



## COMPARISON OF SEASONAL PREVALENCE OF OTITIS MEDIA WITH EFFUSION (OME) IN MENTALLY HANDICAPPED VERSUS NORMAL SCHOOL-GOING CHILDREN.

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**ABSTRACT... Objectives:** Otitis media with effusion is widespread in pre-school and school-going children. The objective of this study was to compare the prevalence of otitis media with effusion (OME) in normal versus mentally handicapped children in perspective of seasonal variation. **Study Design:** Randomized controlled trial. **Setting:** Pakistan Air Force Hospital Masroor, Karachi. **Period:** January 2015 till August 2016. **Material & Methods:** 208 children between 3-8 years of age were divided into 'Mentally Normal' and 'Mentally Handicapped' groups based on a cut off intelligence quotient score of 70. **Results:** Otitis media with effusion uniformly affected all school children. Tympanometric pressures from middle ears of both study groups responded indifferently from each other (p value 0.467 and 0.365 for right middle ear, and 0.708 and 0.920 for left middle ears, in summer and winter, respectively). However, most caregivers of mentally handicapped children exhibited greater concerns about complications associated with otitis media with effusion in winters (p value 0.002). **Conclusion:** Otitis media with effusion is an insidious condition which remains under diagnosed and adversely affects auditory function and speech. Children may develop this condition regardless of their intellectual status. However craniofacial dysmorphism puts a child at a greater risk of otitis media with effusion. Awareness at primary education and healthcare level, a high index of suspicion in these children, careful examination and prompt referral for expert otologic intervention is pivotal in avoiding complications.

**Key words:** Acoustic Impedance Tests, Disabled Children, Otitis Media with Effusion, Secretary Otitis Media, Season, Tympanometry.

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### INTRODUCTION

Otitis media with effusion is defined as accumulation of mucous within the middle ear and sometimes in the mastoid air cell system for more than three months.<sup>1</sup> The occasional synchronous involvement of the mastoid air cells, perilabyrinthine and petrous apex is attributed to the contiguous pneumatization of these parts of the temporal bone. The condition is usually preceded by one or more episode of acute otitis media.<sup>2</sup> The problem is global and its frequency is second only to common cold in a pediatric otolaryngology outpatient.<sup>3</sup> Almost 90% of children around the world get non-purulent sero-mucinous fluid collection in their middle ears by the age of five years. 2.2 million new cases are diagnosed in the US annually

costing \$4.0 billions.<sup>4,5</sup> Major contributory factors are Eustachian tube dysfunction, craniofacial anomalies, allergies and gastro-esophageal reflux.<sup>1,6</sup> Winter season is known to have been related with a rise in incidence of otitis media with effusion due to increased episodes of upper respiratory infections.<sup>7</sup> Otitis media with effusion has a bimodal prevalence, i.e. 20% at two years of age and 16% around the age of five years.<sup>8</sup> Influence of Otitis media with effusion on the suffering child's hearing, speech and language development, cognition, behavior, balance and quality of life has largely been studied.<sup>9-12</sup>

Season association with otitis media with effusion in children has less frequently been studied in our region.<sup>13-15</sup> Little national or regional literature is

available elaborating a comparative analysis of seasonal prevalence of otitis media with effusion in normal junior school children versus mentally handicapped children of the same age admitted in day-care facilities.<sup>16-18</sup> The rationale of our study is to establish climatic cold exposure as a risk factor in etiology of otitis media with effusion in healthy as well as mentally handicapped school children; and, to define multidisciplinary clinical guidelines to accurately diagnose and timely manage a ubiquitous yet under-diagnosed otologic condition school children, that may anticipate a long lasting physical, social and psychological disability.

### PATIENTS & METHODS

After seeking approval from the hospital research ethics committee and the institutional executive body, we requested parents of school-going children between ages 3 to 8 years to provide us a written informed consent for their children to be included in the study. Children from Saleem Nawaz Fazaia College and Pakistan Air Force Women Association (PAFWA) Special Children Academy, PAF Masroor, Karachi were included.

We randomly included 3 to 8 years old children regardless of gender, parental literacy, and socioeconomic class. Children with cleft palate, acute suppurative otitis media, chronic otitis media or sensorineural hearing loss were excluded. Almost 5500 children aged 3-8 years reside in territory of PAF Masroor, Karachi. For research, we kept the confidence level at 95%, and the margin of error at 5%, and the sample size for finite universe (population) turned out to be 199.

We obtained a detailed history from the parents of 208 children, and they were asked to fill in the checklist-based OM-6 validated questionnaire (annexure-1). All children were categorized into two groups basing on modified Urdu translated version of Wechsler Preschool & Primary Scale of Intelligence-IV edition (WPPSI-IV) psychometric assessment. Children who acquired score of 70 and above were mentally normal and were included in Group-1.

Those who obtained a lesser score than 70 were allocated Group-2, categorized as intellectually disabled children. These children were clinically examined in the months of December and January, and subsequently followed in June and July. We performed otoscopic examination on every child using pneumatic bulb attached to Reister otoscope and, tympanometry using MAICO MI-24 digital tympanometer and maintained a record of individual finding in our database.

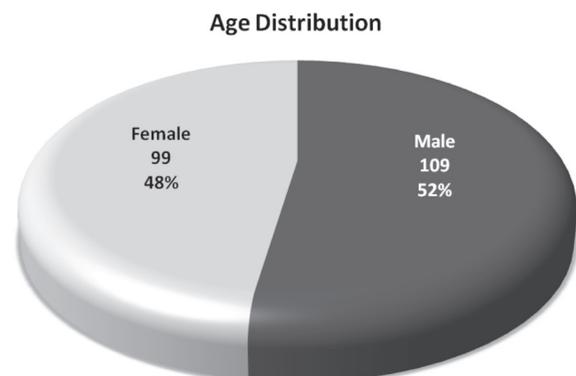
Data analysis was performed using statistical program for social science IBM-SPSS version-22. Frequencies were measured by applying descriptive statistics. Group difference in mean tympanometry and OM-6 symptom scores were evaluated using independent sample t-test. Paired sample t-test was applied to compare these scores in summer and winters. The level of statistical significance in order to prove our hypothesis was 0.05.

### RESULTS

Of the 208 children included in the study, the youngest was 3 years old and the oldest was 8.5 years. Mean age was 5.227 years ( $SD \pm 1.39$ ). 79.3% ( $n=165$ ) children achieved a WPPSI-IV score of equal or more than 70, and they were included in Group-1.

Remaining 20.7% ( $n=43$ ) were categorized as mentally handicapped, and were allocated the Group-2. 7.2% ( $n=15$ ) children had associated cranio-facial dysmorphism, majority suffering from Down syndrome.

Figure-1



We recorded a mean middle ear pressure of -14.48 daPa (SD±75.187) and -13.94 daPa (SD±81.464) in right and left ears, in summer, respectively. Middle ear pressures in right and left ears in winter turned out to be -22.97 daPa (SD±74.666) and -29.97 daPa (SD±83.767), respectively.

Likewise, mean compliance of middle ear in summer months came out to be 0.436 cm<sup>3</sup> (SD±0.332) and 0.438 cm<sup>3</sup> (SD±0.331) in right and left ears.

Tympanometry showed the middle ear compliance in winter as 0.377 cm<sup>3</sup> (SD±0.294) and 0.329 cm<sup>3</sup> (SD±0.257) on right and left sides, respectively. We found a significant decrease in the pressure recordings in summer and winter (p value 0.007 and 0.000 in right and left middle ears, respectively). Similarly tympanometry confirmed a significantly low middle ear compliance in winters (p value 0.000 and 0.000 on right and left sides, respectively).

Applying independent samples t-test, the group statistics revealed significant difference with a markedly high negative pressures in middle ears of children having cranio-facial dysmorphism, as compared to their normal counterparts. Table-I.

Out of the middle ear pressures and compliances, when study groups 1 and 2 were weighed against each other in both seasons, we could only see

a significant difference in the mean compliance score of right ear, which strikingly turned out to be much low in normal children against those who were intellectually handicapped. Table-II. Not much considerable statistical dissimilarity was observed when the remaining parameters between the two groups were studied in summer and winter.

Children who displayed normal intellectual abilities suffered from lesser physical disability than their mentally handicapped counterparts throughout the year (p values 0.016 and 0.003 in summer and winter). In terms of hearing loss and speech impairment, Group-1 children suffered less than those from Group-2 in both seasons (p values for hearing loss and speech impairment, 0.000 in both seasons respectively).

We did not see much distinction in emotional distress and activity limitation between the children of the two groups, round the year (p value for emotional distress between the two groups were 0.944 and 0.609; and for activity limitation were 0.703 and 0.703 in summer and winter, respectively).

Caregivers expressed high concerns on mentally handicapped children in winter (p value 0.002), however indiscriminate concerns were given away by the caregivers toward children of both study groups in summer (p value 0.243). Table-III

	<b>Cranio-facial dysmorphism (if any)</b>	<b>N</b>	<b>Mean</b>	<b>Std. Deviation</b>	<b>Std. Error Mean</b>	<b>Sig. (2-tailed)</b>
Right middle ear pressure in summer (daPa)	Yes	15	-99.13	87.908	22.698	0.000
	No	193	-7.90	70.199	5.053	
Right middle ear pressure in winter (daPa)	Yes	15	-98.87	96.139	24.823	0.000
	No	193	-17.07	69.654	5.014	
Left middle ear pressure in summer (daPa)	Yes	15	-53.73	78.962	20.388	0.049
	No	193	-10.85	81.036	5.833	
Left middle ear pressure in winter (daPa)	Yes	15	-91.87	99.011	25.564	0.003
	No	193	-25.16	80.794	5.816	

**Table-I.**

	Study group	N	Mean	Std. Deviation	Std. Error Mean	Sig. (2-tailed)
Right middle ear pressure in summer (daPa)	Normal	165	-12.54	72.879	5.674	0.467
	Mentally handicapped	43	-21.93	83.970	12.805	
Right middle ear pressure in winter (daPa)	Normal	165	-20.57	72.304	5.629	0.365
	Mentally handicapped	43	-32.19	83.390	12.717	
Left middle ear pressure in summer (daPa)	Normal	165	-15.02	76.913	5.988	0.708
	Mentally handicapped	43	-9.79	97.909	14.931	
Left middle ear pressure in winter (daPa)	Normal	165	-29.67	81.731	6.363	0.920
	Mentally handicapped	43	-31.12	92.187	14.058	
Right middle ear compliance in summer (ml3)	Normal	165	.4126	.32358	.02519	0.045
	Mentally handicapped	43	.5265	.35299	.05383	
Right middle ear compliance in winter (ml3)	Normal	165	.3552	.28975	.02256	0.034
	Mentally handicapped	43	.4616	.29830	.04549	
Left middle ear compliance in summer (ml3)	Normal	165	.4301	.31072	.02419	0.502
	Mentally handicapped	43	.4684	.40507	.06177	
Left middle ear compliance in winter (ml3)	Normal	165	.3119	.23433	.01824	0.058
	Mentally handicapped	43	.3956	.32844	.05009	

Table-II.

	Study group	N	Mean	Std. Deviation	Std. Error Mean	Sig. (2-tailed)
Physical suffering (in summer)	Normal	159	1.36	.984	.078	0.016
	Mentally handicapped	43	1.81	1.350	.206	
Physical suffering (in winter)	Normal	159	1.36	.984	.078	0.003
	Mentally handicapped	43	1.93	1.370	.209	
Hearing loss (in summer)	Normal	157	1.41	1.149	.092	0.000
	Mentally handicapped	43	2.33	2.055	.313	
Hearing loss (in winter)	Normal	157	1.58	1.272	.101	0.000
	Mentally handicapped	43	2.70	2.030	.310	
Speech impairment (in summer)	Normal	157	1.45	1.303	.104	0.000
	Mentally handicapped	43	4.77	2.010	.307	
Speech impairment (in winter)	Normal	157	1.47	1.309	.104	0.000
	Mentally handicapped	43	4.81	1.955	.298	
Emotional Distress (in summer)	Normal	157	1.48	1.047	.084	0.944
	Mentally handicapped	43	1.47	1.032	.157	
Emotional Distress (in winter)	Normal	157	1.48	1.066	.085	0.609
	Mentally handicapped	43	1.58	1.239	.189	
Activity limitations (in summer)	Normal	157	1.38	.781	.062	0.703
	Mentally handicapped	43	1.44	1.278	.195	
Activity limitations (in winter)	Normal	157	1.38	.781	.062	0.703
	Mentally handicapped	43	1.44	1.278	.195	
Caregiver concerns (in summer)	Normal	157	1.47	.991	.079	0.243
	Mentally handicapped	43	1.70	1.520	.232	
Caregiver concerns (in winter)	Normal	157	1.55	1.106	.088	0.002
	Mentally handicapped	43	2.23	1.730	.264	

Table-III.

## DISCUSSION

Development of middle ear effusion is an insidious process attributable to two schools of thought. Eustachian tube dysfunction comprising of ciliary dysfunction and mucosal edema, possibly consequent to anatomical obstruction, allergies or an episode of rhino sinusitis, is the forerunner of production and accumulation of a serous transudate from the mucosa. This is precipitated by unfavorable pressure gradient across the Eustachian tube created by continuous absorption and diffusion of nitrogen and oxygen into the mucosal vasculature. A Eustachian tube with impaired drainage further adds to microbial proliferation in stagnant transudate. 45% of children develop persistent effusion in middle ear one month after an episode of acute otitis media. Recent researchers have used polymerase chain reaction (PCR) technology to identify microbial biofilm in 48% of culture negative middle ear effusions.<sup>19</sup> However Bluestone and Crapko described another model of development of otitis media with effusion. They describe the development of mucosal inflammation due to a reaction to bacteria already present in middle ear.<sup>20,21</sup> Tasker discovered pepsinogen levels 1000 times higher than that of serum, in more than 90% of effusion collection during tympanostomies.<sup>22</sup> Yilmaz et al highlighted a possibility of significant role of oxidants and anti-oxidants in pathogenesis of chronic tonsillitis, adenoid hypertrophy and otitis media with effusion, since the blood levels of oxidants and antioxidants improved after surgical intervention.<sup>23</sup> In children with congenital cleft palate, the anomalous insertion of tensor veli palatini muscle into the soft palate results in inability to open the Eustachian tube orifice upon swallowing.

Though the frequency of otitis media with effusion declines with advancing age, other significant contributory factors include parental smoking, recent episodes of upper respiratory tract infections and acute otitis media, parental illiteracy, low socio-economic status, number of siblings and attending daycare facilities.<sup>24-26</sup> Birth weight, gestational age and breast feeding also have displayed a significant association.<sup>27</sup> However some older researches have shown a

weak correlation with parental smoking, family history of otitis media and parental socio-economic status.<sup>27</sup> High fat diet has also been shown as a confounder in between obesity and otitis media with effusion.<sup>28</sup>

We had requested all the parents and caregivers of the children to complete the OM-6 questionnaire during their first visit to the outpatient.<sup>29</sup> The OM-6, developed in 1997, is a simple, valid, reliable and most frequently used instrument to evaluate quality of life in children suffering from otitis media with effusion.<sup>30,31</sup>

Generally morbidity associated with respiratory tract infections increases in winters. Incidence of otitis media with effusion is highest in fall and winter.<sup>32</sup> Climatic hypothermia of the body surface jeopardizes nasal airway defense mechanism by inducing a reflex vasoconstriction of the respiratory mucosa. The resultant mucosal dehydration decreases the number of leukocytes and cytokines therein.<sup>33</sup> Subsequently impaired mucociliary clearance and diminished leukocyte-dependent phagocytosis stalls the upper respiratory tract imperviousness against infections.<sup>34-37</sup> Advent of polymerase chain reaction (PCR) has paved way to the detection of respiratory viruses in specimens from acute otitis media.<sup>8</sup>

A significant surge in respiratory tract infections is obvious in our setup in winter. Mauripur is located along the Arabian Sea coast of Karachi where temperature drops to 11°C in the months of December and January. It may soar as high as 46°C in the months of June and July. Although highest prevalence of otitis media with effusion has been observed in preschool children in the month of April, and the lowest in October. More studies based in the UK reported a rise in prevalence in winter months.<sup>38,39</sup>

## CONCLUSION

Otitis media with effusion is more prevalent in winter months in normal primary school children as well as mentally handicapped children with special needs, of the same age. The condition puts lasting impact on the auditory and

communication system of mentally handicapped children. Delay in diagnosis predisposes these children to the risk of developing physical and social disability in terms of conductive hearing loss and poor speech development; and, puts psychological constraint on their parents. Primary care clinicians must stress on obtaining pertinent clinical history, develop skill to perform otoscopic examination whenever needed and prompt referral to specialized Ear Nose & Throat clinic for expert investigation and appropriate management.

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**AUTHORSHIP AND CONTRIBUTION DECLARATION**

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2	Kanwal Nadeem	Data collection.	