International Journal of Pediatric Otorhinolaryngology 81 (2016) 46–50

Contents lists available at ScienceDirect

International Journal of Pediatric Otorhinolaryngology

journal homepage: www.elsevier.com/locate/ijporl

# Changes in body composition and growth pattern after adenotonsillectomy in prepubertal children

Alper Koycu [a,*], Erdinc Aydin [a], Sibel Tulgar Kinik [b]

[a] Department of Otolaryngology, Head and Neck Surgery, Baskent University, Ankara 06490, Turkey
[b] Department of Pediatrics, Division of Pediatric Endocrinology, Baskent University, Ankara 06490, Turkey

ARTICLE INFO

*Article history:*
Received 30 September 2015
Received in revised form 30 November 2015
Accepted 13 December 2015
Available online 21 December 2015

*Keywords:*
Prepubertal children
Adenotonsillectomy
Bioelectrical impedance analysis
Body fat percentage
Body muscle mass
Relative body mass index

ABSTRACT

*Objective:* Adenotonsillar hypertrophy and chronic tonsillitis are associated with growth interruption during childhood, while adenotonsillectomy has been associated with growth improvement and increased body mass index (BMI). However, no reported study has investigated the effect of adenotonsillectomy on the proportion of body muscle and fat mass. The aim of this prospective study was to evaluate the effect of adenoidectomy and adenotonsillectomy on body muscle and fat composition in prepubertal children.

*Methods:* Thirty prepubertal children (22 boys, 8 girls; 3–9 years of age) were followed up for 6 months after adenoidectomy or adenotonsillectomy. Twenty-eight age-matched healthy children (12 boys, 16 girls) were followed for the same period, as controls. Data on dietary habits and physical activity were obtained from parent-completed questionnaires at baseline and 6 months. Height and weight *z*-scores, the amount and percentage of body fat and muscle mass, BMI *z*-scores, relative BMI and basal metabolic rate were evaluated before and 6 months after surgery with bioelectrical impedance analysis.

*Results:* After 6 months, body muscle mass and basal metabolic rate scores were significantly higher than at baseline in both groups ($P < 0.05$). The rate of increase was not different between the groups. In the study group, the relative BMI scores improved significantly ($P < 0.05$). Increases in body fat mass, body fat percentage, height *z*-scores, weight *z*-scores and BMI *z*-scores were not significantly different between the groups at 6 months ($P > 0.05$). The number of overweight and obese children did not change significantly in either group ($P < 0.05$).

*Conclusions:* Adenotonsillectomy led to improvement in relative BMI and promoted healthy weight gain without increased body fat percentage in prepubertal children.



## 1. Introduction

Tonsillectomy and adenoidectomy are frequently performed in childhood. Adenotonsillar hypertrophy and chronic tonsillitis are associated with growth interruption during childhood, while adenotonsillectomy has been associated with growth improvement and increased body mass index (BMI) [1–4]. An increased tendency to overweight and obesity has been reported after adenoidectomy or adenotonsillectomy in prepubertal children [5].

If the percentage of adipose tissue in the body rises above normal levels, this state is called obesity. Excess fat is described as the percentage (%) or fat-mass in kilograms of fat of the total weight. Therefore, in order to correctly assess obesity, there is a need for an accurate body fat measurement [6]. There are two ways to diagnose obesity as follows: body fat-mass measurements (BIA, CT, MRI, DEXA and Underwater Weight) and anthropometric measurements (Obesity Index, BMI and the WHR).

Most studies have evaluated growth and obesity after adenotonsillectomy based on anthropometric measurements, such as BMI and standard deviation scores (SDS) for weight and height [1–4]. BMI is a simple method of evaluating obesity. However, one drawback of BMI measurement is that it does not distinguish between lean body mass and body fat [7,8]. Children and adolescents have a higher percentage of lean body mass thanadults because of differences in body composition during growth [9].

* Corresponding author. Department of Otolaryngology, Head and Neck Surgery, Baskent University, 5. Sokak, Number: 48, Bahcelievler, Ankara 06490, Turkey. Tel.: +90 312 212 82 82; fax: +90 312 223 73 33.

*E-mail addresses:* alperkoycu@gmail.com (A. Koycu), drerdincaydin@hotmail.com (E. Aydin), stkinik@hotmail.com (S. Tulgar Kinik).

http://dx.doi.org/10.1016/j.ijporl.2015.12.005
0165-5876/

Bioelectrical impedance analysis (BIA), a relatively simple, quick and noninvasive method of evaluating body composition, is reliable and widely used. This method detects conductance of a small alternating current through the body [9]. Because conductance is mainly determined by the amount of water in the body, which is only present in the fat-free mass, BIA allows calculation of the fat-free mass and body fat percentage [10]. Yu et al. [11] suggested that BIA is the simplest and most effective method to assess body fat mass and body fat percentage, compared with dual-energy X-ray absorptiometry, computed tomography and waist-hip ratio.

To date, there have been no reported studies investigating the effect of adenotonsillectomy on the distribution of body muscle and fat mass. We hypothesized that an increase in body muscle mass would lead to increased BMI and should not be called obesity. The aim of this prospective study was to use BIA to evaluate the body muscle and fat composition of children after adenoidectomy or adenotonsillectomy.

## 2. Methods

### 2.1. Subjects and study design

This was a prospective controlled study, conducted between September 2013 and September 2014 at Baskent University Hospital Department of Otolaryngology, Head and Neck Surgery. Thirty prepubertal children (22 boys and 8 girls) aged 3–9 years (mean $5.0 \pm 1.2$ years) with recurrent adenotonsillitis or adenotonsillar hypertrophy were followed up for 6 months after adenoidectomy or adenotonsillectomy. Twenty-eight age-matched healthy children (12 boys and 16 girls; mean age $5.7 \pm 1.6$ years) were followed for the same duration, as controls. Children with known metabolic diseases, upper airway abnormalities, mental retardation, underlying disease predisposing to upper airway obstruction, craniofacial anomalies, neuromuscular disease, asthma or perennial allergy, chronic diseases such as diabetes and patients with previous adenotonsillectomy were excluded from the study.

The parents of all children gave informed consent for their participation in the study. This study was approved by the Baskent University Institutional Review Board (Project no: KA13/163) and supported by the Baskent University Research Fund.

We evaluated all parameters for both the study and control groups. Children in the study group were divided into three subgroups based on their diagnosis: adenoid vegetation alone, chronic adenotonsillitis or adenotonsillar hypertrophy. Patients who had only adenoid hypertrophy without recurrent tonsillitis or tonsillar hypertrophy were assigned to the adenoid vegetation subgroup. All children in both the study and the control groups were examined with a flexible fiberoptic endoscope to evaluate the size of the adenoid tissue. Adenoid size was assessed during nasal inspiration according to the percentage of nasopharyngeal space obstruction. We also considered parental reports of night-time symptoms, including difficulty breathing, snoring and observed apnea. Adenoidectomy was performed in patients with night-time symptoms and obstruction of more than 50% of the nasopharyngeal airway [12].

The two indications for performing adenotonsillectomy are adenotonsillar hypertrophy and adenotonsillitis. We used the Paradise criteria [13] for recurrent and chronic tonsillitis and the Brodsky classification [14] to determine tonsillar hypertrophy. Patients with airway obstruction of more than 50% (3+, 4+, or 5+ by Brodsky classification) were classified as having tonsillar hypertrophy. A single surgeon performed all clinical examinations and another performed cold dissection surgery.

Anthropometric and body composition measurements were performed for all participants at the pediatric endocrinology clinic of Baskent University Hospital with a Harpendan wall-mounted stadiometer and body impedance analyzer (InBody 230; Biospace, Seoul, Korea) before and 6 months after surgery. An otorhinolaryngologist and a trained nurse took measurements.

Parents completed an open-ended questionnaire that included three questions, one about dietary habits, one about physical activity and one about inactivity. Parents completed the first questionnaire during the initial clinical examination; the second questionnaire was completed 6 months later, at the appointment for anthropometric and body composition measurements. The questionnaire asked about consumption of junk food (as defined by the parent), regular physical activity and time spent watching television and playing video games to evaluate the homogeneity of the groups. We divided participants into groups according to their questionnaire answers: those who ate junk food at least every other day versus those who did not, those who did regular physical activity weekly versus those who did not, and those who watched television or played video games more than 2 h per day versus those who did not.

We obtained blood samples from the study group preoperatively to investigate the presence of metabolic and hormonal disease. Blood tests were not performed in the control group; in that group we considered lack of parental complaint of symptoms to indicate lack of disease.

### 2.2. Bioelectrical impedance analysis and anthropometric measurements

BIA measurements were made with participants in light clothing without socks. Analyses of weight, body muscle mass, body fat mass, body fat percentage, relative BMI, ideal body weight and basal metabolic rate were performed. Height was measured in all participants with a standard wall-mounted stadiometer. We used percentile data files with LMS values from the Centers for Disease Control and Prevention website to calculate *z*-scores for weight, height and BMI [15]. Relative BMI (relBMI) was calculated with the following formula: BMI $\times$ 100/fiftieth percentile BMI for the child's age and sex. Children with a relBMI between 110% and 120% were considered overweight, those with a relBMI greater than 120% were considered obese and those with a relBMI greater than 150% were considered morbidly obese [16].

### 2.3. Blood sampling

We obtained blood samples for measurement of blood cell counts, blood urea nitrogen, creatine, alanine aminotransferase, aspartate aminotransferase, low density lipoprotein, high density lipoprotein, triglycerides, thyroid stimulating hormone, free T4 hormone, calcium, phosphorus and alkaline phosphatase. All venous blood samples were drawn preoperatively by venipuncture in the morning after an overnight fast.

### 2.4. Statistical analysis

SPSS 20 software (IBM Inc., Armonk, NY) was used for statistical analysis. Demographic data and measurement values are presented as mean $\pm$ standard deviation and median (range). The nonparametric Mann–Whitney *U* test and Wilcoxon signed rank tests were used to show skewed distributions. The chi-square test was used to compare defined categorical variables. We used the Kruskal–Wallis test to compare two or more independent samples. *P* values $< 0.05$ were considered statistically significant.