

**PREVALENCE OF VOICE PROBLEMS AMONG PRESCHOOLERS (3.5-  
5.5YEARS) IN YEMMIGANUR TOWN (ANDHRA PRADESH)**

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A dissertation submitted in part fulfillment for the degree of  
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## **CERTIFICATE**

This is to certify that this dissertation entitled “**Prevalence of voice problems among preschoolers (3.5-5.5years) in Yemmiganur town (Andhra Pradesh)**” is a bonafide work in part fulfillment for the degree of Master of Sciences (Speech-Language Pathology) of the student (Registration No. 10SLP015). This has been carried out under the guidance of a faculty of this institute and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

Mysore  
May, 2012

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## DECLARATION

This dissertation entitled **“Prevalence Of Voice problems among preschoolers in Yemmiganur town (Andhra Pradesh)”** is the result of my own study under the guidance of Ms. K. Yeshoda, Lecturer in Speech Sciences, Department of Speech- Language Sciences, All India Institute of Speech and Hearing, Mysore, and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

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## **CHAPTER 1**

### **INTRODUCTION**

Voice is the most important means of communication for an individual from infancy. ‘A normal voice should have a quality that is pleasant, has appropriate pitch, loudness with adequate flexibility and sustainability (Johnson, Brown, Curtis, Edney & Keaster, 1965). Any deviation from this will result in a voice disorder.

Voice problems, or voice disorders, can occur in anyone and at any age. Voice disorders can develop quickly, for instance, following a surgery or loud screaming, or they may take months or years to fully develop. Voice problems are more likely to occur in persons who use their voice extensively or strenuously, but many individuals who develop voice disorders have minimal vocal demands. Usually when communication is impaired or pain is involved during speaking, individuals often seek help. The voice may also be considered disordered if the sound is abnormal or if the voice cannot do what an individual requires it to do.

A voice disorder is present when a person’s quality, pitch, and loudness differ from those of a person’s of similar age, gender, cultural background, geographic location, or when an individual indicates that his or her voice is not sufficient to meet daily needs, even if it is not perceived as deviant by others (Colton & Casper, 1996; Stemple, Glaze & Klaben, 2000).

#### **Voice Disorders in Pediatric Population**

A voice disorder is characterized by an abnormal pitch, loudness, and/or vocal quality resulting from a disordered laryngeal, respiratory, and/or vocal tract functioning (Ramig & Verdolini, 1998).

Voice disorders in pediatric population can be classified as congenital and acquired voice disorders. Congenital voice disorders refer to conditions that are present at birth with idiopathic causes in the larynx. Laryngomalacia, laryngeal web, laryngocele, laryngeal stenosis are a few congenital disorders of voice which can alter the voice from infancy.

The cause of acquired voice problems exist on a continuum with organic at one end and functional at the other. Acquired voice disorders are caused due to vocally abusive behaviors. Vocal abuses occur when the vocal folds are forced to adduct in a vigorous manner causing hyper function of the laryngeal mechanism. Children may enjoy making vocal noises during play and imitating environmental sounds which leads to hyper functional voice disorder. Common types of vocal abuse include shouting, screaming, cheering, strained vocalizations, excessive talking, reverse phonation, explosive release of vocalizations, abrupt glottal attack, throat clearing, coughing, and talking in the presence of high level noise (Wilson, 1972).

Vocal misuse refers to improper use of pitch and loudness, vocal abuse and misuse may be more pronounced in living environments of some children such as loud talking families and large families are conducive to poor vocal habits (Wilson, 1972). There are other predisposing and co - existing conditions that contribute for voice problem in children.

### **Predisposing & co-existing conditions**

Certain conditions such as pharyngitis, acute tonsillitis, hypertrophied adenoids, upper respiratory tract infections and laryngopharyngeal reflux may be predisposing and co-existing factors that contribute for voice problems. Pharyngitis is a condition where children become susceptible to upper respiratory viral infections. Children attending day-care center, preschool or kindergarten may experience

approximately eight or nine respiratory infections per year, associated with pharyngitis. Children with pharyngitis are prone to have reduced breath support and hoarse voice quality (Zalzal & Cotton, 1998). A few parents are able to identify atypical voice in their child. The presence of a voice concern of the child was felt by the parents only if their child had an episode asthma or tonsillectomy (Carding, Roulstone & Northstone, 2006).

Acute tonsillitis is a common condition noticed during childhood with an incidence at around 5 to 6 years of age, but it can occur in children under 3 years of age and in adults over 50 years (Schwartz, Wientzen, Pedreira, Feroli, Mella & Guandolo, 1981). Sore throat is a common symptom indicating a painful condition in the oropharynx. Acute tonsillitis is manifested by a dry throat, thirst, fullness in the throat, odynophagia and dysphagia. The enlargement of the tonsils causes obstruction resulting in voice change (Zalzal & Cotton 1998). Chronic adenoid infection occurs around 3 - 6 years of age with concomitant hypertrophy. Constant mouth breathing is a common symptom observed which results in dryness of the oral cavity. Extreme enlargement of the adenoids results in stuffy or muffled voice. Other speech problems such as hyponasal, hypernasal may develop which may affect the intelligibility of the speech (MacKenzie-Stepner, Witzel, Stringer & Laskin, 1987)

Upper respiratory tract infections are very common in children and the incidence declines with age. The respiratory factors such as tonsillitis, common cold, chronic rhinitis cause upper respiratory tract infections. Steroids are generally used as a treatment for individuals affected with wheezing, asthma and other breathing difficulties. Inhaled corticosteroids provide maintenance treatment for chronic asthma. Dysphonia has been reported to affect 50% of individuals using the steroid aerosols

and 92% patients taking oral corticosteroids (Williamson, Matusiewicz, Brown, Greening & Crompton, 1995).

Another condition observed in children is laryngopharyngeal reflux (LPR). LPR is caused by mucosal injury from acid and pepsin exposure. The most common symptoms observed are dysphonia, chronic throat clearing, and chronic coughing. These symptoms will lead to a hoarse voice quality in the child (Koufman & Amin, 2003).

The incidences of hoarse voice in children from kindergarten to third grade are 28.9% in boys and 17.7% in girls. This was attributed to factors such as upper respiratory tract infection and vocal misuse (Silverman & Zimmer, 1974). Milutinovic (1994) compared 362 12–13 years aged children living in rural and urban areas of Serbia. Many more children living in urban areas (43.67%) were reported to have voice problems as compared to children living in rural areas (3.92%).

A survey conducted in Mysore city by Manohar and Jayaram (1973) on 1454 school children, concluded that 9% of the school children in India aged between 5-14 years had voice problems based on quality, pitch and loudness deviations. Mittal, Zaid, Puri, Dual, Rath, and Bhargava (1977) in New Delhi found out of 372 children 10% of them had voice defects such as whispering, hoarse, or irregular (pitch break) problems.

### **Need for the study**

Vocal behaviors such as screaming, whispering, imitating environmental sounds and making vocal noises during play and learning through verbal means are observed in children. Attention seeking behaviors, such as screaming, whispering, crying, speaking and singing loudly are considered vocally abusive behaviors that pave way for voice disorders. Often children get parents attention by employing such

behaviors. This may cause a voice problem and decrease the child's ability to interact and communicate effectively.

Preschool or Kindergarten is the most important phase for children to move from unstructured play and early learning to a more structured learning environment of formal schooling. Children communicate, narrate and sing in groups, make vocal sounds/noises becoming more prone to develop voice problems. Such behaviors may continue even when they begin formal education.

Thus a study on prevalence of voice problems would help us to know the boundaries between impairment and typical development and to identify the children at risk of voice to develop voice disorder which helps in early identification and early intervention. This would lead to restoration of vocal behavior into 'normal voice stream'.

**Implications of study:**

The data of prevalence of voice problems in children, it gives insight to early identification and prevention of voice problems in children who are at risk to get voice disorders.

## CHAPTER 2

### REVIEW OF LITERATURE

'Voice is one component of speech. Human voice provides an all important vehicle for communication and intrinsic linguistic and grammatical features of stress and intonation in speech. Voice and speech are inclusively human attributes" (Green, 1964)

Voice is constantly evolving over the years in an individual and influenced by a number of intrinsic and extrinsic variables. Voice problems are on the rise for a variety of reasons. Factors such as ill health, diet, pollution, weather changes, age, lifestyle, stress could be some of the common causes for increased incidence and prevalence of voice problems.

#### **Basic issues related to vocal health**

Core issues surrounding basic vocal health are adequate hydration, good nutrition, refraining from smoking and alcohol intake, minimizing allergies and stress. The factors which can potentially damage the vocal fold structure are divided into intrinsic (factors that have less control over by individual) and extrinsic factors (to those which persons may be exposed).

Exposure to irritants (smoking, excessive alcohol, chemical fumes and pollutants) would irritate the delicate mucous lining of the nasal passages, throat and larynx. Coughing and throat clearing would occur due to foreign stimulant in airway which may be either acute or chronic. Continuous cough and throat clearing can cause tissue irritation and damage to vocal folds over time due to high expiratory pressure and shearing forces, (Sapinez & Hoffman-Ruddy, 2009). Caffeine found in coffee,

tea, sodas, chocolate, coca and diet pills is a diuretic which it potentially contributes to dehydration. Talking too loudly will lead to vocal fatigue, (Sapinez & Hoffman-Ruddy, 2009). Lakkanen, Ilomaki, Leppmann and Vilkmann (2006) reported that direct relationship between the degree of elevated loudness levels and degree of vocal fatigue.

Poor nutrition can affect individual's ability to resist disease and infection. Nutrition deprivation or malnutrition can cause alternations in muscle and nerve function. Specific symptoms include general body weakness, fatigue, and loss of respiratory strength, depression, irritability, mental confusion, inability to concentrate, and infection ( Sapinez & Hoffman-Ruddy, 2009).

Allergies are overreaction of the immune system to a substance. In these conditions an individual complains of having runny nose or talks about the effects of season on their voice quality. The types of allergens can be plants, flowers, and weeds, animal dander, shedding fur, and dust mites which typically result in nasal congestion, sneezing, clear drainage, watery itchy eyes, throat clearing, scratchy throat soreness, excessive coughing, pain, and pressure in the ears, headaches, and fatigue (Sapineza & Hoffmann-Ruddy,2009)

### **Studies conducted on vocal behaviors of children**

Carlin and Saniga (1993) conducted study on vocal abuse behaviors in young children to identify the frequency of those behaviors across ages. Mixture of rural and urban public school districts in Mississippi students in kindergarten through second grade was considered. Questionnaire was sent to parents to comment on their child's voice use and vocal abusive behaviors. Voice conversation index was used as questionnaire. Results revealed parental report on vocal abuse behaviors are more in



older children. Hence authors reported the child's age increases voice usage become more conservative.

Takeshita, Auigar-Ricz, Issac, Ricz and Anselmo-Lima (2009) conducted research in Sao Paulo, Brazil on preschool children. This was a questionnaire based study. The participants were 33 parents of kindergarten children between the age ranges of 5-7 years. There were 14 girls and 19 boys who belonged to a day nursery school. The questionnaire contained 12 questions which were divided into 6 categories such as vocal identity, favorite play, vocal habits and family environment, pathological factor and behavior of parents for vocal alteration. Parents answered the questionnaire. Results revealed that vocal behaviors such as shouting, speaking excessively with a strong intensity and laughing loud were answered by 39.6%, imitation of others voice was 24%, imitating monster voices was 26.3%, TV characters was 31.6% and animals was 21%. Around 66.7% of parents classified their child's voice to be normal, 27.3% considered hoarse voice, 18.2% as strong intensity and 9.1% as hoarse and strong intensity. Results of attitudes of parents with children with voice alterations concluded that 36.4% of the parents talked to their children regarding voice problems and 18.2% asked the child to stop speaking. Among the preference of different categories, the favorite plays of children constituted 55.3% continuous use of voice. The constant occurrence of shouting and speaking loudly in family environment was 28.6%. The predisposing condition such as allergic rhinitis was 40.9% which was associated with vocal alterations. Results also indicated that most of the parents recognized their children had abusive voice, predominate usage of voice was noticed in children's favorite plays, allergic rhinitis in almost half and habit of shouting and speaking with strong intensity was noticed in less than half of the children.

Based on the survey The National Institute of Deafness and Communicative Disorders estimated 7.5 million individuals have diseases or disorders of the voice caused by overuse, upper respiratory tract infections, vocal fold lesions, and laryngeal pathologies as reported by (ASLHA, 2002).

### **Prevalence and incidence of voice disorders based on survey and questionnaire**

Prevalence refers to “the proportion or percentage of cases in a given population at a specified time”, (Law, Boyle, Harris, Harkness & Nye, 2000) and is of interest for a number of reasons. Prevalence is the proportion of a population that has an existing condition during a given point in time.

Studies were done to identify the epidemiological data of children aiming at incidence and prevalence of voice disorders or voice problems.

Powell, Filter and Williams (1989) conducted a mass screening of 847 children aged between 6- 10 years in rural schools in the United States. Screening was done by Speech Language Pathologist’s to identify the presence or absence of voice disorder among children and seven point rating scales were used zero indicating normal. Of this only 203 children were identified to have a voice disorder. Follow up was conducted 1 and 4 years later still 38% of them were found to have persisting voice disorders after the initial identification if not treated.

Duff, Proctor and Yairi (2003) conducted study on African and American preschool children. The participants were 2445 children between 2 and 6 years enrolled in 49 different preschools in urban, rural and suburban regions of Illinois. The African-American children were around 64.8% and European-American children were around 35.1%. Using three diagnostic indicators (i.e., teacher identification, parent identification, and investigator screening), voice disorders characterized by

hoarseness were identified in 95 children, or 3.9% of the sample. No significant differences for age, gender, or race were identified. Teachers agreed with the investigators categorization 26.3% times and parents with 25.7% times. They also found no significant difference found between the African American and European American children.

A longitudinal study of prevalence was conducted in Newcastle, United Kingdom by Carding, Roulstone, and Northstone (2006) to estimate the prevalence of dysphonia in a large cohort of children. The study was an eight year follow up. The participants were pregnant women who were residents within the geographical area of approximately 500 square miles. The babies were due for delivery during the period from April 1991 to December 1992. Data regarding the child's health, developmental status, hearing vision and diet was collected. Parental report and information on number and age of family siblings, sex, asthma and other ear, nose and throat problems was collected. A formal assessment of range of speech, voice, and language functions was done. A sample of prolonged vowel phonation / a: / and spontaneous speech were recorded. The voice assessment involved rating on a binary choice judgment by a speech language pathologist who had an expertise in pediatric voice. A rating procedure was also used to know their reactions to voice of their child. The research clinicians identified a dysphonia prevalence of 6% compared with a parental report of 11%. Higher proportion of boys (7.4%) and 4.6 % of girls were identified with atypical voices. 52.9% were children with older siblings and 51.3 % for younger sibling had abnormal voice.

A study was conducted by Mckinnon, Mcleod and Reilly (2007) on school children in Australia which aimed at prevalence of voice problems and gender distribution. Classroom teachers were trained and employed as the primary identifiers

of voice problems among children with special needs. A four staged process was used in identification of students with voice disorders. The first stage was the information session and training for the teachers and principals of the learning support group to aid in data collection. In the second stage these trained teachers and principals of the learning support group trained every teacher from 36 schools and within a week the teachers were required to identify the students with voice disorders. In the third stage a speech language pathologist's report was used as a supporting document for confirmation of a speech disorder. In the fourth stage the principal and learning support teacher reviewed information about each identified student and presented the data to the schools' special needs committee. Results indicated that the subjects identified were 36 children from kindergarten to grade six. Results revealed prevalence of voice disorders was 0.12% and higher prevalence was found in males compared to females.

Balakrishnan (1969) studied 1000 school going children in Mysore and found 15 % of them had speech disorders in that 3.8% of them had dysphonias.

Manohar and Jayaram (1973) conducted a study to check prevalence of speech disorders among school children of Mysore city. 1454 children aged 3-16years were tested in that 707 were boys and 747 were girls. They conducted a screening program on these children for about 2yrs to detect the speech and hearing problems. Speech evaluation was carried out by graduate and post graduate students under the supervision of a Speech Pathologist and all the children were tested for normalcy of speech mechanism, articulation, voice, fluency and language. Voice was examined for the possible deviations in the pitch, quality and loudness with respect to the age of the children. Mutational voice change in children was noted separately. Results revealed

46% of boys, 73.47% girls had dysphonias and higher incidence of dsphonias were found more in girls compared to boys.

### **Studies on acoustic analysis**

Pereira, Cervantes, Abrahao, Parente, and Angelis (2002) conducted study to assess the efficacy of computerized Noise to- Harmonics ratio (NHR) to quantify perceptual and endoscopic findings of dysphonia and/or structural lesion of the vocal fold. 50 Brazilian boys with in age range of 2-16years without vocal complaints were participated in the study and were subjected to computerized, perceptual, and endoscopic examination. Results indicated 30 were classified into the dysphonic by perceptual analysis based on the criteria established by the Japan Society of Logopedics and Phoniatics (1992) and these subjects were categorized, 3 were into grade category, 5 into breathiness, 9 into roughness, and 15 into grade/breathiness. Vocal fold lesions were observed in 25 boys (17 nodules and 8 cysts). Results revealed that NHR was significantly higher in boys with a structural lesion ( $p = 0.007$ ) and in boys with dysphonia ( $p < 0.0001$ ). Authors suggest that noise is a useful quantitative index of dysphonia to confirm a perceptual diagnosis of dysphonia and to evaluate quantitative changes in a dysphonic voice over time.

Studies conducted on relationship between auditory and acoustic analysis of voice disorders in children. Marcia Simoes-Zenari, Nemr and Behlau (2012) conducted astudy on 100 children in the age range of 6-11yrs, 50 were deviant voices (DVG) and 50 were normal voices (NVG) matched for the age and gender. Teachers were asked to complete a questionnaire based on their observations of the children, following a training sessions to assess issues related to phonotrauma. All recordings were individually analyzed by three judges, speech-language pathologists with experience in

voice assessment employing the GRBAS scale. Fundamental frequency (F0) and noise measures (noise and glottal excitation ratio – GNE proportion) of sustained vowels were taken for acoustic analysis. They rated both the sustained vowel and the connected speech and there was no disagreement between the three judges in any analysis. Results revealed Phonotraumatic behaviors groups screaming, talking over noise, talking too much, using loud voice, and interrupting others were consistent across both normal and deviated groups. The acoustic analysis of children with deviant voices presented with a lower mean F0 compared to children with normal voices. These findings of authors indicated the presence of edema or mass lesions of the vocal folds interfering normal vibration and association between deviant voices and noise measurement was observed positively. Presence of deviant voice was the considered based on frequency in which such behaviors occurred, indicating the need for both qualitative and quantitative assessment. The amount and type of vocal abuse observed was associated with increased dysphonia.

In general the results of the above studies suggest that noise is a useful quantitative index to confirm a perceptual diagnosis of dysphonia and to evaluate quantitative changes in a dysphonic voice over time.

Voice disorder in pediatric population is an uprising concern amongst parents, teachers and speech language pathologists Present day competitions, lifestyles, have lead to an increase in awareness and expectations to possess good interpersonal communication skills are on the rise. Effective communication skills have become an integral part of today's education system too. Children are affected to a greater degree as parents have aspirations for their children. With air and water borne infections rising the incidence and prevalence of upper respiratory tract infections and voice related symptoms in children are rising in semi urban areas leading to risk of developing voice

disorders. Most prevalence and survey studies make use of questionnaires. Very few studies use quantitative methods to identify the number of existing cases with voice problems

The review of literature shows, voice problems are prevalent among preschoolers and hence there is need for an epidemiological study to quantify the voice problems in this population. Such a study will help us in early identification of children who are at risk to develop voice problems and thus in undertaking preventive measures for them.

**Aim of the study:**

To study the prevalence of voice problems among preschoolers (3.5- 5.5yrs) in Yemmiganur town (semi-urban)

**Objectives of the study:**

1. To study the occurrence of voice problems among preschoolers using questionnaire.
2. To confirm the prevalence of voice problems using acoustic measures of voice quality.
3. To investigate the differences if any to prevalence of voice problems across gender and school setup.
4. To correlate the results of qualitative of questionnaire with quantitative analysis of voice quality estimates.

## **CHAPTER 3**

### **METHOD**

#### **Subjects**

Total number of subjects comprised 320 children and equally distributed into 2 groups, first 3.5- 4.5yrs and second 4.5-5.5yrs. Each group consisted of 160 children of 80 girls and 80 boys. Equal number of subjects was chosen from schools of government and private aided setups. All the subjects were native speakers of telugu.

#### **School selection**

Examiner initially surveyed the details of the school, number of children prior to the study, the examiner contacted the school authorities in the town and sought their cooperation to the study. They were given objectives of the study depending on the consent provided, equal numbers of schools were chosen to represent the government and private aided setups. The study was carried out in 8 government schools (anganwadis) and 8 private schools in the town of Yemmiganur.

#### **Procedure**

The study was carried out in 2 phases.

In Phase I: A questionnaire was developed by the investigator in Telugu language in line with voice conservation index Saniga and Carlin (1991) and Quick screen for voice and supplementary documents for identifying pediatric voice disorders Lee, Stemple, Glaze, and Kelchner (2004) to tap the presence of behaviors that were functional indicators of voice problems (FIVP).



Functional voice indicators of voice problems (FIVP) questionnaire consisted of four domains as listed below.

1. Vocal abusive behaviors consisted of 8 questions.
2. Reactions of significant others about voices of children, consisted of 4 questions.
3. Voice related symptoms, consisted of 5 questions.
4. Diet habits influencing voice, consisted of 3 questions. Listed in the appendix

A score of “1” was assigned for yes, and “0” was assigned to no responses.

### **Validation of the questionnaire**

The questionnaire was given to five experienced Speech Language Pathologists (SLP) for validation. A detailed method of the study was described to the valuator. They were requested to check the content in the questionnaire. Their views, suggestions and comments were duly incorporated in the questionnaire.

Respondents of the questionnaire: The questionnaire was administered to 50% of parents and 50% of teachers of the chosen participants in the study. They were instructed to choose between the two binary choices namely, ‘yes’ and ‘no’ to indicate the presence or absence of functional indicators of the voice problems in the child. They were instructed to indicate only when these functional indicators of voice problems were persistent problems. Total responses of yes were calculated and converted into percentages under all the domains of questionnaire.

Phase II quantitative analysis using acoustic measures of involved voice quality measures and estimates.

Samples of phonation of /a/ were collected from the subjects of both groups. Each subject was tested individually they were rewarded with tangible reinforcers.

## **Procedure**

Initially, Rapport was build with children before the actual voice sample was elicited. Children were instructed to take deep breath and phonate /a/. The phonation was modeled 3-4 times before the actual sample was elicited. The recording of the voice samples was done by using Olympus 16 bit voice recorder with 44,000Hz sampling frequency. These samples were collected relatively quiet environment within the school. Minimum of 3 phonation samples of /a/ were collected from each child , best of the 3 for their sustained of voice at least for 2 seconds were subjected for acoustic analysis.

Acoustic analysis was done using Dr. Speech software (Dr. Speech 4.3u software subprogram: Vocal Assessment; Dr. Speech, Tiger Electronics, Seattle, WA). The voice samples were subjected to instrumental analysis.

### **Four major parameters that signify voice quality were extracted.**

- 1. Jitter:** The random variations in the periodicity of the Fundamental frequency.  
An indication of the pitch variability or pitch control instability.
- 2. Shimmer:** The random variations of voice amplitude between adjacent cycles of vocal fold vibrations. An indication of the voice intensity variability or instability.
- 3. Standard deviation of F0:** It is a measurement of the variability in statistical sampling of the Fo.
- 4. NNE:** It is a measure of turbulent noise energy in the vocalization.

## **Quality estimates of voice**

This was based on the above four parameters the quality of voice is labeled as hoarseness, harshness and breathiness and also quantification is done numerically. A score of 1 indicates mild, 2 indicates moderate, and 3 indicates severe deviancy under each type.

**Hoarseness:** a voice that is characterized by a rough and husky voice quality, often thought as a combination of harshness and breathiness. eg : voice during an acute upper respiratory infection.

**Harshness:** a voice that is characterized by a rough, strained, dry and strident quality, often associated with increased levels of vocal effort.

**Breathiness:** a voice quality that is marked by the overlay of audible turbulent noise over a voice signal that is usually reduced in intensity. This condition is most often associated with voice pathologies that present with incomplete glottal closure.

**Scoring:** Labeling voice quality as “deviant voice” was done when sum total of 5 or more was obtained for the voice quality estimates.

## **Calculation of prevalence**

The prevalence or proportion of individuals from a population that had the illness at one particular moment is the prevalence. The prevalence was calculated as follows,

$$\text{Prevalence} = \text{number of people with the illness} / \text{total population}$$

## **Statistical Analysis**

Statistical analysis will be done by using Statistical Package for Social Science (SPSS) version 18.0 software.

Qualitative analysis of questionnaire was done by chi-square analysis to know major precursors of comment on the vocal behaviors of the children. four way MANOVA was done to see the main effect of the acoustic parameters on age, gender and school setup. Correlation analysis was done for qualitative and quantitative by using spearman's rank correlation.

## CHAPTER 4

### RESULTS AND DISCUSSION

The objective of the present study was to identify the prevalence of voice problems among preschoolers in a semi-urban setup. A total of 320 subjects were categorized into two groups. Among them, 160 children were from government and the remaining from private school setup. Table 1 summarizes the details of subjects.

**Table 1:** *Distribution of subjects*

| Group 1 |      |        |      | Group 2 |      |        |      |
|---------|------|--------|------|---------|------|--------|------|
| Male    |      | Female |      | Male    |      | Female |      |
| Govt    | Priv | Govt   | Priv | Govt    | Priv | Govt   | Priv |
| 40      | 40   | 40     | 40   | 40      | 40   | 40     | 40   |

*Note: Govt- Government, Priv- Private*

The questionnaire “functional indicators of voice problems” was developed and used to obtain information about occurrence of voice problems in the subjects by their parents and teachers who were the respondents. The phonation samples were subjected to acoustic analysis and, voice quality parameters and estimates were extracted. The raw data were subjected to statistical analysis using Statistical Package of Social Sciences (SPSS) version 18.

The responses of respondents were subjected to Chi-square analysis. The voice quality estimates were subjected to descriptive statistics for mean and standard deviation and, the four way multivariate analysis of variance (MANOVA) for finding the effect of voice quality parameters across groups, gender, and school setup. The grand total of voice quality estimates obtained as 5 and above was consider as deviant voice, based on which periodic prevalence was calculated. Voice quality and FIVP domains were correlated using spearman’s rank correlation.

The results are explained and discussed under the following subheads,

1. Qualitative analysis
2. Quantitative analysis
3. Correlation between qualitative analysis and quantitative analysis

### Qualitative analysis

The association effects on different domains of FIVP across groups, gender and school setup was studied using Chi-square test. These results are tabulated in Tables 2-4.

*Table 2: Correlation of percent responses for FIVP across the groups*

| Domains                         | Response | Groups |    | Chi-square | df | P    |
|---------------------------------|----------|--------|----|------------|----|------|
|                                 |          | 1      | 2  |            |    |      |
| Vocal abusive behaviors         | Yes      | 57     | 61 | 4.34       | 6  | 0.63 |
| Reactions of Significant others | Yes      | 36     | 43 | 8.34       | 4  | 0.77 |
| Voice related Symptoms          | Yes      | 14     | 16 | 2.32       | 4  | 0.51 |
| Diet habits influencing voice   | Yes      | 15     | 15 | 5.38       | 4  | 0.15 |

Table 2 indicates the association effect for questions under different domains in the FIVP questionnaire across 2 groups. It can be observed that the percent affirmative responses were 57, 36, 14, 15 for the vocal abusive behaviors, reactions of significant others, voice related symptoms and diet habits influencing voice respectively for group 1. The percent responses were 61, 43, 16 and 15 for the second group under each domain considered, respectively. Though the scores were slightly more for group 2 in all domains except “diet habits influencing voice”, there was no significance noticed between the questions under different domains and groups.

The results in the Table 2 indicate that older children indulge in vocal behaviors more frequently compared to younger children. This finding is similar to the findings of Carlin and Saniga (1993) who reported that vocal abuse related voice problems were more common in older children. Vocal abuse and other related voice behaviors could be more common in older children due to differences in play activities of these children. In general, younger children are confined to home and indoor games where as older children are allowed to be in open environment and indulge in outdoor games more often.

The responses to the domain “diet habits influencing voice” were same for both groups. This finding is similar to the results of Skinner, et.al, (2002), wherein, it was reported that the food preferences of children were not significantly different between ages 2-8.

*Table 3: Correlation of percent responses for questionnaire across gender*

| Domains                         | Responses | Gender |         | Chi-square | df | p    |
|---------------------------------|-----------|--------|---------|------------|----|------|
|                                 |           | Males  | Females |            |    |      |
| Vocal abusive behaviors         | Yes       | 59     | 59      | 3.98       | 6  | 0.68 |
| Reactions of Significant others | Yes       | 36     | 23      | 16.83      | 4  | 0.02 |
| Voice related Symptoms          | Yes       | 18     | 12      | 3.21       | 4  | 0.35 |
| Diet habits influencing voice   | Yes       | 19     | 13      | 2.85       | 4  | 0.42 |

Table 3 indicates the association effect for questions under different domains in the FIVP questionnaire across gender. It can be observed that the percent affirmative responses were 59, 36, 18, and 19 for the vocal abusive behaviors, reactions of significant others, voice related symptoms and diet habits influencing voice respectively, for males. The percent responses were 59, 23, 12, and 15 for the females under each domain considered, respectively. Though males showed higher percentage

of affirmative responses for other domains of FIVP, there were no significant differences except for “reactions to significant others” present across gender.

The responses for vocal abusive behaviors for both males and females were same indicating that both males and females subjects indulge in vocally abusive behaviors to the same extent. This inference is in contrast to the findings of Takeshita et al. (2009) reporting higher abusive behaviors in boys compared to girls. These results were attributed to the type of play boys indulged in and, the environment. Since boys involve more in outdoor play activities, the maintenance of vocal self control was difficult. Based on the findings of the present study, it can be inferred that the females could be indulging in excessive talking, loud talking, and also taking part in outdoor games as frequent as their male counterparts.

For the domain “reactions of significant others”, responses of parents and teachers showed higher affirmatives for females compared to males. This might be due to the assumption of teachers and parents that females indulge more frequently in vocal acts like talking, than males. This difference is because girls are primarily interested in people and relationships. Girls are generally more sensitive to social and personal context and express their emotions through conversation. They also want to convey large chunks of information in a short span of time (Gurian, Henley & Trueman, 2001). These could be the possible reasons for such findings. This was further supported by the findings of Takeshita et al. (2009) who opined that around 16% of children were talkative. They found that the voice deviations such as rough/hoarse voice quality were higher in talkative children.

The increased responses for the domain “voice related symptoms” for males compared to females could be because of higher susceptibility to different airborne infections due to outdoor play. This could be possibly because boy’s tend to play more



in open environment and, in diverse weather conditions (such as hot sun, in the rain etc).

The increased responses for domain “diet habits influencing voice” for males was in agreement with the findings of Lucy, Cooke and Wardle (2005) suggesting that girls had healthier diet habits than boys.

Table 4 indicates the association effect for questions under different domains in the FIVP questionnaire across school setup. It can be observed that the percent affirmative responses were 47, 22, 8 and 4 respectively for the vocal abusive behaviors, reactions of significant others, voice related symptoms diet habits influencing voice for government. The percent responses were 71, 41, 22, and 27 for private school in each domain considered respectively. The scores for all domains were increased significantly for private setup compared to government setup.

*Table 4: Correlation of percent responses for questionnaire across school setup*

| Domains                         | Responses | School % |      | Chi-square | df | P    |
|---------------------------------|-----------|----------|------|------------|----|------|
|                                 |           | Govt     | Priv |            |    |      |
| Vocal abusive behaviors         | Yes       | 47       | 71   | 32.47      | 6  | 0.00 |
| Reactions of Significant others | Yes       | 22       | 41   | 15.16      | 4  | 0.04 |
| Voice related symptoms          | Yes       | 8        | 22   | 13.53      | 4  | 0.04 |
| Diet habits influencing voice   | Yes       | 4        | 27   | 33.43      | 4  | 0.00 |

*Note: Govt- Government, Priv- Private*

The findings of the present study could be due to differences in socio-economic status among children in private school setup and government school setup.

Additional factor contributing to the findings would be the differences in respondent’s attitude. Also, the teachers and parents of children in private setup were more sensitive in suspecting voice problems, when compared to government schools. This might be due to the dual responsibilities of teachers in government setup,

reducing the time spent with children. The educational and economic status of parents along with the lesser awareness about the voice problem could also be contributing to these findings.

### **Quantitative analysis**

Quantitative analysis involved extraction of voice quality parameters and estimates for the phonation samples and confirmation of deviant voice in the subjects. The effects of voice quality parameters were compared across group, gender, and school setup using four-way MANOVA.

Tables 5 and 6 represent the mean, F, p values of the voice quality measures. The jitter and shimmer values showed increased mean values for group 2 compared to group 1 across school setup indicating that jitter and shimmer values were higher for older children when compared to younger children. The NNE and SDF0, on the other hand were lower for the group 2 in contrast to group 1. However, these differences were not statistically significant for all the parameters, except NNE. These results could have been noticed because of increased vocal abusive behaviors in older children as shown in qualitative analysis.

The mean values of voice quality parameters across the gender were statistically not significant. There was no obvious trend seen in the parameters across the gender. The variation in voice development across gender is considerably less pre pubescent males and females compared to post pubescent development.

The comparison of mean value across school setup showed that except NNE, all the parameters were higher for subjects in private setup compared to government setup. However, the statistical significance was noticed only for jitter and, SDF0. This could be attributed to poor vocal habits in older children which might result in glottal insufficiency, and altering voice quality. These findings draw support from the earlier

studies by Yumoto, Sasaki, and Okamura (1984) and Eskenazi, Childers, and Hicks (1990) who reported that though jitter and shimmer are more specific measures of vocal perturbation, noise measures may be an important predictive factor of dysphonia. They also concluded that the morphological changes during childhood are significant and hinder the establishment of acoustic parameters in children.

*Table 5: The mean and standard deviation of voice quality parameters across groups, gender and school setup*

| Parameter | Government       |                  |                  |                  | Private          |                  |                  |                  |
|-----------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
|           | Group1           |                  | Group 2          |                  | Group1           |                  | Group2           |                  |
|           | M                | F                | M                | F                | M                | F                | M                | F                |
|           | Mean (SD)        | Mean (SD)        | Mean (SD)        | Mean (SD)        | Mean (SD)        | Mean (SD)        | Mean (SD)        | Mean (SD)        |
| Jitter    | 0.31<br>(0.24)   | 0.29<br>(0.13)   | 0.34<br>(0.18)   | 0.36<br>(0.37)   | 0.36<br>(0.26)   | 0.43<br>(0.44)   | 0.44<br>(0.41)   | 0.40<br>(0.23)   |
| Shimmer   | 3.09<br>(1.57)   | 3.09<br>(1.08)   | 3.43<br>(1.35)   | 3.37<br>(1.50)   | 3.49<br>(1.81)   | 3.33<br>(1.74)   | 3.68<br>(1.47)   | 3.77<br>(1.46)   |
| NNE       | -14.21<br>(4.96) | -13.72<br>(4.60) | -10.55<br>(4.66) | -12.99<br>(4.60) | -13.93<br>(5.30) | -13.54<br>(6.39) | -11.10<br>(5.17) | -11.55<br>(4.43) |
| SDF0      | 2.84<br>(0.83)   | 3.23<br>(1.32)   | 2.76<br>(0.95)   | 2.94<br>(1.10)   | 3.07<br>(1.07)   | 3.60<br>(2.20)   | 3.28<br>(1.53)   | 3.27<br>(1.41)   |

*Table 6: The F value and p values of voice quality parameters for groups, School setup and gender*

| Parameter | Groups |        | School setup |       | Gender |      |
|-----------|--------|--------|--------------|-------|--------|------|
|           | F      | p      | F            | p     | F      | P    |
| Jitter    | 1.33   | 0.24   | 5.43         | 0.02* | 0.03   | 0.85 |
| Shimmer   | 3.35   | 0.06   | 3.58         | 0.06  | 0.04   | 0.83 |
| NNE       | 16.51  | 0.00** | 0.34         | 0.55  | 0.78   | 0.38 |
| SDF0      | 0.64   | 0.04*  | 5.60         | 0.02* | 3.10   | 0.08 |

Note: \*\*-  $p < 0.01$ , \*-  $p < 0.05$

## **Periodic prevalence**

The periodic prevalence was calculated by using voice quality estimates. Subjects who scored grand total of 5 and above were labeled as deviant voices. Of the 320 subjects who participated in the study from Yemmiganur town in Andhra Pradesh, 71 subjects had deviant voices and the periodic prevalence was estimated as 22% in the given population. Among the 71 subjects identified with deviant voices, 51% were males and 49% were females. When periodic prevalence was calculated for deviant voices and school setup it was found that 42% of them were from government and 57% was from private setup.

Earlier studies reported by Duff, Proctor and Yairi (2003) found a prevalence of 3.9% among a total of 2445 children. Carding et.al, (2006) reported clinicians identified a dysphonia prevalence of 6% compared with a parental report of 11% and Mckinnon et. al., (2007) found it to be 1.51% for a total population of 10,425. Balakrishnan (1969) reported 3.8% of their population had dysphonias. Mittal et. al., (1977) found voice defects in 10% for a total population of 327.

All the above mentioned studies used perceptual analysis and the ratings were done by teachers /investigators, student trainees of Speech Language Pathology.

The results of the present study found a prevalence of 22% for a population of 320 subjects which is high when compared to results reported in literature. This could be because of fact that acoustic analysis was carried out for the study. Acoustic analysis is an objective procedure which was quantitative in nature when compared to earlier studies where in perceptual analysis was carried out to calculate prevalence.

In the present study the prevalence was found to be more in males compared to females. Mckinnon, Mcleod, Reilly (2007) reported 0.12% higher prevalence in males when compared to females which is in consonance with present findings. But Manohar

& Jayaram (1973) reported 46% of boys and 73.47% of girls had dysphonia. This difference in the prevalence of voice disorder in children with gender as a factor could be due to the differences in the methodology considered between the two studies. In the present study the prevalence was calculated based on acoustic analysis, while Manohar and Jayaram (1973) used perceptual analysis by student SLPs. This could also be the reason for the higher prevalence reported in the present study.

Increased prevalence for the private school setup compared to government as reported in the present study could be because of vocal demands from parents and teachers on the children could be more in private school setup compared to government school setup. In addition to the differences in the type of analysis for calculating prevalence, the higher percentage of prevalence reported in the present study could be due to high sensitivity of the software used for analysis. The presence of background noise while recording could have also contributed to the higher prevalence seen in this study.

### **Correlation between qualitative and quantitative analysis**

Table 7: depicts the correlation between voice quality estimates and domains of FIVP. It showed that the correlation between voice quality estimates and all the domains of questionnaire were not significant ( $p \geq 0.05$ ).

*Table 7: correlation of voice quality estimates with questionnaire*

| Domains                         | Voice quality estimates |      |           |      |             |      |
|---------------------------------|-------------------------|------|-----------|------|-------------|------|
|                                 | Hoarseness              |      | Harshness |      | Breathiness |      |
|                                 | R                       | p    | R         | p    | R           | P    |
| Vocal abusive behaviors         | 0.141                   | 0.24 | 0.05      | 0.62 | 0.15        | 0.20 |
| Reactions of significant others | 0.184                   | 0.12 | 0.13      | 0.25 | 0.12        | 0.29 |
| Voice related symptoms          | 0.004                   | 0.97 | 0.08      | 0.48 | 0.013       | 0.91 |
| Diet habits influencing voice   | -0.019                  | 0.87 | -0.112    | 0.35 | -0.04       | 0.71 |

This might be due to following reasons,

Firstly, the coordination between respiratory and phonatory systems is not well developed in children. Hirano, Kurita, Nakashima (1980) reported that anatomical changes that occur in prepubescent years might impact the acoustic measures. Also, dramatic changes in the inner structures of the vocal folds occur in early childhood. The vocal fold structure of four-year-olds has a thicker mucosal layer than that in adults. Also, the vocal ligament is immature. The lamina propria is undifferentiated between collagen and elastic fibers (intermediate and deep layers) and this differentiation does not occur until 10 years of age. So, one might predict that these histological differences of the vocal fold in children would result in differences in the mechanical properties of the larynx. In addition to the above mentioned reasons, the back ground noise at the time of recording, and the addition of slight noise during the conversion of samples could have attributed to the increased noise component in the samples which in turn might have resulted in higher prevalence of deviant voice when acoustic analysis was considered.

Secondly, the respondents' educational status, cultural background, and lifestyle could have also contributed. Also, lack of awareness about the FIVPs might have also contributed to voice problems.

Moreover the extent of effect of these factors on voice can vary depending on frequency and extent of occurrence of these factors. It also depends on the child's immune system and other factors related to the child health as some of children may be more prone immediately after 2 or 3 episodes of vocal abuse while some might be developing voice problem only after continuous usage of voice.

Finally communication is usually conveyed using speech. Phonation is noted to be difficult to sustain than speech. Hence it was found difficult for the children to phonate accurately even after repeated trials. Factors such as excess mouth opening, aspirated phonation, expelling of saliva during phonation may influence the quantitative measures of voice.

## CHAPTER 5

### SUMMARY AND CONCLUSION

The aim of the present study was to find out the prevalence of voice problems among preschoolers in Yemmiganur town of Andhra Pradesh. 320 subjects were grouped equally into 2 subgroups 3.5-4.5 and 4.5-5.5 years from anganwadis and private schools randomly.

The study involved two phases, qualitative and quantitative assessment. For qualitative assessment the questionnaire called Functional Indicators of Voice Problems (FIVP) was constructed which had 20 questions, grouped into 4 major domains. The parents and teachers of subjects responded to questionnaire. The responses were tabulated and subjected to statistical analysis to find the association effects of the different domains in the questionnaire across groups, gender, and school setup.

Results in general indicated that there was no positive significant association between the domains of FIVP questionnaire and the subject group.

But a positive association was obtained for one of the domains, namely “reaction of significant others” with gender. The respondents indicated females to be more talkative, noticed tiredness in their voice when they spoke continuously for short duration and were perceived to have rough voice when compared to males. This may be because of characteristic nature of females and they are more interested in social relationships although boys had more vocally abusive behaviors owing to their play behaviors.

The association between responses for FIVP domains and school setup revealed that responses for all the domains were significantly higher for subjects from



private setup. This could be due to factors related to the respondents' educational status and socio-economic status, awareness about factors influencing voice.

Quantitative assessment included acoustic analysis of phonation samples. Voice quality parameters and estimates were extracted from the phonation samples. The results of quantitative assessment revealed that all voice quality parameters showed increased trend for older children. However significant difference was found only for the parameter NNE.

The voice quality parameters did not show any significant differences across gender indicating that both males and females subjects obtained similar values. Voice quality characteristic were similar which is expected as the voice characteristics are same in boys and girls before onset of puberty.

The periodic prevalence was calculated by using voice quality estimates. Subjects who scored grand total of 5 and above were labeled as deviant voices. Of the 320 subjects children who participated in the study from Yemmiganur town in Andhra Pradesh, 71 children were identified to have deviant voices and the periodic prevalence was estimated as 22%. Among the 71 subjects identified with deviant voices, 51% were males and 49% were females. When periodic prevalence was checked for deviant voices across school setup, it was found that 42% of these subjects were from government and 57% were from private setup.

An increased prevalence percent in the present study might be because of methodological differences. Here, quantitative assessment was used as an indicator for deviant voice. But most of the studies in review were based on perceptual analysis, which is considered as a qualitative analysis procedure.

Statistical correlation between the qualitative and quantitative assessment, i.e., domains of FIVP and voice quality estimates were negative indicating that functional

indicators of voice problems did not show a relationship with any parameters of voice quality. This might be due to anatomical and physiological factors related to tolerance and sustenance of vocal demands on a regular basis.

Results of the present study cannot be generalized owing to small sample size. Large number of subjects could not be considered due to the time constraints.

Further research in this area may consider a long term study including larger population and check for differences in identification of Functional Indicators Voice Problems by teachers and parents.

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## Appendix

### Functional Indicators of Voice Problems

పాప/బాబు పేరు: \_\_\_\_\_ వయస్సు \_\_\_\_\_

పుట్టినతేదీ \_\_\_\_\_

క్రింద ఉన్న లక్షణాలు పాప/బాబు లో ఉంటే అవును అని లేకుంటే లేదు అని టిక్కు పెట్టండి

| నెం :                                  | గొంతుకి సంబంధించిన సమస్యల లక్షణాలు తెలిపే సూచనలు  | అవును | లేదు |
|--|---|-------|------|
| <b>Domain 1</b>                        |   |       |      |
| <b>Vocal abusive behaviors</b>         |   |       |      |
| 1                                      | పాప/బాబు ఆడుకునేటప్పుడు తరుచుగా గట్టిగా అరవడం చేస్తారా?                                 |       |      |
| 2                                      | పాప/బాబు తరుచుగా వాహనాల శబ్దాలను/జంతువుల శబ్దాలను/టి.వి లోవచ్చేవి గాని అనుకరిస్తుంటారా? |       |      |
| 3                                      | చుట్టుప్రక్కల ఎక్కువగా శబ్దాలు ఉన్నప్పుడు పాప/బాబు మాటలు వినిపిస్తాయా?                  |       |      |
| 4                                      | పాప/బాబు తరుచుగా ఇంట్లో/స్కూల్ లో గట్టిగా మాట్లాడతారా?                                  |       |      |
| 5                                      | పాప/బాబు దూరంగా ఉన్నవాళ్ళతో గట్టిగా అరిచిమాట్లాడతారా?                                   |       |      |
| 6                                      | పాప/బాబు తరుచుగా దగ్గడం/ గొంతు సవరించుకోవడం వంటివి చేస్తారా?                            |       |      |
| 7                                      | పాప/బాబు ఎక్కువగా గుసగుసలాడడం చేస్తుంటారా?  |       |      |
| 8                                      | పాప/బాబు మాటలు వినిపించడానికి గట్టిగా అరచి /కష్టంగా మట్లాడాల్సివస్తుందా?                |       |      |
| <b>Domain 2</b>                        |   |       |      |
| <b>Reactions of Significant Others</b> |   |       |      |
| 9                                      | పాప/బాబు ఎక్కువగా మాట్లాడతారా?  |       |      |
| 10                                     | పాప/బాబు కొద్దిసేపు మాట్లాడగానే స్వరం అలసటగా/బొంగురుగా అనిపిస్తుందా?                    |       |      |
| 11                                     | పాప/బాబు స్వరం ఎల్లప్పుడు ముక్కుతోమాట్లాడుతున్నట్టు/ముక్కుమూసుకున్నట్టు అనిపిస్తుందా?   |       |      |
| 12                                     | పాప/బాబు స్వరం వినసాంపుగా లేనట్టు అనిపిస్తుందా?   |       |      |
| <b>Domain 3</b>                        |   |       |      |
| <b>Voice related symptoms</b>          |   |       |      |
| 13                                     | పాప/బాబు మాట్లాడేటప్పుడు ఎగవూపిరి తీసుకుంటారని అనిపిస్తుందా?                            |       |      |
| 14                                     | పాప/బాబు కి తరుచుగా జలుబు/ముక్కుకారడం/ముక్కుమూసుకుపోవడం/తుమ్ములతోబాధప                   |       |      |

|   |   |  |  |
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|   | డుతుంటారా?  |  |  |
| 15  | పాప/బాబు గొంతునొప్పి/గొంతులోగరగర/గొంతులోమంటగా ఉంటుదని చెప్పారా?                     |  |  |
| 16  | పాప/బాబు కి అన్నం తినేటప్పుడు/ నీళ్ళు త్రాగేటప్పుడు సమస్యలు ఉన్నాయా?                |  |  |
| 17  | పాప/బాబు కు దుమ్ము/ధూళి, పొగమంచు లేదా ఇతరవస్తువుల వల్ల అలర్జిలకు గురవుతుంటారా?      |  |  |
| <b>Domain 4 Diet habits influencing voice</b> |   |  |  |
| 18  | పాప/బాబు రోజుకి సరిపడినంత నీళ్ళు తాగుతారా?  |  |  |
| 19  | పాప/బాబు ఎక్కువగా చిరుతిండ్లు(పాలతో చేసినవి, నునెలో వేయించినవి,మసాలాలు)తింటారా?     |  |  |
| 20  | పాప/బాబు తరుచుగా కాఫీ/టీ(రెండుకప్పులకన్న ఎక్కువగా)/కూల్ డ్రింక్స్ లాంటివి తాగుతారా? |  |  |