An Insight on the Prevalence of Body Weight Disturbance among Children with Otitis Media with Effusion

Ashraf A. Wahbaa, Mohamed A. Fatahalla, Mohamed M.H. Al-Ahmer

Department of Otorhinolaryngology, Faculty of Medicine, Al-Azhar University
Wahbaa345@yahoo.com

Abstract: Objectives: To evaluate the frequency of variant constitutional parameters among children of primary school age and had otitis media with effusion (OME). **Patients & Methods:** The present study was assigned to include 100 children of primary school age with manifestations of OME and underwent myringotomy and insertion of Grommet's tube for middle ear aeration. All patients underwent preoperative determination of age, gender, weight (kg) and height (cm) and body mass index (BMI). Obesity was defined according to the percentile of BMI adjusted for age and gender and for comparative purposes; enrolled patients were stratified according to BMI percentile strata within each age-stratum and gender frequencies. **Results:** The study included 100 patients; 54 males and 46 females with a mean age of 8.7±1.8; range: 6-12 years and mean BMI of 27.2±4.5; range: 17.7-35.5 kg/m2. Twenty-six patients had average healthy weight, 20 patients were at risk of being over-weight, 23 patients were over-weight and 31 were obese. Twenty-three of patients aged 6-8 years (57.5%), 17 patients aged >8-10 years (47.5%) and 11 patients older than >10 years (57.2%) were average weight or at risk of being over-weight with non-significant between age strata. Similarly, the percentages of over-weight and obese patients showed non-significant difference between age strata. Patients' distribution according to gender showed significantly higher percentage of females in obese patients compared to those had average weight or at risk of being over-weight and non-significantly compared to over-weight patients. Average weight patients showed higher percentage of males that was significant compared to over-weight patients and non-significant compared to those at risk of being over-weight. **Conclusion:** There is a relationship between obesity and OME in children of primary school age and this was age or sex-independent and could be attributed to obesity-associated disturbed immune milieu or to affection of taste sensation.

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1. Introduction

Inflammation in the middle ear mucosa, which can be provoked by different primary factors such as bacterial and viral infection, local allergic reactions and reflux, is the crucial event in the pathogenesis of otitis media with effusion. Unresolved acute inflammatory responses or defective immuno-regulation of middle ear inflammation can promote chronic inflammatory processes and stimulate the chronic condition of OME ***(Williamson et al., 2003, Smirnova et al., 2004, Russo et al., 2004 & Kong et al., 2009)***.

The inflammation of the middle ear is characterized by an infiltration of leucocytes, macrophages and mast cells and the resulting effusion contains a large amount of inflammatory mediators ***(Jang et al., 2003)***.

Cytokines initiate, control and influence a number of biological processes like inflammation, sepsis, are the central molecular regulators of middle ear inflammation and can switch the acute phase of inflammation in the chronic stage and induce molecular-pathological processes leading to the histopathological changes accompanying OME ***(Smirnova et al., 2002 a&b)***.

With regard to their functions, all cytokines behave pleiotropic and redundant. In the case of auto/paracrinal regulation they are characterized by minimal effective concentrations, fast stimulation ability as well as short activity and presence time with biological half-live in plasma amounts less than 3 min ***(Fieguth et al., 2003)***.

Obesity behaves like an epidemic with escalating progress up to a fact that the number of overweight and obese people in the world overtook the number of malnourished. As the obesity epidemic increases, health problems associated with obesity became more frequently than ever before; in 2007, it has been reported that the prevalence rate of obesity in the United States increased 50% and 41% of women were classified as obese ***(Demerath et al., 2009, Frossard et al., 2009 and Graves et al., 2010)***.

The current prospective observational study aimed at evaluation of the frequency of variant constitutional parameters among children of primary school age and had otitis media with effusion (OME).

2. Patients & Methods

The present study was conducted at Yanbu National Hospital since February 2010 till June 2011, and assigned to include 100 children of primary school age and attending Otorhinolaryngolgy outpatient clinic with manifestations of otitis media

effusion (OME). Diagnosis of OME relied on otoscopic findings and tympanometry showing a flat curve and patients underwent myringotomy and insertion of Grommet's tube for middle ear aeration.

All enrolled patients underwent preoperative determination of constitutional data including age, gender, weight (kg) and height (cm) and body mass index (BMI) was computed as the weight in kilograms divided by the square of the height in meters. Obesity was defined according to the percentile of BMI adjusted for age and gender as follows: <85th percentile= average healthy weight, >85th-90th= at risk of being over-weight, >90th-95th percentile= over-weight and >95th percentile=obese ***(Cole et al., 2000)***. For comparative purposes, enrolled patients were stratified according to BMI percentile strata within each age-stratum and gender frequencies.

Statistical analysis

Obtained data were presented as mean±SD, ranges, numbers and ratios. Results were analyzed using Chi-square test. Statistical analysis was conducted using the SPSS (Version 15, 2006) for Windows statistical package. *P* value <0.05 was considered statistically significant.

3. Results

The study included 100 patients; 54 males and 46 females with a mean age of 8.7±1.8; range: 6-12 years. Forty patients had mean age of 6.9±0.8; range: 6-8 years, 36 patients had mean age of 9.1±0.4; range: 8.5-9.5 years and 24 patients had mean age of 11.1±0.8; range: 10-12 years, (Fig. 1).

Mean body weight was 36.7±11; range: 20-60 kg, mean body height was 115.2±12.8; range: 85-138 cm and mean BMI of 27.2±4.5; range: 17.7-35.5 kg/m^2. There were 26 patients had average healthy weight with BMI <85th percentile of BMI adjusted for age and sex, 20 patients were at risk of being over-weight with BMI ranged between the 85th and the 90th percentile of BMI adjusted for age and sex, 23 patients were over-weight with BMI ranged between the 90th and the 95th percentile of BMI adjusted for age and sex and 31 obese patients with BMI >the 95th percentile of BMI adjusted for age and sex. Details of patients' weight data according to percentile strata are shown in table 1 and figure 2.

Twenty-three of patients aged 6-8 years (57.5%), 17 patients aged >8-10 years (47.5%) and 11 patients older than >10 years (54.2%) were average weight or at risk of being over-weight with non-significant (p>0.05) difference between age strata. Similarly, the percentages of over-weight and obese patients showed non-significant (p>0.05) difference between age strata (Table 2).

Patients' distribution according to gender among percentile strata presented as male-to-female ratio showed significantly higher percentage of females in obese patients compared to those had average weight (X^2=3.129, p<0.05) to those at risk of being over-weight (X^2=3.467, p <0.05) and non-significantly (X^2=1.405, p >0.05) compared to over-weight patients. Average weight patients showed higher percentage of males that was significant (X^2=3.953, p <0.05) compared to over-weight patients and non-significant (X^2=1.542, p >0.05) compared to those at risk of being over-weight, (Fig. 3). It is noticed that number of obese males (n=15) nearly equals that of obese females (n=16).

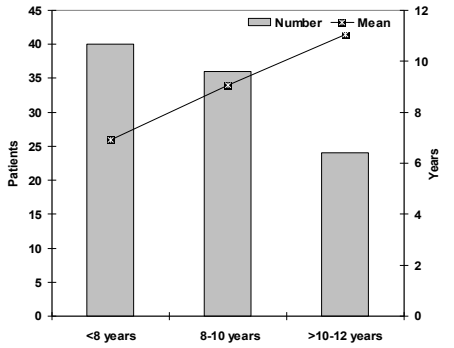

Fig. (1): Patients' distribution according to age strata

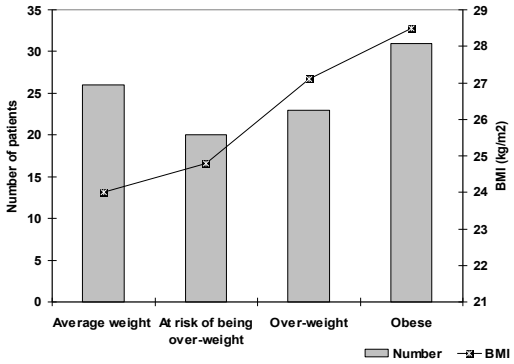

Fig. (2): Patients' distribution and mean BMI of each BMI strata

Table (1): Weight data of studied patients categorized according to percentile strata

Stratum	Weight (kg)	Height (cm)	BMI (kg/m^2)	BMI percentile
Average weight (n=26)	32.1±8 (20-49)	115.6±12.2 (98-135)	24±5 (17.7-22)	83.8±1 (81.1-84.7)
At risk of being over-weight (n=20)	35.4±8.1 (22-50)	118.7±7.7 (104-138)	24.8±3.4 (18.5-26)	88.2±1.5 (86-90)
Over-weight (n=23)	39.6±12.5 (22.1-55.5)	116±14.6 (96-133)	27.1±2.3 (24-31.5)	93.4±1 (91.6-94.7)
Obese (n=31)	39.4±12.2* (22-60)	133±17.6 (108-167)	28.5±3.7* (22-35.5)	97.2±0.9 (96.1-99.3)
Total (n=100)	36.7±11 (20-60)	115.2±12.8 (85-138)	27.2±4.5* (17.7-35.5)	

Data are presented as mean±SD, ranges are in parenthesis; *: significant versus average weight patients

Table (2): Patients' distribution according to their age among each percentile strata

Stratum	6-8 years	>8-10 years	>10 years
Average weight (n=26)	12 (30%)	9 (25%)	6 (25%)
At risk of being over-weight (n=20)	11 (27.5%)	8 (22.2%)	5 (29.2%)
Over-weight (n=23)	8 (20%)	9 (25%)	7 (20.8%)
Obese (n=31)	9 (22.5%)	10 (27.8%)	6 (25%)
Total (n=100)	40 (100%)	36 (100%)	24 (100%)

Data are presented as numbers, percentages are in parenthesis

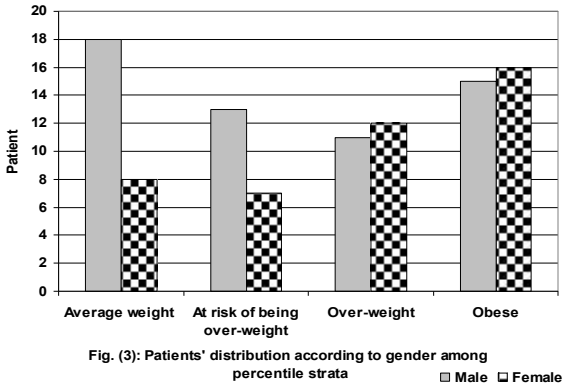

Fig. (3): Patients' distribution according to gender among percentile strata

4. Discussion

The current study was based on observational basis for evaluation of the frequency of variant constitutional among children with otitis media with effusion within the age range of 6 to 12 years. Diagnosis of OME relied on otoscopic findings and tympanometry showing a flat curve, the dependence on clinical findings still the gold standard for diagnosis and was supported by ***Shaikh et al. (2011)*** who in survey study of 793 patients examined by 7 expert otoscpists reported that bulging of the TM was the finding judged best to differentiate AOM from OME in 96% of ears.

All patients underwent myringotomy and insertion of Grommet's tube for middle ear aeration and all showed improvement of their clinical manifestations. Such policy still showing proper outcome as documented recently by ***Lous et al. (2011)*** who conducted a MEDLINE and EMBASE search for randomized controlled trials for management of acute otitis media and found 143 eligible papers that documented that tube treatment could reduce the frequency of acute otitis media with about one attack in six months after operation.

As regards evaluated constitutional factors, age was found to be non-determinant factor as no age strata was found to be immune of the possibility of development of OME, despite the higher percentage of patients were in age range of 6-<10 years. Similarly, patients' gender does not constitute a differentiating effect without predominance of one sex.

These data indicated minor association between age and sex and the frequency of occurrence of otitis media and go in hand with multiple survey studies conducted elsewhere in the world; ***Gultekin et al. (2010)*** tried to determine the impact of environmental, epidemiologic and familial factors in the development of persistent otitis media with effusion in primary school children in Istanbul and found sex factors, mothers smoke history during pregnancy, relative marriage, smoking history of the fathers and duration of breastfeeding were not statistically significant. ***Sophia et al. (2010)*** tried to establish the role of various risk factors for otitis media among preschool, rural Indian children and found age, sex, socioeconomic status, parental education, seasonal or allergic rhinitis and exposure to household smoke were not significant risk factors. ***Zhang et al. (2011)*** tried to identify the prevalence of otitis media with effusion in urban Chinese children in Xi'an, China diagnosed dependent on an abnormal tympanogram and simultaneous otomicroscopic signs of effusion and reported no statistically significant difference between genders or between ear sides.

One interesting observation is the increased body weight measures among enrolled patients as only 26 patients were of average weight with BMI percentile of $<85^{th}$ percentile for age and sex matched children, while the remaining 74 patients ranged between at risk of being over-weight to being obese. Thus, there may be an association between being obese and development of otitis media. Moreover, there was increasing frequency of being obese and age and female gender, this could be attributed to the more inclination of females to be obese and to the more sedentary life of older female children than males and the quality of life and diet especially in Eastern countries.

In line with the obtained results, ***Kim et al. (2007)*** tried to determine the difference between the experimental and control groups in BMI and the difference between the obese and non-obese subgroups in frequency of ventilation tube insertion and found BMI, serum total cholesterol and triglycerides were significantly different between experimental and control groups but the frequency of ventilation tube insertion did not differ significantly between the obese and non-obese subgroups and concluded that childhood obesity may be associated with the occurrence of otitis media with effusion.

Multiple studies tried to investigate the relationship between obesity and induction or aggravation of inflammatory conditions; ***Lee & Yeo (2009)*** supposed a reciprocal relationship between obesity and otitis media in the form of obesity may result in altered cytokine expression, gastroesophageal

reflux disease, or fat accumulation, all of which may contribute to OME, conversely, OME may induce taste changes through middle ear cavity inflammation, thus contributing to obesity and supported their assumption by the fact that a similar pattern of taste change has been shown in patients with gustatory nerve anesthesia. On contrary, to such assumption, ***Seaberg et al. (2010)*** did not demonstrate a relationship between acute otitis media and elevated body mass index and concluded that this is counter-evidence to the previous hypothesis that increasing acute otitis media is responsible for increasing childhood obesity through alteration in chorda tympani nerve function. On the other hand, ***Shin et al. (2010)*** evaluated changes in taste threshold in patients with chronic otitis media with effusion (COME) and their relationship with body mass index and reported that body mass index was significantly higher in the COME than in the control group and concluded that COME can cause changes in taste and that these changes may be related to pediatric obesity.

As another mechanism, obesity was found to be strongly associated with insulin resistance; insulin resistance has been induced by an overload of free fatty acid and inappropriate change of adipocytokines such as tumor necrosis factor-α (TNF-α), resistin, and adiponectin related to visceral fat accumulation. Also, fasting serum leptin, C-reactive protein, and soluble intercellular adhesion molecule-1 were significantly higher and adiponectin was lower in the overweight and obese children compared to non-obese children ***(Zou et al., 2005, Gonzalez et al., 2006 and Quirós-Tejeira et al., 2007)***.

Out of the obtained observational results of the current study and search of published articles, it could be concluded that there is a relationship between obesity and OME in children of primary school age and this was independent on age or sex and could be attributed to obesity-associated disturbed immune milieu or to affection of taste sensation. However, wide-scale comparative studies are mandatory to establish such relation and to evaluate the impact of weight reduction on the frequency and/or the recurrence of OME.

Corresponding author
Ashraf A. Wahbaa
Department of Otorhinolaryngology, Faculty of Medicine, Al-Azhar University
Wahbaa345@yahoo.com

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