

Type of Study: Original Research

An Estimation of Blood Glucose Level in Children with Early Childhood Caries- A Retrospective Study

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Abstract

ECC is one of the most common oral conditions seen in children. It is primarily seen on the central incisors in the form of a white spot, which later spreads to the posterior teeth as well. This is a serious concern for the biological and the social life of a child. Treatment of this condition is also expensive making it difficult for the economically backward to avail treatment. It has a lot of etiological factors including diet, socio economic status and poor oral hygiene. It is a condition seen in children below the age of 6. The aim of this study is to find the level of blood glucose in children with early childhood caries and to evaluate whether there are any abnormalities in blood glucose level compared to normal reference level. A retrospective descriptive study was conducted using patient records of a university dental hospital in Chennai from June 2019-March 2020 among patients diagnosed with ECC who had their blood sample taken and their blood glucose levels recorded. Descriptive statistical tests were employed. Point biserial correlation analysis was done to find out the relationship between blood glucose levels in boys and girls with ECC. ECC was most prevalent in the age group of 3 and the mean blood glucose of the participants was found to be 88.22 mg/dl. There was no significant correlation or difference in the mean blood glucose level of males and females with ECC (Point biserial correlation coefficient=0.07). Based on the results, there were no abnormalities in blood glucose values of children with ECC.

Keywords: *Early childhood caries, Children, Caries, Blood glucose, Relationship.*

Introduction

The primary aim of pediatric dentistry is to preserve the primary teeth since it acts as a natural space maintainer to guide the eruption of permanent teeth ^{1,2}. This becomes challenging due to the high prevalence of trauma between the age of 2 and 4 ³, presence of

other biological conditions ⁴ and due to diseases like Early Childhood caries(ECC), which is one of the most common diseases of the oral cavity in children. It is also a major oral health condition, especially in socially backward populations. ⁵ Its widespread nature and expensive cure makes it a difficult problem to deal with. The condition is also known as nursing bottle caries, it is the presence of one or more decayed, missing or filled tooth surfaces in any primary tooth in preschool children between birth and 71 months of age. It usually begins as a white spot lesion in the upper primary incisors and then spreads as the caries starts to set in. Information relating to the non cavitated carious lesions in young children is very important as it provides additional components of understanding problems of caries in toddlers. ⁶

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In the early phase, ECC is recognized as a dull, demineralised enamel which advances rapidly to full

blown decay along the gingival margin.⁷ It can be seen either on the labial side, the lingual side or both (depending upon the factors which lead to the evolution of caries). It is primarily seen in school children between the age of 2-5, sometimes extending till 8 years. Various studies conducted all across the globe show the highest prevalence in Africa and SouthEast Asia.⁸ In India, the state with the highest prevalence was found to be Andhra Pradesh at 64%.⁹ and the lowest prevalence was found in Sikkim at 41.92%

The etiology of ECC is varied and is well established. Some of the factors include, poor oral hygiene,¹⁰ carbohydrate rich diet,¹¹ microflora, incorrect feeding habits [hence known as nursing bottle caries] and biological anomalies (eg. High frenal attachment¹²). When microflora is concerned streptococcus mutans and streptococcus sobrinus were found in high association with ECC¹³. But, very few studies were found which tested the relation of glucose level in children and ECC. All the articles found regarding this topic were from the early 20th century¹⁴. Studies showed a positive relation between carbohydrates and a fat rich diet and the incidence of Early Childhood Caries.¹⁵ Fluoride levels in the oral cavity also dictate the presence of carious lesions in children.^{16,17}

A cause of the initiation of ECC could be lipid peroxidation, which has been known to cause alterations in the structure and function of the host cells by producing malondialdehyde (MDA) as the byproduct. This along with cell damage in the host tissue affects the immune mechanism in saliva, leading to initiation and progression of dental caries.¹⁸ A study by Subramanyam et al showed an increase in the MDA levels of the patients with ECC in children below the age of 6 in Chennai.¹⁹

Since increased carbohydrate consumption is the main etiology of ECC, a question arises whether there can be any increase in the average blood glucose level of children with ECC. The increased glucose in the blood may lead to more potential cariogenic property and it may lead to the teeth providing more substrate for the microbes to feast on, leading to their uncontrolled multiplication and formation of caries via demineralisation of the enamel. The aim of this study is to find the level of blood glucose in children with early childhood caries and to evaluate whether there are

any abnormalities in blood glucose level compared to normal reference level.

Materials and Method

Study Design and Setting

This descriptive study examined the records of patients from June 2019-March 2020 undergoing treatment at a University Dental College in Chennai. The records were collected from the hospital's record database. Ethical approval was obtained from the Institutional Ethical Review Board (Approval number 0619-0320). The study population included children under the age of 6 who visited the Department of Pediatric Dentistry, underwent blood test and treatment under general anesthesia by means of simple random sampling. Children with any systemic conditions were excluded from the study.

Data Collection

Out of the patient records of the 1557 0-6 year old patients who visited the hospital between June 2019 to March 2020, 122 patient's records undergoing treatment for ECC were analysed. Relevant data such as patient age, gender, RBS recorded at the time of visit were recorded. Repeated and incomplete patient records were excluded from the study to prevent possibility of bias. Data was verified by an external reviewer.

Statistical Analysis

Data was recorded in Microsoft Excel 2016 (Microsoft Office 10) and later exported to the Statistical Package for Social Science for Windows (Version 20.0, SPSS Inc., Chicago, Illinois, USA) and subjected to statistical analysis. Descriptive statistical tests were employed. Point biserial correlation analysis was done to find out the relationship between blood glucose levels in boys and girls with ECC.

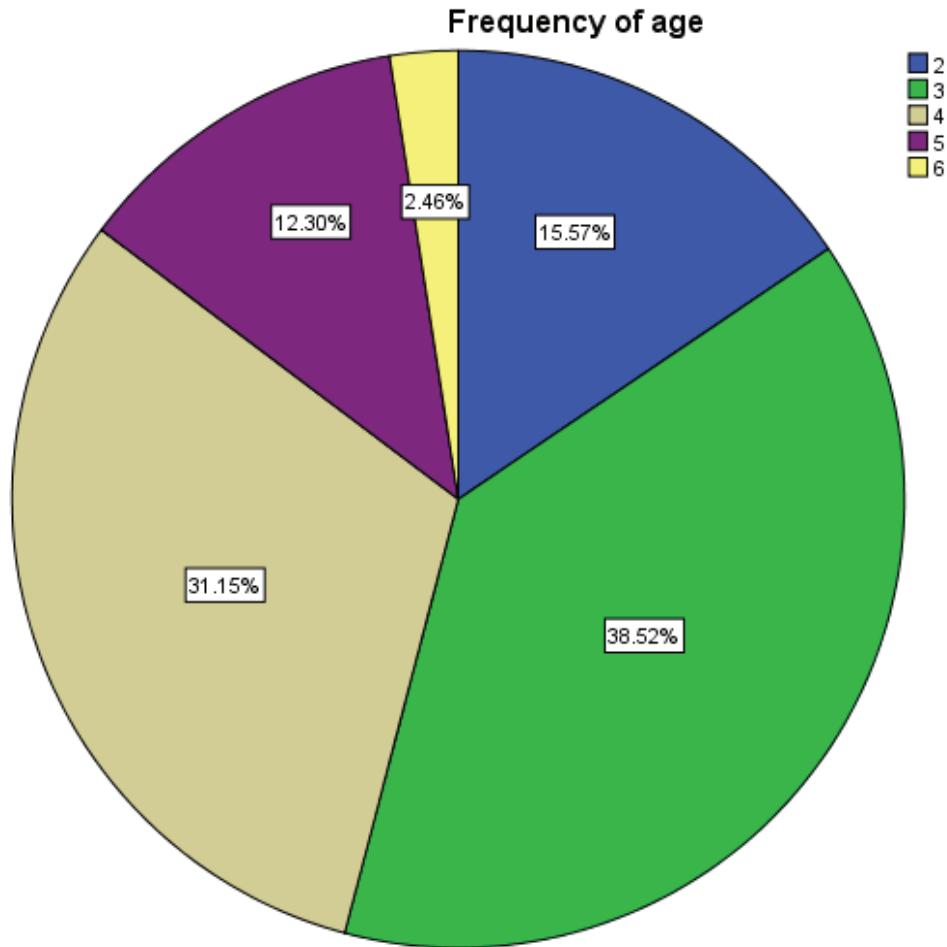
Results and Discussion

The final data set consisted of 122 patients of Indian origin who underwent treatment under general anesthesia. The mean age for children with ECC treatment was 3.48 years \pm 0.981 years. The age group associated with the greatest prevalence of ECC was 3 years [38.52%], followed by 4 years [31.5%]. The prevalence of ECC among 2 year old children was found

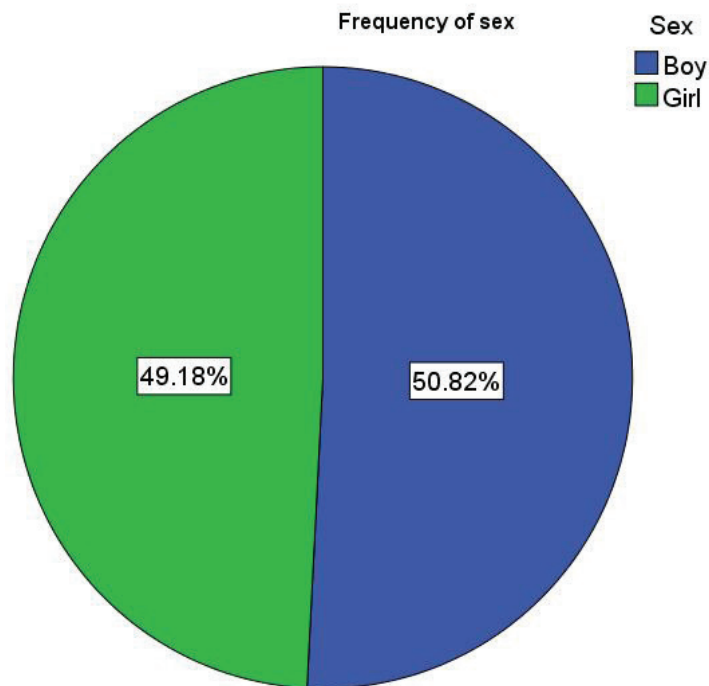
to be 15.1%. [Graph 1]

50.8% of the participants were male and 49.2% were female.[Graph 2] 54.8% of the participants in the 0-3 age groups were male showing a male dominance, although the differences between the gender were not statistically significant. The mean blood glucose level of the male participants was 87.6 mg/dl [Graph 3] and the mean blood glucose level of the female participants was 88.87 mg/dl [Graph 4].

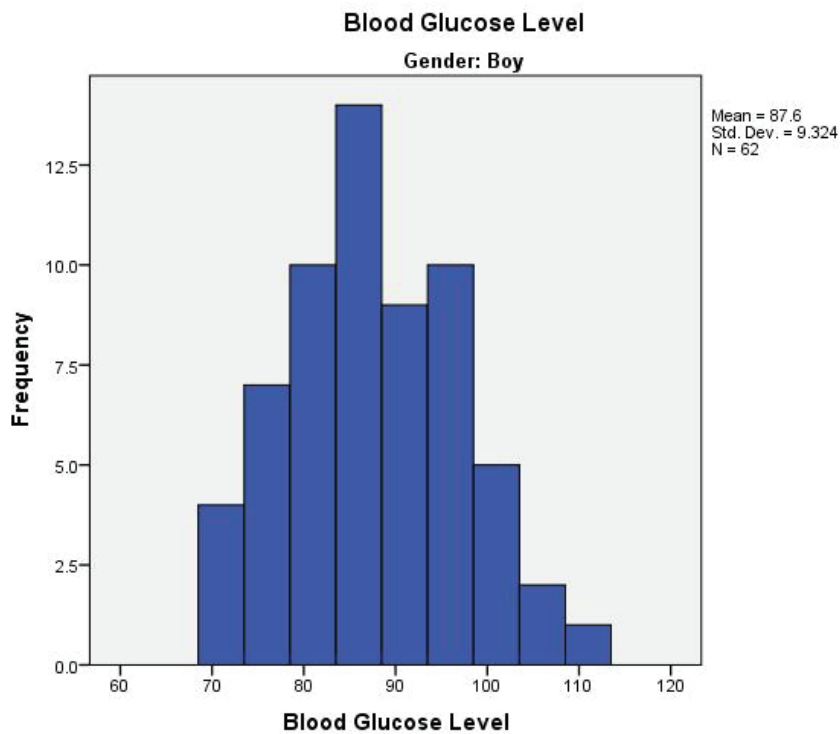
The mean blood glucose level was found to be 88.22 mg/dl in the total population. It was found that 10% of the study population had a blood glucose above 100g/dl. [Graph 5]. Point biserial correlation coefficient was elicited and value was found to be .07 (close to zero) suggesting no relationship/correlation between blood glucose levels of boys and girls with ECC.[Graph 6]



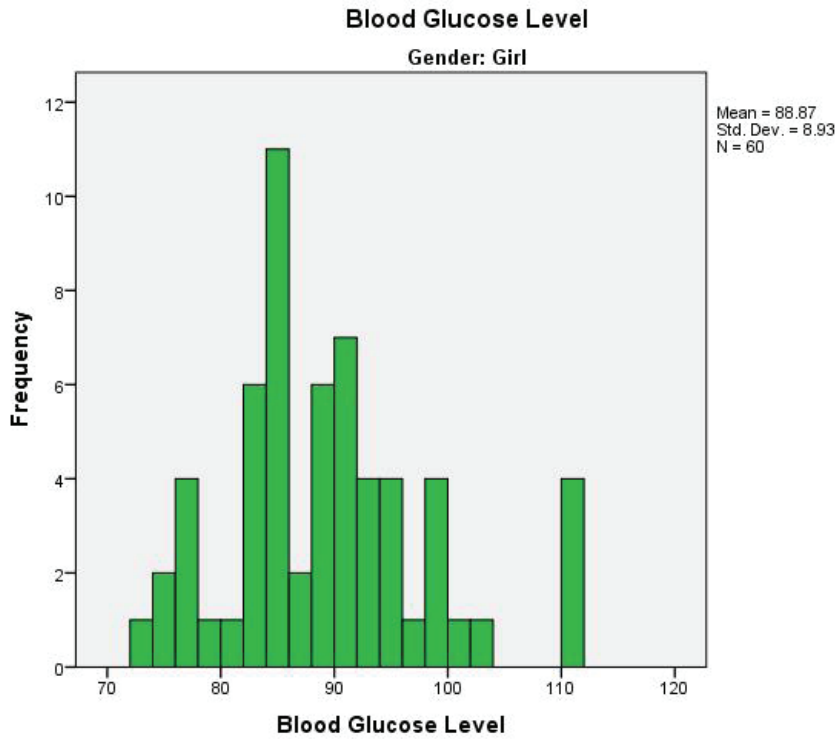
Graph 1: Pie chart representing frequency distribution of age of study population. Blue represents the frequency of 2 year olds, green represents frequency of 3 years olds, beige represents the frequency of 4 year olds, purple represents the frequency of 5 year olds and yellow represents the frequency of 6 year olds. 38.52% of the participants were 3 years old, 31.15% were 4 years old, 15.17 were 2 years old, 12.30 were 5 years old and 2.46% were 6 years old.



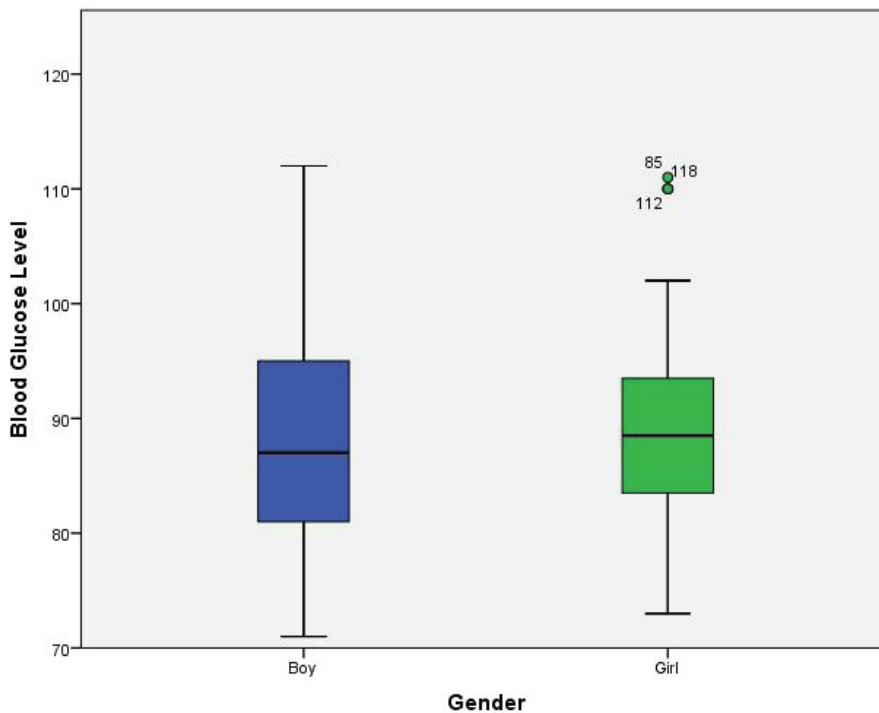
Graph 2: Pie chart representing frequency of gender of population who underwent treatment under general anesthesia. Blue represents the participants who were boys and green represents the participants who were girls. 50.82% of the participants were boys and 49.18 were girls.



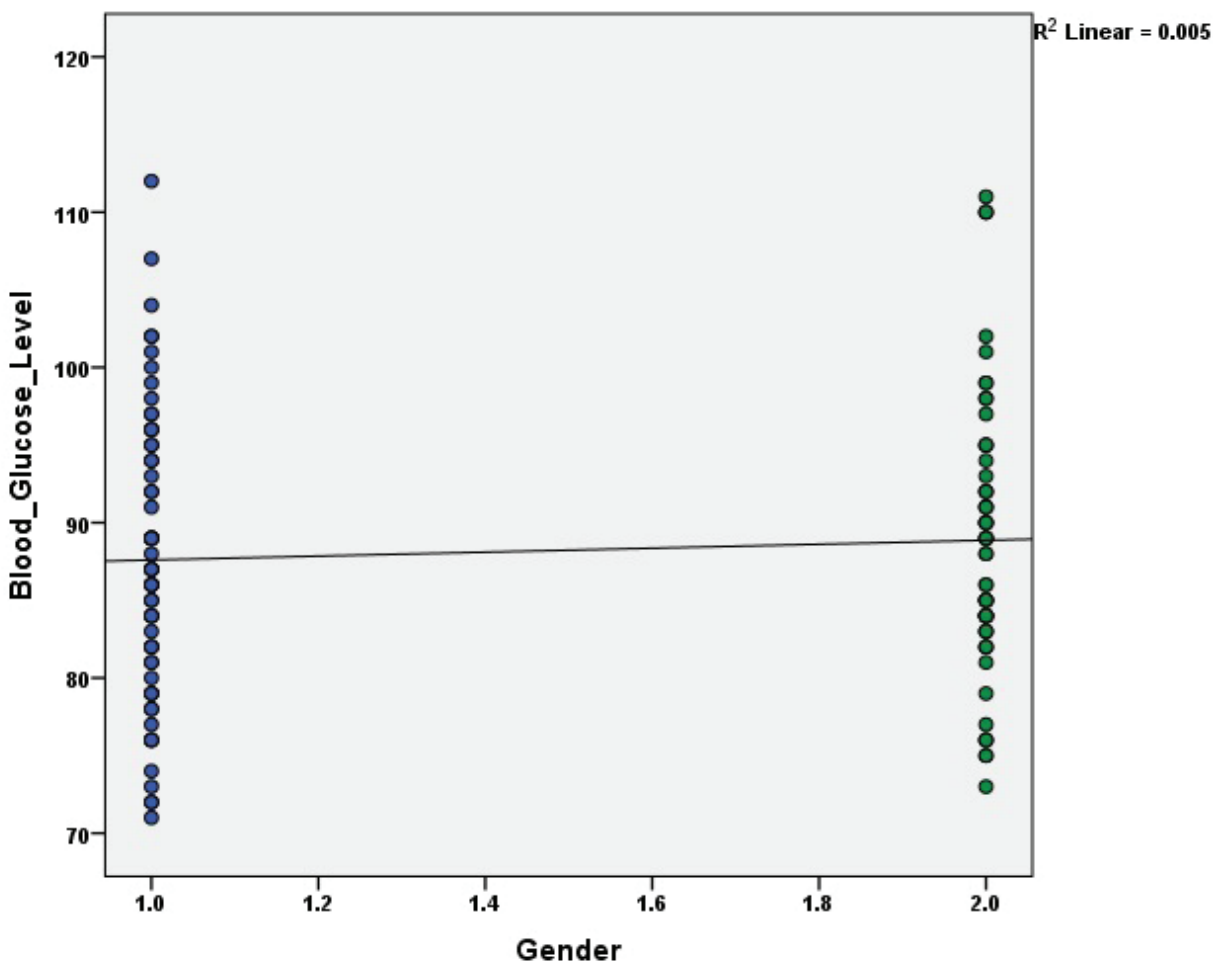
Graph 3: Histogram depicting Frequency of different blood glucose levels in boys. The mean blood glucose level was found to be 87.6 ± 9.324 mg/dl.



Graph 4: Histogram depicting Frequency different blood glucose level in girls. The mean blood glucose level was found to be 88.87 ± 8.93 mg/dl.



Graph 5: Box plot depicting the Correlation between blood glucose levels and gender. X axis represents the different genders of the participants of the study and the Y axis represents the blood glucose level of participants. There was no difference in blood glucose levels between boys and girls with ECC. Point biserial correlation coefficient was elicited and value was found to be .07 (close to zero) suggesting no relationship/ correlation between blood glucose levels of boys and girls with ECC.



Graph 6: Scatter plot depicting the Correlation between blood glucose levels and gender. X axis represents the different genders of the participants of the study and the Y axis represents the blood glucose level of participants. There was no difference in blood glucose levels between boys and girls with ECC. Point biserial correlation coefficient was elicited and value was found to be .07 (close to zero) suggesting no relationship/correlation between blood glucose levels of boys and girls with ECC.

A study done by Rudesil et al showed the normal value of blood glucose level in children to be between 60 to 100 mg/dl¹⁴. The data for this retrospective study was based on residents of Chennai seeking treatment at a university hospital in Chennai. Currently, there are no existing studies investigating the relation of blood glucose level to incidence of ECC. Since all data was included without a sorting process, no bias was expected in selection of patients. The current study aimed to

assess whether any variation in the blood glucose levels existed in ECC patients.

A study done by Bansal et al showed a strong association of anemia with ECC due to iron deficiency²⁰ Ling et al also showed a similar result in one of his studies²¹ where he showed a correlation between ECC and atherosclerosis. These associations show that there can be systemic manifestations as a result of ECC.

Diet has been shown as one of the most consistent etiological factors in ECC. A study done by Hu et al showed a positive correlation between dietary patterns and ECC showing that diet plays an important factor in determination of the spread of ECC.²² Due to the major role played by carbohydrate rich diet in etiology, the estimation of blood glucose levels and any variations can be suspected, hence this study was conducted.

Usually, pulpectomy is done for the treatment of caries which involve the pulp.^{23,24} A survey showed 50% of its participants to be using rotary instruments while doing a pulpectomy.²⁵ A study showed ProTaper rotary files had significantly less instrumentation time when compared to other instrumentation methods.²⁶ However a study by Lakshmanan et al showed that the Kedo-S rotary system provided the best quality of root canal filling in the shortest instrumentation time.²⁷

The extent of ECC in children can also be due to increased neglect of dental care. A study done by Gurunathan et al, showed that there was a higher dental neglect score in people with secondary education.²⁸ This could lead to decreased awareness on the importance of oral health, especially in childhood. Proper care should be taken during the development of dentition to prevent oral hygiene issues. This includes brushing regularly, rinsing the mouth after every meal and having regular dental checkups. A study by Govindaraju et al showed chewable toothbrushes to be a good alternative for pediatric patients.²⁹ Studies like these show different methods to appeal to the psychology of a child to satisfy him while making sure that his oral hygiene is maintained.

Since the consumption of glucose in excess leads to increased glucose in the blood over a short period of time, it may be possible to see a link between blood glucose level and ECC. But it will not be possible in this study as there was no normal control group to compare it with i.e the blood of children who do not have ECC was not taken due to ethical reasons. Studies by Watson et al showed the mean glucose level of children before they underwent surgery to be 100 mg/dl. Since articles comparing blood glucose levels of diseased children are very few and are old, no conclusion can be drawn based only on data on one group. However, our study showed that more than 10% of the children had blood glucose levels above 100mg/dl. This may be a reason for concern and also a predictor for future type 2 Diabetes in children when they grow into adults. Unless and until longitudinal studies which follow up children till adulthood and probing their diabetic status are done we won't be getting conclusive evidence.

Furthermore, the limited inclusivity of the population of this study considering its focus only on

residents of Chennai could have played a part in the results acquired. A future study showing the correlation of blood glucose levels of children with ECC and a control group with normal children without ECC might yield more prominent results.

Conclusion

Within the limitations of this study, it was found the patients with ECC had blood glucose levels within the normal limits($p>0.05$) with a mean value of 88 mg/dl, however 10% of the study population had an RBS value 100mg/dl which can be a risk factor for future diabetes. [Figure 6] A clear association if present can only be established with further longitudinal studies.

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Conflict of Interest: None Declared

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Ethical Clearance: It is taken from "Saveetha Institute Human Ethical Committee" (Ethical Approval Number- SDC/SIHEC/2020/DIASDATA/0619-0320)

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