds (15).

Upon the collection of all the required data from both the intervention and control groups in both measurements, confidence interval was used to draw conclusions, and Independent Sample t Test for the comparison of the intervention and control groups. SPSS 11.5 (SPSS Inc., Chicago, IL) was used for the analyses.

### Results

Table 1 shows the characteristics of the intervention group. The rates of change in BMI, MAC, WC and body fat percent indices have also been included in this table (Table 2).

**Table 1:** Characteristics of the intervention group

	Female	Male
Age	3-10 years old	3-10 years old
Number (Percentage)	23 (46%)	27 (54%)
Body fat percent (Mean $\pm$ SD)	15.53 $\pm$ 1.91	15.01 $\pm$ 2.67
Race	Asian	Asian

According to the results of the analyses, BMI gain after adenotonsillectomy was significant in the 50 children of the intervention group compared with that of the 50 children in the control group ( $P=0.002$ ).

Body fat percent had also shown a significant difference due to the surgery between the intervention and control groups ( $P=0.002$ ). However, other measured parameters, including MAC and WC, did not show any significant changes in the analyses.

The rates of change in these four indices according to the sex (regardless of the child having undergone adenotonsillectomy or not) were calculated at the second measurement, and for none of these indices, was the rate significant ( $P_{\text{BMI}}=0.831$ ,  $P_{\text{MAC}}=0.986$ ,  $P_{\text{WC}}=0.487$ , and  $P_{\text{body fat percent}}=0.884$ )- that is, sex did

not have an effect on the changes in these four indices, and only the intervention was of effect.

### Discussion

The results of this study and most other studies on the effects of adenotonsillectomy on children's BMI show that in children who have undergone this surgery for various indications, BMI has a gradual postoperative rise (13,16-20). Possible causative mechanisms include the role of the insulin-like growth factor 1 (IGF-1) and that of insulin-like growth factor-binding protein 3 (IGFBP-3), which increase post-adenotonsillectomy according to the previous studies (21-23). For another, the highest rate of growth hormone (GH) secretion in children occurs in their REM sleep, and children suffering from adenotonsillar hypertrophy have a lower GH secretion due to disturbances in their REM sleep. However, after adenotonsillectomy, REM sleep GH secretion improves, speeding the rise in children's weight and height (24).

Another cause can be the fact that obstructive disorders keep the child awake at night, causing them to have respiratory hyperactivity, but the sum of 5 kcal/kg of energy lost due to this preoperative hyperactivity is reported to be saved, resulting in a 13% weight gain (25). Nonetheless, some studies have shown no significant changes in the pre- and post-adenotonsillectomy BMIs. For instance, Ron B. Mitchell reported the change in BMI before the surgery until six months later as insignificant. One explanation could be the fact that the overweight subjects in this study were between 3 and 17 years old (26).

### Conclusion

It should be noted that some of the indices examined in this study, such as post-adenotonsillectomy changes in WC, MAC and body fat percent, were measured for the first time in Iran. According to this

study, among these indices, only body fat percent differed significantly between the intervention and the control groups.

This study had a number of limitations, one of which was the number of subjects; since the study period was one year, not more than 50 children could practically be

selected for the intervention and control groups each. Further, inaccessibility to some children because of the distances involved made it impossible to make the second measurements, which resulted in the reduction of the number of subjects.

	Sex	Number (Percentage)	BMI(kg/m <sup>2</sup> )			MAC (cm)			WC (cm)			Body Fat Percent (%)		
			Pre-Op (Mean ± SD)	Post-Op (Mean ± SD)	P †	Pre-Op (Mean ± SD)	Post-Op (Mean ± SD)	P †	Pre-Op (Mean ± SD)	Post-Op (Mean ± SD)	P †	Pre-Op (Mean ± SD)	Post-Op (Mean ± SD)	P †
Intervention	M	27 (54)	15.01 ± 2.67	17.28 ± 2.78	0.002 *	17.43 ± 2.95	18.22 ± 3.12	0.336	54.24 ± 8.57	55.67 ± 9.03	0.617	8.73 ± 5.51	10.44 ± 6.18	0.024 *
	F	23 (46)	15.53 ± 1.91	15.39 ± 2.01		16.46 ± 2.98	17.61 ± 3.12		53.52 ± 8.75	55.71 ± 8.10		8.44 ± 5.67	10.08 ± 5.44	
Control	M	26 (52)	15.80 ± 2.78	17.23 ± 2.89		17.19 ± 3.12	17.31 ± 3.28		53.63 ± 8.64	54.88 ± 8.71		12.43 ± 5.91	12.04 ± 5.69	
	F	24 (48)	17.73 ± 5.46	18.17 ± 3.51		17.93 ± 3.70	17.21 ± 3.88		56.92 ± 10.62	58.40 ± 10.89		12.14 ± 7.57	12.26 ± 7.26	

† P value based on the comparison of the intervention and control groups according to Independent sample t Test.

\* P value <0.05 shows a significant change.

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