



# Ice-cream: Fantasy triggering industrialization: A boon or bane to hearing

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## ABSTRACT

*Ice cream is defined as “a sweet frozen food that is made from cream or milk products or both and is generally aerated (Beeton, Isabella, 1911). Nowadays, Industrialization is at its peak to beat the fantasy of Ice-cream lovers which catalyzes the recruitment of employees for the Ice-cream factory where the workers are more exposed to low temperature. This study provides a review of latest evidence relating to the understanding of the middle ear infections with effusion, current treatment maneuvers, their constraints, new areas of research, and new strategies for prevention and treatment. 110 workers were interviewed and examined by Otosopic examination, Pure Tone Audiometry (Air Conduction: 250 Hz – 8 KHz & Bone Conduction: 250 Hz – 4 kHz at Octave and Mid-Octave frequencies) and Immittance Audiometry in a sound-treated room by using the modified Hughson Westlake procedure (Carhart and Jerger, 1959). It was observed that the Severity of Hearing Loss (ranging from mild to moderately severe) increases with increasing years of working experience (5-15 years). Maximum Workers were having a Moderate Conductive Hearing loss from Candy Section and Cold room as the Candy section has High atmospheric pressure & humid condition and the Cold room had very low temperature i.e.-0.55c (31 F). The workers work more than 15 hours revolving between these two units. The continuous fluctuating exposure of the cold room and the candy section creates an imbalance in the middle ear pressure resulting in frequent episodes of Otitis Media. The present study determines the need of administration of Hearing checkups, Pneumococcal vaccines for prevention for the development of Otitis media, Compulsion for using ear protection devices, and decreasing the working hours for lessening the exposure of temperature and pressure variance (within limits). Providing ear health guidelines to the workers before joining and Organizing Hearing conservation programs.*

**Keywords**— *Ice-cream, Otitis media, Frostbite, Conductive hearing loss, Hearing conservation program*

## 1. INTRODUCTION

Ice cream is defined as “a sweet frozen food that is made from cream or milk products or both and is generally aerated (Beeton, Isabella, 1911). Ice creams– The name itself is a mouth-watering term. Ice-creams are the friends of children even the adults and older people, but the same act as a foe for the ice-cream factory workers. Nowadays, Industrialization is at its peak to beat the fantasy of Ice-cream lovers which catalyzes the recruitment of employees for the Ice-cream factory where the workers are more exposed to low temperature.

The possibility an ear infection increases in cold winters. In winters many individuals suffer from ear infection two or three times in a year, but if it is continuously occurring during the months then individuals may need to take further precautions. Frequently exposing to cold and wet weather can cause Exostosis/Surfers ears (Gross, Moore, 2012). This occurs when these cold environments lead to an abnormal growth of bone inside the ear canal. Early symptoms include ear infections and difficulty draining the ear of water, dirt, and ear wax. This inability to allow the ear to clean itself which is the basic job of ear wax means that someone with this condition likely will struggle from repeated ear infections and potentially permanent Hearing loss.

The impact of temperature and pressure variance in ice-cream factory significantly leads to various stages of middle ear infections categorized as Acute, Serous and Chronic. Common symptoms of acute otitis media are fever, pain, and irritability. If the fluid builds up in the ear, this infection is known as serous otitis media. Chronic otitis media refers to a long-lasting ear infection.

Even the impact of very low temperature i.e., -0.55c (31 F) typically causes frost bite (Gross, Moore, 2012). Frost bite is the damage to skin and tissue caused by exposure to freezing temperatures (Handford, Thomas, Imray, 2017). Frost bite can affect any part of your body, but the parts such as the hands, feet, nose, ears, and lips are mostly seen to be affected.

So, the effects of varying temperature and pressure in the Ice cream factory situated in Odisha causing significant Conductive Hearing Loss has been examined in the present study. The Ice-cream factories have mainly 5 sections. That is:

1. Production section
2. Candy section
3. Cold Room
4. Mix Section
5. Store.

The production and mix sections are exposed to noise which is within the PEL (Permissible Exposure Limits)-8hours per day of 90 dB (A) specified in the state regulations (OSHA,1983), which in result does not have any significant effect on Hearing.

Whereas, as the candy section had high atmospheric pressure and the cold room had a very low temperature (-20 to -30 degree Celsius) as measured by the administration section of the factory. The workers work around 15 hours a day rotating between these two sections. The continuous varying exposure of cold room and candy section creates an imbalance in the middle ear pressure resulting in frequent episodes of (middle ear infections) Otitis media i.e., Recurrent Otitis media (serous to suppurative type).

## **2. NEED FOR THE STUDY**

Cases of Conductive Hearing Loss were frequently seen in hospitals mainly from the ice cream factory. Workers and the management department were not aware of the effects of low temperature and High pressure on Hearing. This study provides a review of latest evidence relating to the understanding of the middle ear infections with effusion, current treatment maneuvers, their constraints, new areas of research, and new strategies for prevention and treatment.

## **3. AIMS AND OBJECTIVES**

To assess the impact of variable temperature and pressure on Hearing in an Ice cream factory and the preventive measures which should be taken at these places.

## **4. METHOD**

A heterogeneous group of 114 workers was taken from 5 sections out of which 4 workers who had in their audiograms sensorineural or another history of ear pathologies were excluded. At first, workers were interviewed, inspected and information was collected. Each subject underwent a Visual examination of the ear canal (Otoscope examination) to ensure normal anatomy of the outer ear and no presence of obstructive debris & pure tone audiometry examination. Pure tone audiometry was conducted in a double-walled sound-treated room with ambient noise levels within permissible limits according to ANSI standards ANSI/ASA S3.1-1999 (R2008) and clinical audiometer was calibrated annually according to ANSI 3.6 1996. Air conduction thresholds were determined using MADSEN ITERA II audiometer with TDH 39 earphones and B-71 for Bone conduction. Air conduction thresholds were determined at Octave and mid-octave frequencies from 250Hz to 8 KHz, Bone conduction at frequencies from 250 Hz to 4 KHz by using the modified Hughson Westlake procedure (Carhart and Jerger, 1959). Immittance Audiometry was done to check the middle ear status.

## **5. RESULTS AND DISCUSSION**

Among 110 workers, 18.18% of the workers were found to have Normal Hearing sensitivity with 'C' type tympanogram after exposure of low temperature and high pressure. Significant Conductive Hearing Loss with 'B' type tympanogram was seen i.e. (81.81%), in most of the workers working in candy section and cold room i.e. (65.45%) than the workers working in mix section and production section i.e. (11.81%).

Recurrent ear infections were the primary complaint of the patients. The results also showed the positive correlation between the years of working and severity of Conductive Hearing Loss ranging from mild to moderately severe in the workers who worked for more than 5-15 years respectively ( $p < 0.02$ ).

## **6. SUMMARY AND CONCLUSION**

The present study concludes that the temperature and pressure variations play a role of a catalyst in the persistent occurrence of Conductive Hearing Loss (CHL). It was observed that the Severity of Hearing Loss (ranging from mild to moderately severe) increases with increasing years of working experience (5-15 years). Maximum Workers were having a Moderate Conductive Hearing loss from Candy Section and Cold room as the Candy section has High atmospheric pressure & humid condition and the Cold room had very low temperature i.e. -0.55c (31 F). The workers work more than 15 hours revolving between these two units. The continuous fluctuating exposure of the cold room and the candy section creates an imbalance in the middle ear pressure resulting in frequent episodes of Otitis Media.

## **7. CLINICAL SIGNIFICANCE**

The present study determines the need of administration of Hearing checkups in every 6 months (OSHA, 2002) in the ice cream industries along with the medical intervention in the cases of ear infections. Pneumococcal vaccines for prevention for the development of Otitis media are important in limiting the impact of this disease, associated antibiotic prescription, and emerging bacterial resistance. The compulsion for using ear protection devices, and decreasing the working hours for lessening the exposure of temperature and pressure variance (within limits). Providing ear health guidelines to the workers before joining and Organizing Hearing conservation programs. It is better to stay a short period of time in the freezing section. But if you face bitter temperatures in that short period of time too, then the administration must invest in protection for worker's ears and avoid leaving them exposed in the freezing section for a longer period of time.

Table 1 depicts the distribution of noise level in different sections (Production Section, Candy Section, Store, Cold Room, and Mix Section) within normal limits.

**Table 1: Distribution of noise levels in different sections**

Sections	Noise level (in dB)	Average Reading
Production Section	80-85	83
Candy Section	70-80	74
Store	70-75	73
Cold Room	65-70	67
Mix Section	80-85	83

Table 2 shows the relation between years of working experience and the prevalence of Hearing loss. It was observed that the severity of Hearing loss increased with the increasing years of work experiences.

**Table 2: Years of Work Experience**

Working years	Number of workers	Number of affected workers
0-5	24	7
6-10	36	33
11-15	39	39
.>15	11	11
<b>Total</b>	<b>110</b>	<b>90</b>

Table 3 depicts the total number of workers affected in an ice-cream factory having different degrees of hearing loss, mostly ranging from moderate to moderately severe hearing loss.

**Table 3: Audiometric results: Total number of workers affected in an ice-cream factory having different degrees of hearing loss**

S. no	Workers Exposed to Low Temperature and High Pressure		
	Hearing Level (in dBHL)	Degrees of Hearing Loss	Total
1.	26-40	Mild	19
2.	41-55	Moderate	50
3.	56-70	Moderately Severe	21

Table 4 shows most of the workers working in candy section and cold room were more affected i.e. (65.45%) than the workers working in mix section, production section and Store i.e. (16.36%).

**Table 4: Section wise distribution of workers with Hearing Loss**

S. no	Degree Of Hearing Loss	Workers Exposed to Low Temperature and High Pressure					Total (Workers with Hearing Loss)
		Production Section	Candy Section	Store	Cold Room	Mix Section	
1.	Mild	02	08	03	04	02	19
2.	Moderate	03	29	02	12	04	50
3.	Moderately Severe	02	15	-NIL-	04	-NIL-	21
<b>Total</b>		07	52	05	20	06	90

Maximum Workers were having Moderate Conductive Hearing Loss from Candy Section and Cold room.

- The Candy section has High atmospheric pressure & humid condition and the Cold room had very low temperature i.e. -0.55c (31 F). The workers work more than 15 hours revolving between these two units. The continuous fluctuating exposure of the cold room and the candy section creates an imbalance in the middle ear pressure resulting in frequent episodes of Otitis Media.

Table 5 depicts the prevalence of Otitis media over Recurrent ear Infections and Eustachian Tube dysfunction.

**Table 5: Section-wise distribution of workers having Middle ear pathology**

Sections	Recurrent ear infections	Otitis media	Eustachian tube Dysfunction
Production Section	04	01	02
Candy Section	12	36	04
Store	03	01	01
Cold Room	08	10	02
Mix Section	01	04	01
<b>Total</b>	<b>28</b>	<b>52</b>	<b>10</b>

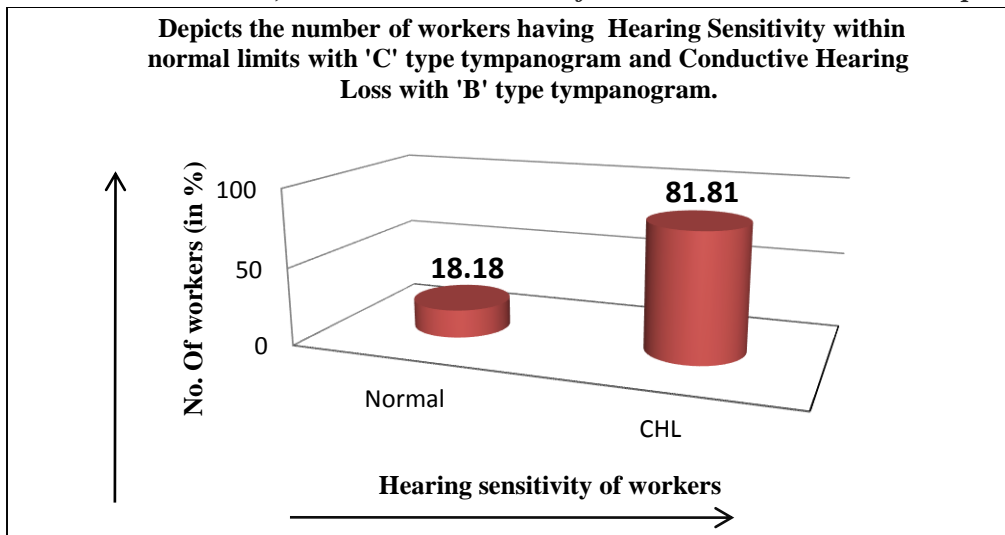


Fig. 1: Depicts the number of workers having hearing sensitivity within normal limits with 'C' type tympanogram and conductive hearing loss with 'B' type tympanogram

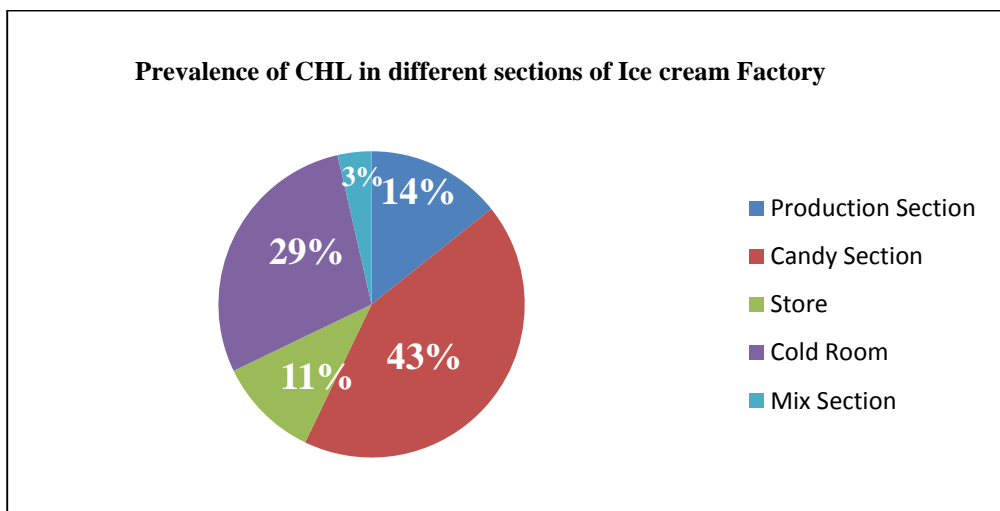


Fig. 2: Depicts the prevalence of CHL in different sections of Ice cream Factory

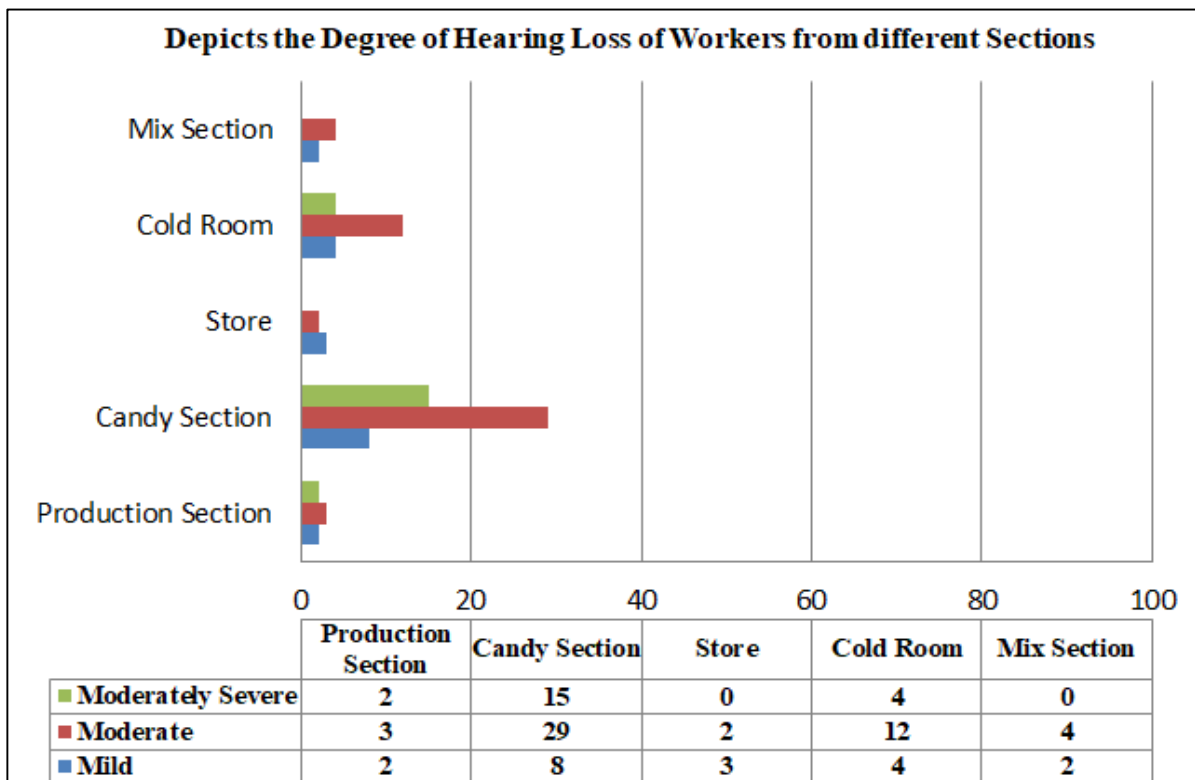


Fig. 3: Depicts the degree of hearing loss of workers from different Sections

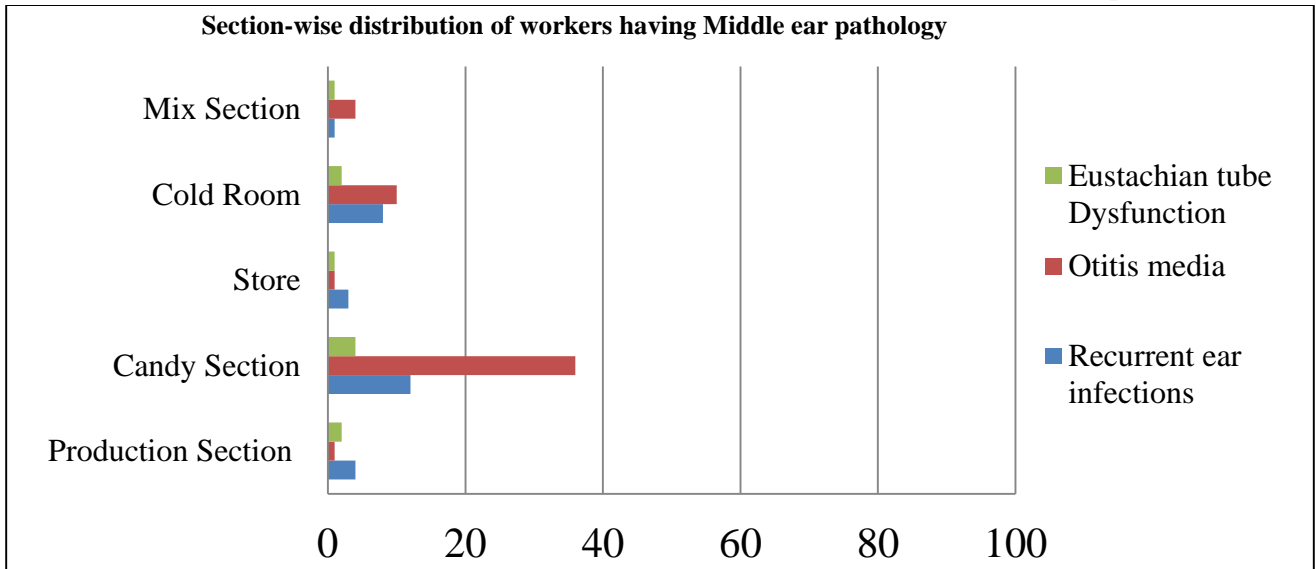


Fig. 4: Depicts Section-wise distribution of workers having Middle ear pathology

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## BIOGRAPHY



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