"FLUORIDE CONCENTRATION OF DRINKING WATER AND ITS ASSOCIATION WITH INTELLIGENCE QUOTIENT AMONG 12-15 YEARS OLD GOVERNMENT SCHOOL CHILDREN IN BELAGAVI DISTRICT – A CROSS SECTIONAL STUDY"

By
DR. DEEPIKA. V
REGISTRATION NO: IL0219002

Dissertation

Submitted to
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In partial fulfillment
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IN

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(BRANCH – VII)

Under Guidance of
DR. ROOPALI. M. SANKESHWARI M.D.S, Ph.D
Reader

DEPARTMENT OF PUBLIC HEALTH DENTISTRY
KLE VISHWANATH KATTI INSTITUTE OF DENTAL SCIENCES
KAHER, BELAGAVI, KARNATAKA
MAY – 2022

KLE Academy of Higher Education & Research, Belagavi Karnataka

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Date : 4/1/2022

Place : Belgaum

Dr. DEEPIKA. V

KLE Academy of Higher Education & Research, Belagavi
Karnataka

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Date : 4/1/22

Place: Belgaum.

Dr. ROOPALI. M. SANKESHWARI M.D.S. Ph.D
Reader
Department of Public Health Dentistry,
KLE Vishwanath Katti
Institute of Dental Sciences,
Belgaum-590010.

KLE Academy of Higher Education & Research, Belagavi

Karnataka

ENDORSEMENT BY THE HEAD OF DEPARTMENT, PRINCIPAL OF THE INSTITUTION

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Dr. ANIL. V. ANKOLA M.D.S.
Professor and Head,
Department of Public Health Dentistry,
KLE Vishwanath Katti
Institute of Dental Sciences,
Belgaum-590010.

Date : 4/1/2022
Place : Belgaum

Professor and Head
Dept. of Public Health Dentistry
K.L.E. VK. Institute of Dental Sciences
Nehru Nagar, Belgaum-10

Dr. ALKA KALE M. D.S.
Principal,
KLE Vishwanath Katti
Institute of Dental Sciences,
Belgaum-590010

PRINCIPAL
KLE V. K. Institute of Dental Sciences
Nehru Nagar, Belagavi

Date : 4/1/2022
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Date : 4/1/22

Place : Belgaum.

Dr. DEEPIKA. V

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KLE VK Institute of Dental Sciences

A Constituent Unit of KLE Academy of Higher Education and Research
(Deemed-to-be-University u/s 3 of the UGC Act, 1956)
Nehru Nagar, Belagavi - 590 010, Karnataka State

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☎: 0831-2470362 **Web: http://www.kledental-bgm.edu.in**
FAX: 0831-2470640 **E-mail:principal@kledental-bgm.edu.in**

Date : 3.1.2022 **Serial No. :** 095

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UG / PG / Ph.D / Staff : POSTGRADUATE
Batch & Year : 2019-22
Department : PUBLIC HEALTH DENTISTRY

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KAHER - Belagavi

BIOSTATISTICIAN REPORT

KLE V.K. Institute of Dental Sciences
(A Constituent unit of KLE Academy of Higher Education & Research
Deemed-to-be-University u/s 3 of the UGC Act, 1956)
Nehru Nagar, Belagavi-590 010 INDIA
Re-Accredited 'A' grade by NAAC (2nd Cycle) & Placed in Category 'A' by MHRD (GoI)
0831-2470362
FAX: 0831-2470640
Web: http://www.kledental-bgm.edu.in
E-mail: principal@kledental-bgm.edu.in

Biostatistics Clearance Certificate

This is to certify that the Biostatistics aspect of the Dissertation / Research work of **Dr. Deepika. V, Post Graduate Student**, under the guidance of **Dr. Roopali M Sankeshwari, M.D.S, PhD Reader, Department of Public Health Dentistry**, entitled **"Fluoride concentration of drinking water and its association with intelligence quotient among 12-15 years old Government school children in Belagavi district – A cross sectional study"** has been done under my guidance and considered satisfactory.

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Dedicated

To

My Beloved Parents

And My

Adorable Sister

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A task undertaken cannot reach its destined culmination without the divine grace of the almighty. A silent prayer to pledge my faith and allegiance to the One, whose aura has lifted me high on the wave of achievement and engulfed me completely in moments of distress.

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I am thankful to all my ***seniors*** *and* ***juniors****, for their moral support, co-operation and help whenever I needed it. A special note of thanks to my friends****, Dr. Atrey Pai Khot, Dr. Ram Surath Kumar, Dr. Mehul Shah*** *for always being there for me.*

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Thank you, one and all.

Date :

Place : Belgaum.

Dr. Deepika V

LIST OF ABBREVIATION

DFI	Dean's Fluorosis Index
df	Degree of freedom
DMFT	Decayed Missing Filled Teeth
F	Fluoride
HS	Highly Signifiant
L	Liter
mg	Milligram
N/n	Number of subjects (frequency)
NS	Not significant
OHIS	Oral Hygiene Index - Simplified
ppm	Parts per million
SD	Standard Deviation
S	Significant
Sq. Km	Square Kilometers
SPSS	Statistical Package for the Social Sciences
WHO	World Health Organization
$\overline{X}$	Mean
χ^2	Chi-Square

ABSTRACT

Introduction: Fluoride, as an essential trace element in the body, can help prevent dental caries and is favourable to bone metabolism. Long-term exposure to fluoride increases the risk of dental and skeletal fluorosis. It also impedes neural development, by affecting gene and protein expression and enzyme activity. According to some research, fluoride can cause changes in the physical structure and biochemistry of the brain, affecting children's mental development during cognitive functions such as learning and memory, particularly during the foetal period and the first eight years of life

Aim of the study: To assess the relationship between water fluoride level and IQ of 12-15 years old Government school children residing in areas with different concentration of fluoride in drinking water in Belagavi district, Karnataka.

Methodology: The present cross-sectional study was conducted from the month of June 2021 to September 2021. Study population consisted of 12-15 years old Government school children of Belagavi district residing in areas with different concentration of fluoride in drinking water.

Sample size was estimated using the mean difference and standard deviation of previous studies and arrived at, n = 394 for the two groups (197 in each group). Ethical approval and permissions were taken from the respective authorities. A pilot study was conducted among 20 students to assess the comprehension and validity of the questionnaire and feasibility of the study. Information on fluoride levels of drinking water was obtained from the documented records of the office of the Ground water sanitation and from the study reports of India water portal organization. The entire district was divided into two zones i.e. medium fluoride level (>1.2ppm) and

low fluoride level (<1.2ppm) based on the records. Five schools were randomly selected from the two zones and water samples were collected. The collected samples were subjected to analysis according to BIS 3025-SPADNS specifications using Acid–zirconyl-SPADNS reagent and Spectrophotometer. The intelligence quotient of the study participants were assessed using Raven's questionnaire. Clinical examination was carried out to record DMFT index, OHIS index, details regarding trauma (Ellis and Davey's classification of tooth fracture), malocclusion (Angle's classification), dental anomalies and Dean's fluorosis index.

The collected data was entered in Microsoft excel and Statistical analysis was done using SPSS package (Ver. 26; Raleigh, NC, USA). The results for continuous variable were given as frequencies, standard deviations and mean values (Quantitative data). Differences between the groups were assessed by the Chi-square test. Relation between fluoride levels and intelligence quotient was assessed by simple linear regression. P value <0.05 was considered to be significant.

Results: Among 540 study subjects; 389 (72.0%) belonged to low fluoride level (<1.2 ppm) and 151 (28%) subjects belonged to medium fluoride level (>1.2 ppm). Out of 540 participants, 26(4.8%) were belonged to "intellectually superior" category, 97(18%) were having "definitely above average" IQ, 265(49.1%) were belonged to "average" category, 107(19.8%) of the participants belonged to "below average category" and 45(8.3%) of the subjects were belonged to "intellectually impaired" category. There was a significant difference found between water fluoride levels and Raven's score (p<0.0002). From the regression analysis it was found that for every unit change in water fluoride level, the average change in mean of IQ score is about -10.571 units. Prevalence of dental fluorosis in low water fluoride level was 8.74% and

medium level was 43.04%. Prevalence of dental caries of study participants was found to be 51.4%.

Discussion: The current study result is in line with the findings of a study conducted by Trivedi et al, which revealed that fluoride level and IQ of school children were inversely proportional. The prevalence of fluorosis in children residing in low fluoride area (<1.2ppm) was 18.33%, which was consistent with the finding by WHO that 20% of the population residing in low fluoride level areas had manifestations of fluorosis. Oral hygiene has been identified as an incidental factor in the development of dental caries and periodontal disorders among lower IQ persons, according to a study conducted by Kothari et al. However the current study results show a contrasting results to above mentioned study, where children with low IQ had good oral hygiene.

Conclusion: The maximum ravens score was found to be 30 out of 36 and the minimum score was 6. The mean score was found to be 19.37 with standard deviation 4.55. Among 540 subjects, 22.2% of the students scored below average score. 8.3% students score above 95^{th} percentile. There was a significant association between water fluoride level and intelligence quotient of school children. For every unit change in water fluoride level, the average change in mean of IQ score was found to be -10.571 units. A significant association was found between dental fluorosis and water fluoride level. Prevalence of fluorosis in low water fluoride level was found to be 8.74% and medium level was found to be 43.04%. The mean DMFT of the study population was 4.11+-1.37. The range of DMFT score varied from 1-8.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF GRAPHS

LIST OF PHOTOGRAPHS

INTRODUCTION

Fluorine is the 13th most prevalent element on the planet, accounting for 0.08 percent of the Earth's crust.[1]. It has the highest electronegativity of any element. Fluoride is found in the air, soils, rocks, and water and is widely spread in the environment. In January 1945, community water sources in Grand Rapids, Michigan, were fluoridated to a level of 1 ppm as a dental caries prevention measure, and fluorides were initially used as a supplement to treat dental caries.[2] Water fluoridation, contrastingly, is a contentious public health issue. The addition of a fluoride chemical (typically hexafluorosilicic acid) to public drinking water sources, known as community or artificial water fluoridation, is a contentious public health intervention.[3]

From Turkey to China, a geological fluoride belt stretches through India. Around 12 million tonnes of the estimated 85 million tonnes of fluoride deposits in the Earth's crust are found in India. It's hardly surprising, then, that fluoride endemicity is high in India. The states with the greatest rates of endemicity include Andhra Pradesh, Haryana, Karnataka, Punjab, and Tamil Nadu.[4] Areas of endemic fluorosis are natural laboratories, where the influence of fluoride on dental caries can be studied in a real life situation.[5]In India, nearly 72% of the population reside in villages and do not have access to pipe water. They depend entirely on ground water from wells for drinking purposes and it is largely through water that fluoride finds its way into their bodies and when in excess, causes fluorosis of bones and teeth. Belagavi district of Karnataka belongs to the semi-arid tracts were the ground water in major parts of the district have reported high fluoride content, levels above 2 ppm in

drinking water.[6] There are reports of not only dental fluorosis, but also crippling skeletal fluorosis from this region.[7]

The main route for the incorporation of F into the human body is the digestive tract; 90% of the F ingested is absorbed in the stomach. In adults, some 10% of it is deposited in the bones, whereas in children, up to 50% is fixed to bone tissue.[8] The maximum concentration of F in plasma is reached between 30 and 60 min after intake.[9]Fluoride is capable of crossing the blood-brain barrier, which can cause biochemical and functional changes in the nervous system during pregnancy, since F accumulates in the brain tissue prior to birth.[10] Exposure to F during embryonic development has been reported to be related to learning disorders.[11] In this sense, other research mentions the consumption of large amounts of F as associated with decreased intelligence in children. Six studies evaluating the toxicity of F on neurodevelopment during pregnancy found significant differences in neurobehavioral performance in newborns in areas that are endemically rich in F compared to controls when assessing visual and auditory orientation reactions in newborns in areas that are endemically rich in F compared to controls. Neurotransmitters including norepinephrine and 5-hydroxytriptamine, as well as their receptors, have been discovered to be lower in the brains of aborted foetuses in locations where endemic fluorosis is present, whereas epinephrine levels are higher than in patients from areas where the condition is not present. Hence, these results suggest that the accumulation of F in brain tissue can disrupt the synthesis of certain neurotransmitters and receptors in cells of the nervous system and may even go so far as to provoke neural dysplasia or other damage.[12]

The intelligence quotient, or IQ, is a measurement of a person's capacity to reason. In a nutshell, it's designed to see how well someone can utilise reasoning and knowledge to answer questions and make predictions. Short- and long-term memory are measured in IQ tests to begin assessing this. They also assess how effectively and rapidly people can solve puzzles and retain information they've heard[13]. In other words, a number resulting from a collection of standardised tests established to measure a person's cognitive ability ("intelligence") in relation to their age group is known as an intelligence quotient, or IQ.[14] Many theories exist, including allegations that fluoride exposure affects intelligence. The study was undertaken by a research team from York University, and 601 pairs of mothers and children were evaluated for the same. The study discovered a link between the mothers' average daily fluoride intake (as determined by questionnaires) during pregnancy and their children's eventual IQ scores[15].

Traditionally, an inverse relationship has been found between the concentration of fluoride in drinking water and caries experience. It has become clear that enamel fluoride level, caries experience and dental fluorosis score vary from one population to another. However, the effect of fluoride on the dentition is dose dependent and is not confined to increased caries resistance[16]. If accumulated above certain levels in the body, fluoride causes various disorders, together called as fluorosis. Dental fluorosis is a disorder in the mineralization of teeth as a result of exposure to excess amount of fluoride during tooth development. Although a late sign, dental fluorosis is the most sensitive sign of prolonged high fluoride exposure[17]. A recent WHO report says, “It may not be possible to achieve effective fluoride based caries prevention without some degree of dental fluorosis. Public heath administrators must seek to maximize caries reduction, while minimizing dental fluorsis.[18] It is well

documented that high levels of fluoride in drinking water are associated with varying degree of fluorosis. Hence, fluoride is commonly called a 'double edge sword'.[19]

Despite the fact that several research have been conducted around the world to investigate the effects of fluoride on dental caries and intelligence quotient, published data is not available to know the effect of fluoride on dental caries and IQ of the children in this region.[20, 21] Also there are no study available which illustrates how the study population's intelligence quotient, water fluoride level, and dental hygiene status are associated. Hence an attempt was made in the present study to assess the relationship between water fluoride level and IQ of 12-15 years old Government school children residing in areas with different concentration of fluoride in drinking water in Belagavi district, Karnataka.

REVIEW OF LITERATURE

1. **Y Lu, a ZR Sun, a LN Wu, a X Wang, a W Lu, a SS Liub Tianjin (2000)**: The purpose of this study was to determine the link between fluoride levels and IQ levels in 118 children aged 10 to 12 years old who attended school in the Tianjin Xiqing District of China. According to the findings, children who are subjected to high fluoride dosages may experience delayed intelligence development.[22]
2. **MH Trivedi, RJ Verma (2007):** With respect to similar educational and socioeconomic situations but variable fluoride (F) concentrations in the drinking water, intelligence quotient (IQ) of 190 school-aged children aged 12 to 13 years old was tested in two villages in India. There was a substantial inverse connection between IQ and urine F level. These findings, which are in line with those of other studies, suggest that youngsters who drink high-F water are at danger of having their intelligence development stunted.[23]
3. Murgesh Trivedi (2007): The fluoride impact intake on the intelligence quotients of two groups of school children was investigated in a cross-sectional study. The IQ of 190 school-aged children aged 12 to 13 years old was measured in two villages in India with differing fluoride (F) concentrations in the drinking water but, similar educational and socioeconomic conditions. The IQ scores of 101 children in the lower F area (104.44 +-1.23) was significantly lower than that of 89 children in the high F area (91.72 +-1.13).[24]
4. **Priyanka Razdan (2007):** The fluoride concentration impact in ingested water on the intelligence quotient (IQ) of 12-14-year-old children was studied in a cross-sectional study in the Mathura area. When IQ scores were compared, it was discovered that 35 (46.7%) participants belongs to high fluoride locations and 10

(13.3%) participants belongs to medium fluoride areas had lower than average IQ. Furthermore, children belongs to high-fluoride area (13.9467) had the lowest mean marks, compared to those in the medium (18.9467) and those in the least highlighted fluoride area (18.9467). (38.6087). [25]

5. **Michael Connett and Hardy Limeback (2008)** conducted a Systematic Review to see if fluoride (F-) exposure is linked to a loss of intelligence in humans (IQ). Ovid MEDLINE and its related versions, CINAHL, AMED, EMBASE, Cochrane DSR, ACP Journal Club, DARE, CCTR, CMR, HTA, and NHSEED, Health and Psychosocial Instruments, HealthSTAR, and International Pharmaceutical Abstracts were searched from the earliest record to January 2008. Only original human research on the effect of F- on IQ were included. They found 18 ecological studies that claim a link between high fluoride exposures and lower human IQ, albeit the evidence isn't conclusive. [26]

6. **K M Sudhir (2009):** K M Sudhir (2009): To investigate the connection between exposure to different levels of fluoride content in drinking water and children's Intelligence Quotient (IQ), a cross-sectional study was conducted among 13-15 year old school children in Nalgonda District, Andhra Pradesh. Overall IQ levels in children exposed to high fluoride levels were significantly lower than in children exposed to low fluoride levels, according to the findings of this study.[27]

7. **H. R. Poureslami1, A. Horri1, S. Khoramian (2011) Khoramian (2011**) In this cross-sectional study, researchers looked at two metropolitan populations in Iran's Kerman province that had similar socioeconomic and cultural status but differing degree of content of fluoride in their drinking water. According to the findings, chronic high-fluoride exposure is one of the elements that influences

intellectual development. As a result, measures for limiting the negative consequences of high fluoride ion intake in the body are needed, particularly in places like Koohbanan.[28]

8. **B. Seraj (2012**): To see how high fluoride intake affected the intelligence quotient (IQ) of youngsters in five rural districts of Makoo, Iran, a cross-sectional study was carried out. Children living in places where water fluoride levels were greater than normal showed signs of delayed intellectual development.[29]
9. **Ramesh Nagarajappa, Piyush Pujara (2013)** During July 2012, in the Kutch District of Gujarat, India, a cross-sectional descriptive survey of 100 school students aged 8 to 10 years old was done. Chronic exposure to high levels of fluoride in water was linked to a lower cognitive quotient, according to the findings.[30]
10. **Xiang (2013):** By looking at the cross-sectional study, the Intelligence Quotient (IQ) of 512 children aged 8-13 years who lived in two villages in Sihong County, Jiangsu Province, China, with varied levels of fluoride in their drinking water. An increased risk of mental retardation (IQ 70) and borderline intelligence (IQ 70-79) have been associated with the levels of fluoride in drinking water.[31]
11. **Suleman Abbas (2015):** To evaluate the IQ levels of school students from two different regions with varied fluoride levels in their water, and to see if there was a link between fluoride levels, fluorosis prevalence, and IQ levels, a cross-sectional study was done. The majority of children free of fluorosis (76.3%) had an IQ of 2 or higher (above the average, undoubtedly). The majority of children having very moderate and mild fluorosis had an IQ of 3 or higher, according to the study (Intellectually average). IQ grade 4 was discovered in children with moderate dental fluorosis (Definitely below average). The study only included 5

children with severe fluorosis, all of them were determined to have an IQ of 5. As a result, there was a trend of increasing IQ grade (loss in intellectual capacity), demonstrating a strong relationship between fluorosis grade and IQ grade. According to the findings of this study, children exposed to high content of fluoride in drinking water and so suffering from dental fluorosis had a considerably lower overall IQ than children in low fluoride areas.[32]

12. **Hansa Kundu, P. Basavaraj, Ashish Singla (2015):** To examine the fluoride impact in drinking water on IQ in 8-12 year old schoolchildren living in high and low fluoride districts of Delhi, A cross-sectional study was conducted. According to the findings, in drinking water the content of fluoride has a substantial relationship with children's IQ. Along with fluoride, the mother's nutrition during pregnancy has been linked to the IQ of her offspring. [33]
13. **Shibu Thomas Sebastian, Sunitha S. (2015):** This study looked at the Intelligence Quotient (IQ) of school-aged children in Mysore district communities with varying fluoride levels. According to the findings, high water fluoride levels can impact children's IQ.[34]
14. **A. Aravind, R. S. Dhanya (2016)** The association between fluoride levels in drinking water and intelligence quotient (IQ) in children's was investigated in a cross-sectional study involving 288 school children from three communities. The fluoride contents in drinking water were proved to have a strong unfavourable connection with IQ (r value = 0.204; P 0.000). The amount of content of fluoride in drinking water was found to be inversely linked with IQ.[35]
15. **Kousik Das & Naba Kumar Mondal (2016):** In the Simlapal Block of Bankura District, West Bengal, to determine the connection between fluoride (F) exposure as exposure dosage (ED) and dental fluorosis (DF), urine fluoride concentration

(UF), intelligence quotient (IQ), and body mass index (BMI) (BMI), a cross-sectional study was done. The researchers concluded that the concentrations of UF and DF might be used as a biomarker for fluoride poisoning.[36]

16. **Diana Rocha-Amador, Maria Elena Navarro (2017):** The researchers wanted to see if there was a link between children's intellect and content of fluoride and arsenic in drinking water. The researchers looked at three rural areas in Mexico with varying levels of fluoride and arsenic in their drinking water. According to the findings, children who are exposed to fluoride or arsenic have a higher risk of having lower IQ scores.[37]
17. **Sandhya P Naik (2018):** The impact of fluoridated water on schoolchildren's intelligence quotient (IQ) levels was investigated in a cross-sectional study with 88 schoolchildren in each group. Three towns were chosen based on the concentrations of naturally obtained fluoride in drinking water, namely fluoride levels ranging from 1.2 to 2 ppm (middle), and fluoride levels >2 ppm (high) (high). The fluoride ion selective electrode technique was used to determine the fluoride content in the water sample. The Raven's Standard Progressive Matrices exam was used to calculate IQ. According to the findings, the concentration of fluoride in drinking water is negatively connected with schoolchildren's IQ levels. [38]
18. **Rivka Green, MA; Bruce Lanphear (2019):** In a prospective, multicentre birth cohort study, they used data from the Maternal-Infant Research on Environmental Chemicals cohort. The Wechsler Primary and Preschool Scale of Intelligence was used to test the IQ of children aged 3 to 4 years. By using multiple linear regression models, the covariate-adjusted correlations between IQ score and each fluoride exposure metric were investigated. Higher the amounts of

fluoride exposure during pregnancy, lower was the IQ scores in children aged 3 to 4 years old, according to one study. These findings show that fluoride consumption during pregnancy should be limited.[39]

19. **Christine Tilla, Rivka Greena (2019):** conducted research on the link between intellectual ability in children living in fluoridated and fluoride free cities in Canada and early fluoride exposure. The study concluded that higher levels of fluoride in tap water were linked to decreased nonverbal cognitive ability. The effect was more significant in children who were fed formula.[40]
20. **Shibu Thomas Sebastian (2021):** To evaluate the IQ of school-aged children in villages in the Mysore area aged 10 to 12 years with varying fluoride levels, a cross-sectional study was carried out. When compared to school children in locations with normal and low water fluoride levels, school children in places with higher than average water fluoride levels showed more impaired intelligence development. As a result, excessive water fluoride levels can have an impact on children's intelligence.[41]

JUSTIFICATION OF THE STUDY

Shortt et al. were the first to report fluorosis in India, in the Nellore district of Madras state[42]. Fluorosis affects more than 62 million people in India, including 6 million children under the age of 14[43]. This is due to the consumption of fluoridated water. Fluoride can harm people of all ages, but it is especially harmful to pregnant women and developing children. Excessive fluoride consumption can also have negative neurological consequences. Fluoride can generate lipid-soluble compounds that can pass through the foetal blood-brain barrier and accumulate in cerebral tissues before birth, impairing IQ. According to some research, fluoride can cause changes in the physical structure and biochemistry of the brain, affecting children's mental development during cognitive functions such as learning and memory, particularly during the foetal period and the first eight years of life[44].

Despite the fact that several research have been conducted around the world to investigate the effects of fluoride on intelligence quotient, published data is not available to know the effect of fluoride on IQ of the children in Belagavi District[45, 46]. Also there are no studies available which illustrates how the study population's intelligence quotient, water fluoride level and their dental hygiene status are associated. Hence this study was attempted.

AIM AND OBJECTIVES

AIM OF THE STUDY

To assess the association between various levels of fluoride concentration of drinking water and intelligence quotient of 12-15 years old Government school children in Belagavi district.

OBJECTIVES OF STUDY

- To assess the Intelligence quotient of 12-15 years old Government school children in Belagavi district using Raven's scale.
- To assess the association between various levels of fluoride, medium (1.2 to 2 ppm) and low (<1.2 ppm), in drinking water and intelligence quotient of 12-15 years old government school children in Belagavi District.
- To assess the prevalence of dental fluorosis in medium (1.2 to 2 ppm) and low (<1.2 ppm) level of fluoride areas using Dean's fluorosis index among 12-15 years old Government school children in Belagavi District.

MATERIALS AND METHODS

The present cross-sectional study was conducted to assess the association between various levels of fluoride concentration of drinking water and intelligence quotient of 12-15 years old Government school children in Belagavi district.

STUDY DESIGN AND STUDY DURATION

This was a descriptive cross sectional study. The study was conducted from the month of June 2021 to September 2021.

SOURCE OF DATA

Area and population under study

Study population consisted of 12-15 years old Government school children of Belagavi district residing in areas with different concentration of fluoride in drinking water.

Inclusion criteria

- All children of 12-15 years age, who are permanent resident of Belagavi district
- Those who used same source of drinking water (bore well water) since birth
- No history of chronic illness, trauma to head, not on any medication.
- Children who are willing to participate in the study
- Children whose parents gave consent for the study

Exclusion criteria

- History of trauma to the head and other neurological disorder
- Congenital disease
- Children who had change in source of drinking water
- Children who are not willing to participate in the study
- Children whose parents did not give consent for the study

METHOD OF SAMPLE SIZE CALCULATION

Sample size was estimated using the following formula. Standard deviations and mean difference were taken from a previous study. [47]

$$n = \frac{(SD_1^2 + SD_2^2)\,(Z_{\alpha/2} + Z_{\beta})^2}{(\bar{X}_1 - \bar{X}_2)^2}$$

Z alpha = 1.96 at 5% alpha error

Z beta = 1.682 at 5% beta error

Power = 95%

SD_1 and SD_2 = Standard Deviation of group 1 and group 2

$\bar{X}_1 - \bar{X}_2$ = Mean Difference between the two groups

Sample size = 197 in each group

Thus the final sample size was, n = 394 considering the two groups.

SAMPLING TECHNIQUE

The list of talukas with low fluoride level (<1.2 ppm) and medium fluoride level (>1.2 ppm) were obtained from the District Ground water board and sanitation department, Belagavi. A total of five schools were randomly selected from two zones. All the students aged 12–15 years, present on the day of examination, who gave consent and satisfied the inclusion criteria's from the respective schools were considered for the study.

ORGANIZATION OF THE STUDY

1. Approval from the Authorities:

Ethical approval (Annexure I**):** Ethical clearance obtained from the Ethical committee, "KLE VK Institute of Dental Sciences", Belagavi.

Permissions (Annexure II): Permission was obtained from higher authorities like Head master / Head mistress of respective schools.

Informed consent (Annexure III): Informed consent was obtained from the parents and assent was obtained from the children after explaining the study in their local language.

2. Pilot study

A pilot study was conducted among 20 students to assess the comprehension and validity of the questionnaire and feasibility of the study.

3. Training and calibration of examiner:

The clinical examination of all the subjects constituting the sample was entirely done by a single investigator. Before conducting the study, the investigator examined 10 subjects at Department of Public Health Dentistry, KLE VK Institute of Dental Sciences, Belagavi under the guidance of a professor for calibration and to limit intra examiner variability, the results so obtained were subjected to Kappa statistics. Five of these subjects were randomly called later and the investigator repeated his examination on them. The intra examiner variability, Kappa co-efficient was 0.83, indicating a good degree of observational congruence.

4. Collection of water samples

Information on fluoride levels of drinking water was obtained from the documented records of the office of the Ground water sanitation and from the study reports of India water portal organization (http://cgwb.gov.in). The entire district was divided into two zones i.e. medium fluoride level (>1.2ppm) and low fluoride level (<1.2ppm) based on the records. Five schools were randomly selected from the two zones and water samples were collected. Sufficient bottles were carried to the schools to collect water samples.

- Capacity of each plastic bottle was 1000 ml.
- Quality of the plastic bottle was such that they could withstand the stress caused during water collection and storage, transportation to laboratory and till the water analysis was done.
- All the bottles were labelled with identification of name of the place and time of water sample collection.
- The collected samples were sent to the “District ground water sanitation board, Belagavi” for fluoride concentration estimation.

5. Analysis of fluoride level in collected water samples

The collected water samples were sent to the District ground water sanitation board, Belagavi to confirm the fluoride levels in the water before commencement of clinical examination. Water analysis was done according to BIS 3025-SPADNS specifications using Acid–zirconyl-SPADNS reagent and Spectrophotometer.

DATA COLLECTION

The study was conducted from various five Government schools of Belagavi district. The intelligence quotient of the study participants were assessed using Raven's questionnaire. Clinical examination was carried out to record DMFT index[48], OHIS index[49], details regarding trauma (Ellis and Davey's classification of tooth fracture)[50], malocclusion (Angle's classification)[51], dental anomalies and Dean's fluorosis index[52]. The study participants were interviewed for their sociodemographic details, history of their residence and the source of their drinking water from birth to 10^{th} year of life.

Study Questionnaire: (Annexure V)

The study was carried out using a pre-tested self-designed questionnaire, which consisted of three parts:

- Part 1 of the questionnaire consisted of sociodemographic details of the study subjects like name, age, gender, school name and Taluka name and socioeconomic status (Modified Kuppuswamy scale 2019)[53] of the parents.
- Part 2 of the questionnaire consisted of oral health parameters of the study participants which included DMFT index, OHIS index, details regarding trauma (Ellis and Davey's classification of tooth fracture), malocclusion (Angle's classification), dental anomalies and Dean's fluorosis index

- Part 3 of the questionnaire contained Raven's questionnaire with 36 questions to assess the IQ of the children.

1. Assessment of Intelligence quotient of the children[54]

Assessment of intelligence quotient of children was done by using Raven's scale method.

This is a validated test for basic cognitive abilities and is widely used to evaluate the normal brain functions. It is a nonverbal questionnaire, examples of problems contain a matrix of geometrical design with a part removed. The child has to select missing cell from 6 given alternatives and tick their correct option.

- Each child was given a questionnaire that contained 36 questions.
- They were allotted a time limit of 30 minutes.
- Appropriate measures was taken to ensure that there is no duplication of answers.

The acquired findings were converted to percentiles, and then the overall score in each individual examination was graded using Raven's coloured progressive manual technique criteria. Grading criteria for IQ scores according to Raven's progressive matrices manual:-

- **Grade 1**: Intellectually superior. Score - **above 95th percentile.**
- **Grade 2**: Definitely above average. Score - **at or above 75th percentile.**
- **Grade 3**: Intellectually average. Score - **between 75th and 25th percentile.**
- **Grade 4**: Definitely below average. Score - **at or below 25th percentile.**
- **Grade 5**: Intellectually impaired. Score - **at or below 5th percentile.**

2. Instruments and materials used

The quantity of sterilized instruments and supplies used in the study were kept to sufficient. The following are the list of instruments used.

- Mouth mirrors
- CPI probes
- Tweezers
- Kidney trays
- Disposable tumblers
- Cloth hand towels
- Gauze and cotton
- Gloves and mouth masks
- Torch
- Cold sterilization (Korsolex) composition
    - Glutaraldehyde – 7 g
    - 1,6 dihyroxy 2,5 dioxahexane – 8.2 g
    - Polymethyl urea derivatives 17.6 g
    - Rust inhibitors
- Self-designed questionnaire
- Raven's questionnaire

3. Infection control:

The study took place during the height of the pandemic, necessitating stringent adherence to infection protocols established by the Centre of Disease Control (CDC) and World Health Organization (WHO). An apron, respirator, face shield, and

surgical gloves were used as personal protective equipment. Before each subject was examined, the gloves were changed, and the hands were disinfected with sanitizer on a regular basis. Sterilization was carried out using autoclave. Spot sterilization was done during study using chemical sterilizing solution – Korsolex.

4. Details of examination:

The clinical examination was carried out by the principal investigator throughout the study. A recording clerk was trained to assist the recording procedure throughout the study. The permissions were obtained from the Headmaster/Headmistress of the school, Informed consent from the parents and assent from the students, prior to the study.

5. Examination area:

The data was collected during the morning working hours of school to ensure the presence of the children. Examinations were performed under natural day light. The subjects were made to sit in such a way that they would receive maximum illumination while avoiding direct sunlight, which would be uncomfortable for both the subject and the examiner.

6. Examination chair:

The subjects were made to sit on a chair in a well-ventilated room such that the examination was carried out under natural lighting conditions. The oral health parameters were recorded in the performa, as the examiner said them out loud. The recording clerk was made to sit close to the examiner so that the instructions and codes could be easily heard and the examiner could see that the findings were being

recorded correctly. This also enabled the recording clerk to check that the score recorded related to the region or tooth that had just been examined.

7. Clinical examination

Type III clinical examination, as recommended by "American Dental Association" was followed throughout the study. On each day approximately 25-30 subjects were examined. Following indices were recorded

a. DMFT index

The DMFT index (developed by Henry T Klein, Carrole E Palmer and Knutson J W in 1938) was used to measure the caries experience of the study participants. The format was reproduced from the "Studies on Dental Caries: V. Familial Resemblance in the Caries Experience of Siblings by Henry Klein and Carroll E. Palmer". This format is designed for measurement of dental caries. DMFT is the sum of the number of Decayed, Missing due to caries and Filled component in the permanent teeth. The details of the format has been included in the annexure VI.

b. OHIS index

The OHIS index (developed by John C Greene and Jack R Vermillion in 1964) was used to classify and assess the oral hygiene status of the study participants. The format was reproduced from the "Epidemiologic study of cleft lip and cleft palate in four states by John C Greene and Jack R Vermillion. The details of the format has been included in the annexure VI.

c) Dean's Fluorosis index – Modified criteria 1942

Dean's fluorosis index (introduced by Trendley H Dean in 1934) which is also known as Dean's classification system for dental fluorosis was used to record dental fluorosis of the study subjects. The criteria for Dean's fluorosis index – Modified is based on a 6 point ordinal scale: Normal (0), Questionable (0.5), Very Mild (1), Mild (2), Moderate (3) and Severe (4). The details of the format has been included in the annexure VI.

d) Trauma to dentition

Trauma to dentition was recorded using Ellis and Davey classification which was given in the year of 1970. The details of the format has been included in the annexure VI.

e) Malocclusion

Malocclusion was recorded using Angle's classification (developed by Edward H Angle in 1899). The details of the format has been included in the annexure VI.

After the examination, the children were educated regarding the oral health, oral hygiene practices and maintenance. Emphasis was laid on importance of routine, simple preventive measures and periodic dental visits.

The children were given tooth paste, a toothbrush, and a referral card for treatment at the dental college (KLE VK Institute of Dental Sciences, Belagavi) with a 20% discount on treatment.

8. Method of statistical analysis

The collected data was entered in Microsoft excel sheet. Data cleaning was performed to eliminate data that was incorrect, corrupted, incorrectly formatted, duplicated, and incomplete. Statistical analysis was done using SPSS package (Ver. 26; Raleigh, NC, USA).

The results for continuous variable were given as frequencies, standard deviations and mean values (Quantitative data). Differences between the groups were assessed by the Chi-square test. Relation between fluoride levels and intelligence quotient was assessed by simple linear regression.

a) Chi- Square (χ^2) test: [54]

This is a non-parametric test, used when data are expressed in frequency or proportion or percentages. It is useful for discrete data

Formula:

$$\chi^2 = \Sigma \frac{(O - E)^2}{E}$$

Where

O - Observed frequency

E – Expected frequency

b) Simple linear regression: [55]

Simple linear regression is a linear regression model with a single explanatory variable. That is, it concerns two-dimensional sample points with one independent variable and one dependent variable (conventionally, the x and y coordinates in a Cartesian coordinate system) and finds a linear function (a non-vertical straight line)

that, as accurately as possible, predicts the dependent variable values as a function of the independent variable. The adjective simple refers to the fact that the outcome variable is related to a single predictor.

The formula for r is: $$r = \frac{\sum XY - \frac{\sum X \sum Y}{n}}{\sqrt{\sum (X - \bar{X})^2 \sum (Y - \bar{Y})^2}} = \frac{SSCP}{\sqrt{(SSX)(SSY)}}$$

In all the above tests 'p' value <0.05 was accepted as indicating statistical significance.

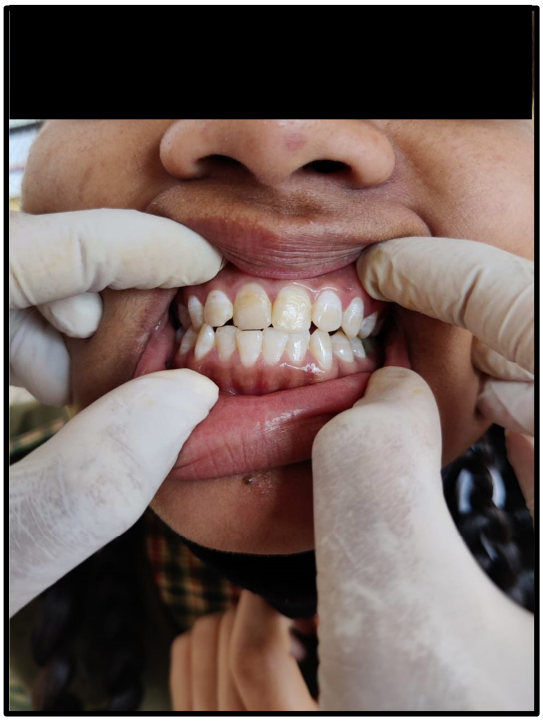
Photograph 1: Collected water sample

Photograph 2: Spectrophotometer and Acid Zirconyl - SPANDS reagent

Photograph 3: Armamentarium

Photography 4: Distribution of Ravens questionnaire

Photograph 5: Clinical examination of the subject



Photograph 6: Dental Fluorosis

RESULTS

The descriptive cross sectional study was conducted to assess the association between intelligence quotient and water fluoride levels of 12 to 15 years old Government school children with varying fluoride concentrations in Belagavi District, Karnataka. The data obtained from the study was subjected to statistical analysis. The results are presented under the headings of various parameters considered for this study.

Table 1: Distribution of study schools according to fluoride levels

Schools in Belagavi, Bailhongal and Kothali had low level fluoride with water fluoride concentration of 0.98, 0.95, 1.08 and 1.13 ppm. School in Chinchani had medium water fluoride level with concentration of 1.41 ppm.

DISTRIBUTION OF STUDY SUBJECTS

Table 2: Shows the distribution of study subjects according to fluoride levels

There were a total of 540 study subjects; in fluoride level 1, low fluoride level (<1.2 ppm) there were 389 (72.0%) subjects, in fluoride level 2, medium fluoride level (>1.2 ppm) there were 151 (28%) subjects.

Table 3: Shows the distribution of study subjects according age

The age range of study population was 12-15 years. Number of subjects aged 12 years were 262 (48.5%), 13 years were 174 (32.2%), 14 years were 93 (17.2%) and 15 years were 11 (2.1 %).

Table 4: Shows the distribution of study subjects according to gender

Out of the total 540 subjects, 279 (51.7%) were males and 261 (48.3%) were females.

Table 5: Shows the distribution of study subjects according to socioeconomic status (Kuppuswamy 2019)

Among total study participants, 249 **(**46.1%) were belonged to lower middle class (III), 266 (49.3%) were belonged to upper lower class (IV) and 25 (4.6%) were belonged to lower class (V).

Table 6: Shows the distribution of study subjects according to DMFT scores (WHO 1997)

Among 540, 18 (3.3%) of the subjects examined were in very low category. 46(8.5%) subjects were in the low category, 268(49.6%) subjects were in moderate category, 185(34.3%) subjects were in high category and 23(4.3%) subjects were in very high category. The mean DMFT of the study population was 4.11 ± 1.37. The range of DMFT scores varied from 1-8.

Table 7: Shows the distribution of study subjects according to OHIS score.

Out of 540 subjects, (433)80.2% of the subjects examined were having good oral hygiene. 93(17.2%) subjects were in fair category, 14(2.6%) subjects were having poor oral hygiene. The mean value of OHIS score was found to be 1.22 ±0.476.

Table 8: Shows the distribution of study subjects according to Dean's Fluorosis index.

Among all the subjects, 441 (80.7%) of the study participants were in the normal category, 57(10.6%) of the study participants were in questionable category, 16(3%) were in very mild category, 11(2%) in mild category, 10(1.9%) in moderate category, 5(0.9%) in sever category.

Table 9: Shows the distribution of study subjects according to trauma of the dentition

Among all the subjects, 490 (90.7%) of the subjects were not having any history of trauma to the dentition. 25(4.6%) of the subjects were having Ellis class I tooth fracture of the central incisor, 17(3.1%) of the subjects were having Ellis class II fracture and 8(1.5%) of the study subjects were having Ellis Class III fracture.

Table 10: Shows the distribution of study subjects according to malocclusion

Among all the subjects, 468(86.7%) of the subjects were having Angle's class I malocclusion, 63(11.7%) of the study subjects were having Angle's class II malocclusion and 9(1.7%) of the study subjects were having Angle's class III malocclusion.

DISTRIBUTION OF STUDY SUBJECTS ACCORDING THEIR RAVEN'S SCORE

Table 11: Shows the distribution of study subjects according their Raven's score

The maximum score was found to be 31 out of 36 and six students scored 31. Minimum score was found to be 6 out of 36 and only 1 student scored 6. The mean score was found to be 19.37 with standard deviation 4.55. One (0.2%) scored 6 out of 36. Two (0.4%) students scored score 7. One (0.2%) student scored score 8. Three students scored 9. 4 (0.7%) of the study participants scored 10 marks. 3 (0.6%) of the subjects scored 11. 12 (2.2%) of the subjects scored 12 out of 36. 28 (5.2%) of the subjects scored 13. 42 (7.8%) of the children scored score 14. 56 (10.4%) of the students scored 15. 40 (7.4%) study participants got score 16. 53(9.8%) of the students scored 17. 45 (8.3%) of the participants scored 18. 51(9.4%) of the students scored 19. 43(8%) of the students scored 20. 69 (12.8%) of the students scored 21. 16 (3%) scored 22. 17 (3.1%) students scored 23. 7 (1.3%) scored 24. 7 (1.3%) students scored 25. 12 (2.2%) scored 26. 9 (1.7%) subjects scored 27. 5 (0.9%) students scored 28. 7(1.3%) scored 29. 1(0.2%) student scored 30 out of 36 and 6 students scored 31 out of 36 which is the maximum score.

Table 12: Shows the distribution of study subjects according their Raven's score category

Among 540 subjects, 26(4.8%) of the study participants were belonged to "intellectually superior" category, 97(18%) of the study participants were having "definitely above average" IQ. 265(49.1%) were belonged to "average" category. 107(19.8%) of the participants were belonged to "below average category" and 45(8.3%) of the subjects were belonged to "intellectually impaired" category.

Table 13: Shows the association between dmft score and water fluoride level

Among 18 subjects who are having very low dmft value, 17 of them belonged to low level water fluoride and 1 belonged to medium level. 46 subjects who belonged to low level dmft value, 40 belonged to low level water fluoride and 6 belonged to medium level. Out of 268 subjects who were having moderate dmft value, 184 belonged to low water fluoride level and 84 belonged to medium. Out of 185 who were having high dmft score, 127 belonged to low and 57 belonged to medium level of water fluoride level. Among 23 subjects who were having very high dmft score, 21 were from low level fluoride area and 2 from medium level.

There was a significant difference found between dmft score and water fluoride level (p=0.003*).

Table 14: Shows the association between OHIS score and water fluoride level

Among 433 subjects who were having good oral hygiene, 310 were belonging to low fluoride level and 123 were from medium fluoride level. Among 93 students who were having fair oral hygiene, 68 were from low fluoride level and 25 from medium level. Out of 14 students who belonged to poor oral hygiene, 11 were belonged to low fluoride area and 3 from medium level. There was no significant difference found between OHIS score and water fluoride level (p=0.822).

Table 15: Shows the association between Dean's fluorosis index and water fluoride level.

Among 389 subjects who were from low level fluoride, 355 were having normal, 30 questionable, 4 very mild dean's fluorosis score. Out of 159 subjects from medium level of fluoride area, 86 were having normal, 27 questionable, 12 very mild,

11 mild, 10 moderate and 5 were severe. There was a significant difference found between water fluoride level and dean's fluorosis index (p=0.000*)

Prevalence of fluorosis

Among 540 study subjects, 99 students were having fluorosis, hence prevalence of fluorosis is 18.33%. Prevalence of fluorosis in low water fluoride level was found to be 8.74% and medium level was found to be 43.04%.

Table 16: Shows the association between trauma to the dentition and water fluoride level.

Out of 389 participants who belonged to low level fluoride, 350 were having no trauma, 19 were having Ellis class 1, 13 were having class 2 and 7 were having class 3. Among 151 subjects who were from medium fluoride level, 140 were having no trauma, 6 were having Ellis class 1, 4 were having class 2 and 1 was having class 3. There was no significant difference found between trauma to the dentition and water fluoride level (p=0.705).

Table 17: Shows the association between Malocclusion and water fluoride level.

Out of 389 participants who belonged to low level fluoride, 334 were having Angles class 1 malocclusion, 49 were having Angles class 2 malocclusion and 6 subjects were having Angles class 3 malocclusion. Among 151 participants who belonged to medium level fluoride, 134 were having Angles class 1 malocclusion, 14 were having Angles class 2 malocclusion and 3 subjects were having Angles class 3 malocclusion. There was no significant difference found between trauma to the dentition and water fluoride level (p=0.532).

Linear Regression analysis

Assumptions

Assumption 1: Both the variables are measured in continuous scale.

Assumption 2: A linear relationship exist between the two variables. “Figure 1”

Assumption 3: There are no significant outliers.

Assumption 4:

Table 18: Out of 389 subjects from low level fluoride, 28 (7.2%) belonged to intellectually impaired category, 34 (8.7%) belonged to below average category, 205(52.7%) belonged to average category, 96(24.7%) belonged to definitely above average category and 26(6.7%) belonged to intellectually superior category. Out of 151 subjects from medium level fluoride, 17(11.3%) were belonged to intellectually impaired category, 73(48.3%) belonged to below average category, 60(39.7%) belonged to average category, 1 (0.7%) belonged to definitely above average category and no subjects were belonged to intellectually superior category.

The p value was found to be 0.0002* which shows there is a significant difference between water fluoride levels and Raven’s score. Thus an independence of observations exists between the two variables.

Assumption 5: The data shows homoscedasticity where the variances along the line of best fit remain similar as you move along the line.

Assumption 6: The residuals or the errors of the regression line are approximately normally distributed.

The R and R2 values are listed in Table 19. The R value (the "R" Column) represents the simple correlation and is 0.0369, indicating a low degree of correlation. The R2 number (the "R Square" column) reflects how much the independent variable, water fluoride level, can explain in terms of total variation in the dependent variable, IQ level (Raven's score). In this scenario, only 13.6 percent of the variance can be accounted, which is low.

This table 20 shows that the regression model accurately predicts the dependent variable. Looking at the "Regression" row and the "Sig." column, which displays the regression model's statistical significance, $p < 0.0001$, which is less than 0.05, indicating that the regression model statistically significantly predicts the outcome variable (i.e., it is a good fit for the data).

The Coefficients table (table 21) gives us the information we need to forecast IQ score from water fluoride level and establish whether water fluoride has a statistically significant impact on the model (by looking at the "Sig." column). The values in the "B" column under the "Unstandardized Coefficients" column can also be used, as demonstrated below:

To present the regression equation as:

IQ score = 31.742 – 10.571(water fluoride)

For every unit change in water fluoride level, the average change in mean of IQ score is about -10.571 units.

TABLES

Table 1: Distribution of study schools according to fluoride levels

Fluoride areas / levels / strata	Study setting	Fluoride concentration as analyzed during the survey in ppm
Low Level (<1.2ppm)	Belagavi School 1	0.98
	Belagavi School 2	0.95
	Bailhongal School	1.08
	Kothali School	1.13
Medium Level (1.2-2ppm)	Chinchani School	1.41

Table 2: Shows the distribution of study subjects according to fluoride levels

Water Fluoride level	Frequency	Percentage (%)
Low Level (<1.2ppm)	389	72.0
Medium Level (1.2-2ppm)	151	28.0
Total	**540**	**100.0**

Table 3: Shows the distribution of study subjects according age

Age in Years	Frequency	Percentage (%)
12	262	48.5
13	174	32.2
14	93	17.2
15	11	2.0
Total	**540**	**100.0**

Table 4: Shows the distribution of study subjects according to gender

Gender	Frequency	Percentage (%)
Male	279	51.7
Female	261	48.3
Total	**540**	**100.0**

Table 5: Shows the distribution of study subjects according to socioeconomic status (Kuppuswamy classification 2019)

Socioeconomic status	Frequency	Percentage (%)
Lower Middle Class (III)	249	46.1
Upper Lower Class (IV)	266	49.3
Lower Class (V)	25	4.6
Total	**540**	**100.0**

Table 6: Shows the distribution of study subjects according to DMFT scores (WHO 1997)

DMFT Category	Frequency	Percentage (%)
Very low (0.0 to 1.1)	18	3.3
Low (1.2 to 2.6)	46	8.5
Moderate (2.7 to 4.4)	268	49.6
High (4.5 to 6.5)	185	34.3
Very High (>6.6)	23	4.3
Total	**540**	**100.0**

Table 7: Shows the distribution of study subjects according to OHIS score.

OHIS Score	Frequency	Percentage (%)
Good (0.0 to 1.2)	433	80.2
Fair (1.3 to 3.0)	93	17.2
Poor (3.0 to 6.0)	14	2.6
Total	**540**	**100.0**

Table 8: Shows the distribution of study subjects according to Dean's Fluorosis index.

Deans fluorosis index	Frequency	Percentage (%)
Normal	441	81.7
Questionable	57	10.6
Very Mild	16	3.0
Mild	11	2.0
Moderate	10	1.9
Severe	5	0.9
Total	**540**	**100.0**

Table 9: Shows the distribution of study subjects according to trauma of the dentition

Trauma	Frequency	Percentage (%)
No Trauma	490	90.7
Ellis Class I	25	4.6
Ellis Class II	17	3.1
Ellis Class III	8	1.5
Total	**540**	**100.0**

Table 10: Shows the distribution of study subjects according to malocclusion

Malocclusion	Frequency	Percentage (%)
Angle's Class I Malocclusion	468	86.7
Angle's Class II Malocclusion	63	11.7
Angle's Class III Malocclusion	9	1.7
Total	**540**	**100.0**

Table 11: Shows the distribution of study subjects according their Raven's score

Raven's score	Frequency	Percentage (%)
6	1	0.2
7	2	0.4
8	1	0.2
9	3	0.6
10	4	0.7
11	3	0.6
12	12	2.2
13	28	5.2
14	42	7.8
15	56	10.4
16	40	7.4
17	53	9.8

18	45	8.3
19	51	9.4
20	43	8
21	69	12.8
22	16	3
23	17	3.1
24	7	1.3
25	7	1.3
26	12	2.2
27	9	1.7
28	5	0.9
29	7	1.3
30	1	0.2
31	6	1.1
Total	**540**	**100**

Table 12: Shows the distribution of study subjects according their Raven's score category

Raven score Category	Frequency	Percentage (%)
Intellectually impaired (at or below 5th percentile)	45	8.3
Below average (at or below 25th percentile)	107	19.8
Average (between 75th and 25th percentile)	265	49.1
Definitely above average (at or above 75th percentile)	97	18.0
Intellectually superior (above 95th percentile)	26	4.8
Total	**540**	**100**

Table 13: Shows the association between DMFT score and water fluoride level

DMFT score	Water Fluoride level		Total	Pearson's chi square
	Low Level (<1.2ppm)	Medium Level (1.2-2ppm)		
Very low (0.0 to 1.1)	17(94.4%)	1(5.6%)	18(100.0%)	**0.003***
Low (1.2 to 2.6)	40 (87.0%)	6 (13.0%)	46(100.0%)	
Moderate (2.7 to 4.4)	184(68.7%)	84(31.3%)	268(100.0%)	
High (4.5 to 6.5)	127(68.6%)	58(31.4%)	185(100.0%)	
Very High (>6.6)	21(91.3%)	2(8.7%)	23(100.0%)	
Total	**389(72.0%)**	**151(28.0%)**	**540(100.0%)**	

Table 14: Shows the association between OHIS score and water fluoride level

OHIS score	Water Fluoride level		Total	Pearsons chi square
	Low Level (<1.2ppm)	Medium Level (1.2-2ppm)		
Good (0.0 to 1.2)	310 (71.6%)	123 (28.4%)	433 (100.0%)	**0.822**
Fair (1.3 to 3.0)	68 (73.1%)	25 (26.9%)	93 (100.0%)	
Poor (3.0 to 6.0)	11 (78.6%)	3 (21.4%)	14 (100.0%)	
Total	**389 (72.0%)**	**151(28.0%)**	**540 (100.0%)**	

Table 15: Shows the association between Dean's fluorosis index and water fluoride level.

Water Fluoride level	Deans fluorosis index						Total	Pearsons chi square
	Normal	Questionable	Very Mild	Mild	Moderate	Severe		
Low Level (<1.2ppm)	355 (91.3%)	30 (7.7%)	4 (1.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	389 (100.0%)	**0.003***
Medium Level (1.2-2ppm)	86 (57.0%)	27(17.9%)	12 (7.9%)	11 (7.3%)	10 (6.6%)	5 (3.3%)	151 (100.0%)	
Total	**441 (81.7%)**	**57 (10.6%)**	**16 (3.0%)**	**11 (2.0%)**	**10 (1.9%)**	**5 (0.9%)**	**540 (100.0%)**	

Chi square= 110.88, df= 5, p= 0.003* Highly Significant

Table 16: Shows the association between trauma to the dentition and water fluoride level.

Water Fluoride level	Trauma				Total	Pearson's chi square
	No Trauma	Ellis Class I	Ellis Class II	Ellis Class III		
Low Level (<1.2ppm)	350(90.0%)	19(4.9%)	13(3.3%)	7(1.8%)	389(100.0%)	0.**705**
Medium Level (1.2-2ppm)	140(92.7%)	6(4.0%)	4(2.6%)	1(0.7%)	151(100.0%)	
Total	**490(90.7%)**	**25(4.6%)**	**17(3.1%)**	**8(1.5%)**	**540(100.0%)**	

Chi square= 1.400, df= 3, p= 0.705

Table 17: Shows the association between Malocclusion and water fluoride level.

Water Fluoride level	Malocclusion			Total	Pearson's chi square
	Angle's Class I	Angle's Class II	Angle's Class III		
Low Level (<1.2ppm)	334 (85.9%)	49(12.6%)	6(1.5%)	389 (100.0%)	**0.532**
Medium Level (1.2-2ppm)	134(88.7%)	14(9.3%)	3(2.0%)	151 (100.0%)	
Total	**468(86.7%)**	**63(11.7%)**	**9(1.7%)**	**540 (100.0%)**	

Chi square= 1.264, df= 2, p= 0.532

Table 18: Shows the association between Raven score and water fluoride level.

Water fluoride level	Ravens score					Total	Pearsons chi squre value (p<0.05*)
	Intellectually impaired (at or below 5th percentile)	Below average (at or below 25th percentile)	Average (between 75th and 25th percentile)	Definitely above average (at or above 75th percentile)	Intellectually superior (above 95th percentile)		
Low Level (<1.2ppm)	28(7.2%)	34(8.7%)	205(52.7%)	96(24.7%)	26(6.7%)	389 (100.0%)	**0.0002***
Medium Level (1.2-2ppm)	17(11.3%)	73(48.3%)	60(39.7%)	1(0.7%)	0(0.0%)	151 (100.0%)	
Total	**45(8.3%)**	**107 (19.8%)**	**265 (49.1%)**	**97 (18.0%)**	**26 (4.8%)**	**540 (100.0%)**	

Chi square= 137.01, df= 4, p= 0.0002* Highly Significant

Table 19: Model summary of Linear Regression analysis

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.369a	0.136	0.134	4.233
a. Predictors: (Constant), Water Fluoride level				

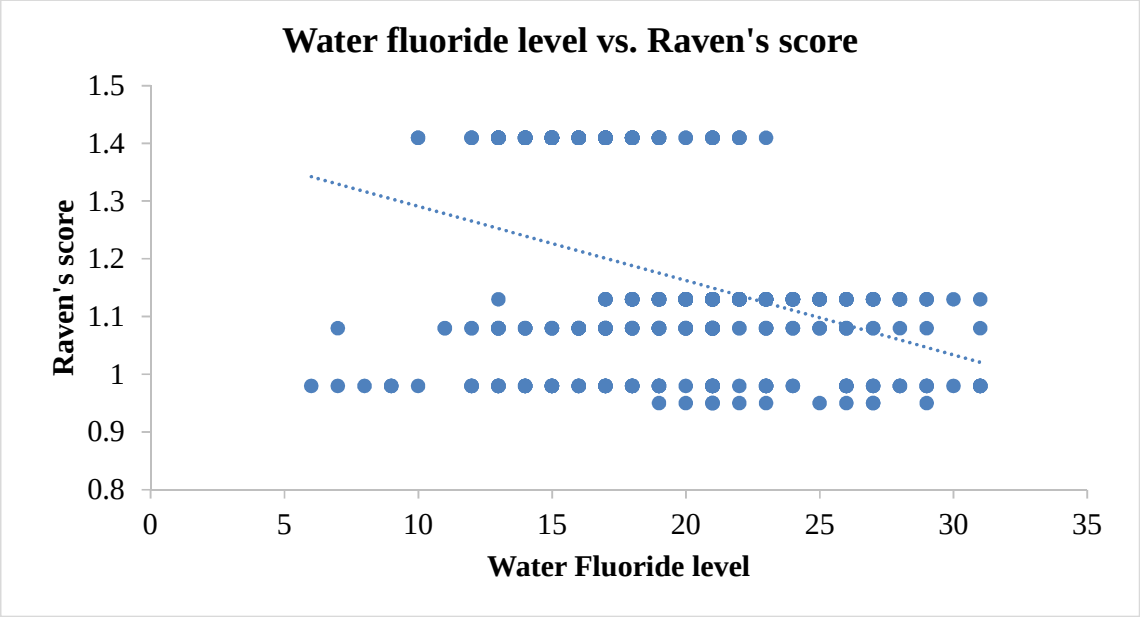
Table 20: Stepwise simple linear regression analysis with Raven's score as dependent variable

ANOVA[a]						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	1516.818	1	1516.818	84.645	.0001[b]
	Residual	9640.847	538	17.920		
	Total	11157.665	539			
a. Dependent Variable: Ravens score						
b. Predictors: (Constant), Water Fluoride level						

Table 21: Shows the prediction of dependent variable using regression model

COEFFICIENTS[A]								
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**	**95.0% Confidence Interval for B**	
		B	**Std. Error**	**Beta**			**Lower Bound**	**Upper Bound**
1	(Constant)	31.742	1.357		23.388	0.000	29.076	34.408
	Water Fluoride level	-10.571	1.149	-0.369	-9.200	0.000	-12.828	-8.314
a. Dependent Variable: Ravens score								

Figure 1: Showing linear relationship between water fluoride level and Raven's score



DISCUSSION

Fluoride, as an essential trace element in the body, can help prevent dental caries and is favourable to bone metabolism. However, fluoride has a finite safe dose range. Long-term fluoride exposure not only increases the risk of dental and skeletal fluorosis, but also to impedes neural development, by affecting gene and protein expression, enzyme activity, and causing oxidative stress.[56] Fluoride's effects on the neurological system have been observed in intellectual development of lab animals. Chronic high fluoride exposure in drinking water of maternal mice during pregnancy and lactation may have negative effects on young mice's learning and memory. Fluoride ingested by the mother has been shown to penetrate the placental as well as the blood-brain barrier, affecting the cognitive function development of the offspring.[57] Similarly, human trials by Green et al. (2019) revealed that prenatal fluoride exposure was linked to poorer IQ scores in children.[58]

Over 85% of India's population relies on groundwater for drinking (World Bank Report 2012), making groundwater quality a critical issue and it must be addressed independently. Without thorough risk assessment, groundwater in India was thought to be predominantly safe and was frequently used for drinking.[59] Many studies have shown that pollution of groundwater occurs as a result of a variety of natural and manmade factors (Shekhar and Sarkar, 2013; Saha et al., 2016).[60, 61] Fluoride pollution in groundwater is one of the most pressing concerns, with negative consequences seen on every continent. Many studies have revealed fluoride-related health issues in people, such as dental and skeletal fluorosis, which have major socioeconomic consequences (Ali et al., 2016).[62]

In our study, an attempt was made to assess the relationship between water fluoride level and IQ level of Government school children and its association with their oral hygiene status at different concentration of fluoride in drinking water in the rural areas of Belagavi district, Karnataka.

General information:

The subjects included in the study presented a remarkable homogeneity in terms of ethnicity, habitat, and social environment. The lower age limit of the study participants was 12 years and the upper age limit was 15 years. An almost equal proportion of male and female children participated in the study. There was no significant relationship found between mean IQ level and gender in the current investigation. There is also no significant difference in the SES and mean IQ of the children in the present study. Thus, the confounding bias of the current study is very minimal. These findings are comparable to the studies done by Poureslami et al[63] and Seraj et al[64]. Only one hamlet out of two investigated in a study by Xian et al[65] exhibited a significant association between IQ and gender. Gender is also stated as a non-related factor to IQ in a psychology book written by Beirne-Smith et al.[66]

Water fluoride and Intelligence quotient

An advantage of conducting fluoride research in these areas was that only a small insignificant seasonal variation occurred in the fluoride content of bore-wells which were the major sources of drinking water.[67] The average IQ of children living in areas with high fluoride levels in their drinking water was significantly lower than that of children living in areas with low water fluoride levels. The difference in IQ scores may be attributed to the possible influence of high fluoride exposure on

children's intellectual development because all possibly confounding factors were balanced. These findings are in line with those of Xiang et al[68]who discovered a decline in children's neurobehavioral abilities when they were exposed to high fluoride levels. In addition, the current research tested two fluoride levels to see how varying fluoride concentrations affected children's IQ and dental fluorosis. It revealed, compared to the medium fluoride group, the low fluoride group had a higher number of children with IQs above the normal range. This was in line with the findings of a study conducted by Trivedi et al[69], which revealed that fluoride level and IQ of school children were inversely proportional.

Several animal studies have suggested possible explanations for fluoride's neurotoxic impact[70, 71, 71]. Fluoride can pass through the placenta if the mother is exposed to high amounts of fluoride during pregnancy, or it can be consumed through the child's diet. In children (80-90 percent) and adults (60 percent), high levels of ingested fluoride are maintained in the body. Fluoride is absorbed into the bloodstream and produces lipid-soluble complexes that pass across the blood-brain barrier and accumulate in cerebral regions. Different neurotoxic and cytotoxic mechanisms, such as free radical production, inhibition of antioxidant and mitochondrial energy enzymes, and inhibition of glutamate transporters, all have negative effects on CNS development.

In the current study, Raven’s questionnaire was employed to assess the child's intellectual growth in this study. The Raven’s test is a validated test for fundamental cognitive abilities that is widely used to assess the proper development of brain functions. It consists of proforma with a geometrical design matrix with a deleted component. The child must choose one of the six options for the missing cell. Raven’s

test is recommended for measuring the intellectual and mental abilities of young children because of the high correlation of this test in evaluating children's IQ when compared to the standard IQ test.

According to Kundu et al[73], Raven's test, which is used to measure children's IQ, is a "culture-fair" test that can be used to compare people's immediate capacities for observation and clear reasoning. Despite the fact that the Raven's test was meant to cover the widest possible range of mental abilities, there are a few potential flaws that need to be investigated. The results are based on relative intelligence rather than absolute intelligence. Creativity, persistent curiosity, logical reasoning, problem-solving ability, critical thinking, and adaptation are all characteristics that fall under the umbrella of intelligence. The factors that influence intelligence are unrelated to one another. The Raven's test mainly assesses observation, clear thinking, and logical reasoning which makes it a poor predictor of other cognitive traits. The other categories of IQ are not taken into account and the IQ test cannot provide a balanced picture of an individual.[74]

The urinary fluoride level was used as the primary measure of a child's fluoride exposure in a study conducted by Razdan et al[75]. The effect of fluoride content on a child's IQ was investigated in this study and it was found that fluoride and IQ level were inversely related. However, the author also stated that, other trace elements in drinking water could also have neurological adverse effects. As a result, more research is needed to determine the impact of additional environmental or geological pollutants.

The mechanism of action of fluorides in lowering IQ isn't well understood. Guan et al[76] found that the amounts of phospholipids and ubiquinone in the brains of

rats with chronic fluorosis were altered, suggesting that changes in membrane lipids may be a cause of this condition. The potential of fluoride to pass the blood-brain barrier, causing biochemical and functional impairment of the nervous system throughout prenatal and development stages of early childhood and childhood, is one of the main reasons for lower intellect in human children exposed to high amounts of fluoride. Many other factors like the changes in biological susceptibility, environmental conditions, and test mistakes, are also known to influence IQ.

According to Kundu et al[77], nutritional status, the diet of the mother during pregnancy, parental education, work, and maternal exposure to fluoride during pregnancy play a role in IQ development. The study also found that there was a positive link between IQ and the level of F in drinking water, the mother's diet during pregnancy, and the mothers' education (P = 0.015, 0.001, and 0.004, respectively). This was linked mostly to malnutrition (as measured by a child's weight/BMI), which has an impact on IQ and results in poor cognitive function.

According to a study done by Trivedi et al[78] the average IQ level of children exposed to high F in drinking water was significantly lower than that of students exposed to lower F drinking water. The rate or degree of exposure to F was determined by evaluating the urine F level, as the kidney is the primary organ for F excretion. As a result, it appeared that increased F exposure decreased higher levels of intelligence even more than it affected the children's normal and below-normal intelligence. Overall, there was a 12.2 percent difference in mean IQ between the two groups, which is statistically significant. The result is similar to the current study which states that for every unit of increase in fluoride level of drinking water, there is a reduction of ten unit IQ.

Oral health parameters and Intelligence quotient

The oral health status of children has been inferred to be associated with IQ in several studies exploring the relationship between dental caries and IQ of young children. Thus, in furtherance of it, the current study was carried out to also assess the prevalence of dental caries and its correlation with IQ among children and prevalence was found to be 51.4%, which is similar to the study done by Madhan et al where the prevalence of dental caries was found to be 52.62%.[79]

Oral health behaviours such as maintaining oral hygiene, following dentist instructions, cooperating in dental settings while undergoing dental treatment, and being able to communicate and respond well during counselling are all linked to the patients' (children in this case) cognitive skills, which are developed as a result of IQ. A strong link has been discovered between a child's dental fears and IQ, which could influence the level of cooperation and acceptance of dental treatment. Understanding information, instructions, causes and effects, and expressing pain or relief from pain are all features of children that are heavily influenced by their intelligence. Children with lower IQ had fewer dental visits, poor plaque control, and inadequate oral health attitudes as compared to those with higher IQ. According to a study by Thomson et al[80], Navit et al[81] a nonsignificant link was found between DMFT and IQ in children aged 10–15 years old (2014). This has been attributed to the variation in the findings of previously conducted studies that aimed to find a link between IQ and dental caries[82, 83]. The current study results show a contrasting results to above mentioned study, where children with low IQ had good oral hygiene.

Oral hygiene has been identified as an incidental factor in the development of dental caries and periodontal disorders among lower IQ persons, according to a study conducted by Kothari et al.[84] The study's mean OHI-S score for mentally impaired people was 2.51, which was consistent to prior studies. Anders and Davis[85, 86] looked at 27 research of mentally retarded people and found that they have lower oral hygiene. Poor dental hygiene in the impaired population has been linked to a lack of ability to grasp instructions, low attention capabilities, and a loss of motor skills and natural abilities, as well as a lack of physical coordination. The general increase in OHI-S scores with increasing age group agrees with prior data, and Grants and Stern concluded that this was attributable to the cumulative effect of plaque and calculus as people get older.[87]

Prevalence of fluorosis

The current study revealed that children with high water fluoride level had a higher prevalence and severity of dental fluorosis. The prevalence of fluorosis in children residing in low fluoride area (<1.2ppm) was 18.33%, which was consistent with the finding by WHO that 20% of the population residing in low fluoride level areas had manifestations of fluorosis.

Fluorosis in India

Srikanth[88], in 2009, pointed out that in India about 62 million people are suffering from various levels of fluorosis, of which 6 million are children below the age of 14 years. It should not come as a surprise that excess fluoride is one of the three major hurdles according to tenth 5-year plan in India. Although the bio mechanism of fluoride in reducing IQ is not clear; but on the basis of the data from

this study, it is evident that excess fluoride in drinking water has neurological toxic effects. Therefore, a close monitoring of fluoride levels in local water supplies from areas with endemic fluorosis and implementing public health measures to reduce the fluoride exposure levels in high fluoridated regions seem necessary.

Limitations of the study

1. Even though there is a minimal bias over confounding factors, a thorough investigation should be carried out to assess the other factors which affects the intelligent quotient of the children.
2. The Raven's questionnaire was only partially completed by a few students. The questions that were not answered, received a score of zero. As a result, it's unclear whether the pupils didn't know the answer or did not attempt the questions. It's possible that 8% of the study participants who scored "intellectually challenged" were owing to unanswered questions.
3. Regardless of the investigator's measures, there is a potential that the pupils will duplicate the responses.
4. Representation of all the Talukas were compromised due to the ongoing global pandemic of COVID19. Further studies can be done by including all the other Talukas to obtain a more comprehensive result.

CONCLUSION AND SUMMARY

The present study was undertaken to assess the relationship between water fluoride level and IQ level of Government school children and its association with their oral hygiene status at different concentration of fluoride in drinking water in the rural areas of Belagavi district, Karnataka. The results of the pilot study were utilized for estimating the sample size. Study population consisted of 540 Government school children of Belagavi district aged 12-15 years based on the fluoride concentration in drinking water. Entire geographical area of Belagavi was divided into 2 strata based on the concentration of naturally occurring fluoride in drinking water. Information on drinking water of Belagavi district was obtained from the Ground water sanitation department office and survey reports of India water-portal organization. Based on the available data, water samples of 5 randomly selected schools were sent to the laboratory for fluoride concentration estimation. Water analysis was done using BIS 3025-SPADNS method. Fluoride concentration in the drinking water of the selected schools ranged from 0.9-1.4 ppm. Based on that, areas were divided into low fluoride area (<1.2 ppm) and medium fluoride area (>1.2 ppm). The supply of drinking water to the study areas was by bore-wells. The population under the study presented a remarkable homogeneity in terms of ethnicity, habitat, socio-economic status, diet and lack of oral hygiene and oral health care services with the exception of fluoride level in the drinking water.

Assessment of intelligence quotient of children was done by using Raven's scale method. It is a nonverbal questionnaire examples of problems contain a matrix of geometrical design with a part removed. The child has to select missing cell from 6 given alternatives. Each child was given a questionnaire that contains 36 questions.

Documentation of other information was done using a self-designed questionnaire. It consisted of 3 parts which included socioeconomic status, oral hygiene status and Ravens questionnaire respectively. Clinical examination was carried out to record DMFT score, OHIS score, Dean's fluorosis index and other dentition status like trauma to the dentition, malocclusion etc.

Among the total subjects, 49% were females and 51% were males. Almost half of the study participants (46.1%) were belonged to lower middle class (III) group of Kuppuswamy classification 2019. More than 80% of the study participants were having "good" oral hygiene status. The maximum ravens score was found to be 30 out of 36 and the minimum score was 6. The mean score was found to be 19.37 with standard deviation 4.55. Among 540 subjects, 22.2% of the students scored below average score. 8.3% students score above 95^{th} percentile. There was a significant association between water fluoride level and intelligence quotient of school children. For every unit change in water fluoride level, the average change in mean of IQ score was found to be -10.571 units. A significant association was found between dental fluorosis and water fluoride level. Prevalence of fluorosis in low water fluoride level was found to be 8.74% and medium level was found to be 43.04%. The mean DMFT of the study population was 4.11+-1.37. The range of DMFT score varied from 1-8.

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ANNEXURE – I - ETHICAL CLEARANCE CERTIFICATE

Research and Ethics Committee
KLE V K INSTITUTE OF DENTAL SCIENCES
KLE University
Accredited 'A' Grade by NAAC Placed in Category 'A' by MHRD (GoI)
Nehru Nagar, Belagavi - 590 010, Karnataka State
☎: 0831-2470362
FAX: 0831-2470640
Web: http://www.kledental-bgm.edu.in
E-mail:principal@kledental-bgm.edu.in

Sl. No. : 1306

CERTIFICATE

This is to Certify that the synopsis titled

FLOURIDE CONCENTRATION OF DRINKING WATER AND ITS ASSOCIATION WITH INTELLIGENCE QUOTIENT AMONG 12 YEARS OLD GOVT. SCHOOL CHILDREN IN BELGAVI DISTRICT - A CROSS SECTIONAL STUDY *Submitted by*

Dr. DEEPIKA . V. *P. G. Student /*

Staff, Guided by DR. ROOPALI SANKESHWARI *from Department of* PUBLIC HEALTH DENTISTRY *has been critically evaluated by committee members and granted ethical clearance to conduct the above mentioned study*

Date :

Member Secretary
Research and Ethical Committee
KLEVK Institute of Dental Sciences
Belagavi

Chairman
Research and Ethical Committee
KLEVK Institute of Dental Sciences
Belagavi

ANNEXURE – II - PERMISSION FROM RSDW DEPT

Date:24/11/2020

From,

Dr. Deepika. V
Post graduate
Department of Public Health Dentistry
KLEVKIDS Belagavi

To,

The Executive Engineer
Rural Drinking water and Sanitation Division
Belagavi

Sir,

Sub: To assess the fluoride level of water samples

I, Dr Deepika. V, second year postgraduate of Department of Public Health Dentistry in KLEVKIDS Belagavi, conducting my thesis on "Fluoride concentration of drinking water and its association with intelligence quotient among 12 years old Government school children in Belagavi district – A cross sectional study" under the guidance of Dr Roopali M Sankeshwari, reader, Department of Public health dentistry KLEVKIDS Belagavi. For that I need to assess the fluoride level of few water samples. I have already approached the office last year for the same purpose but it was postponed due to COVID-19. I request you to provide the water fluoride level of the water samples and do the needful.

Thanking You,

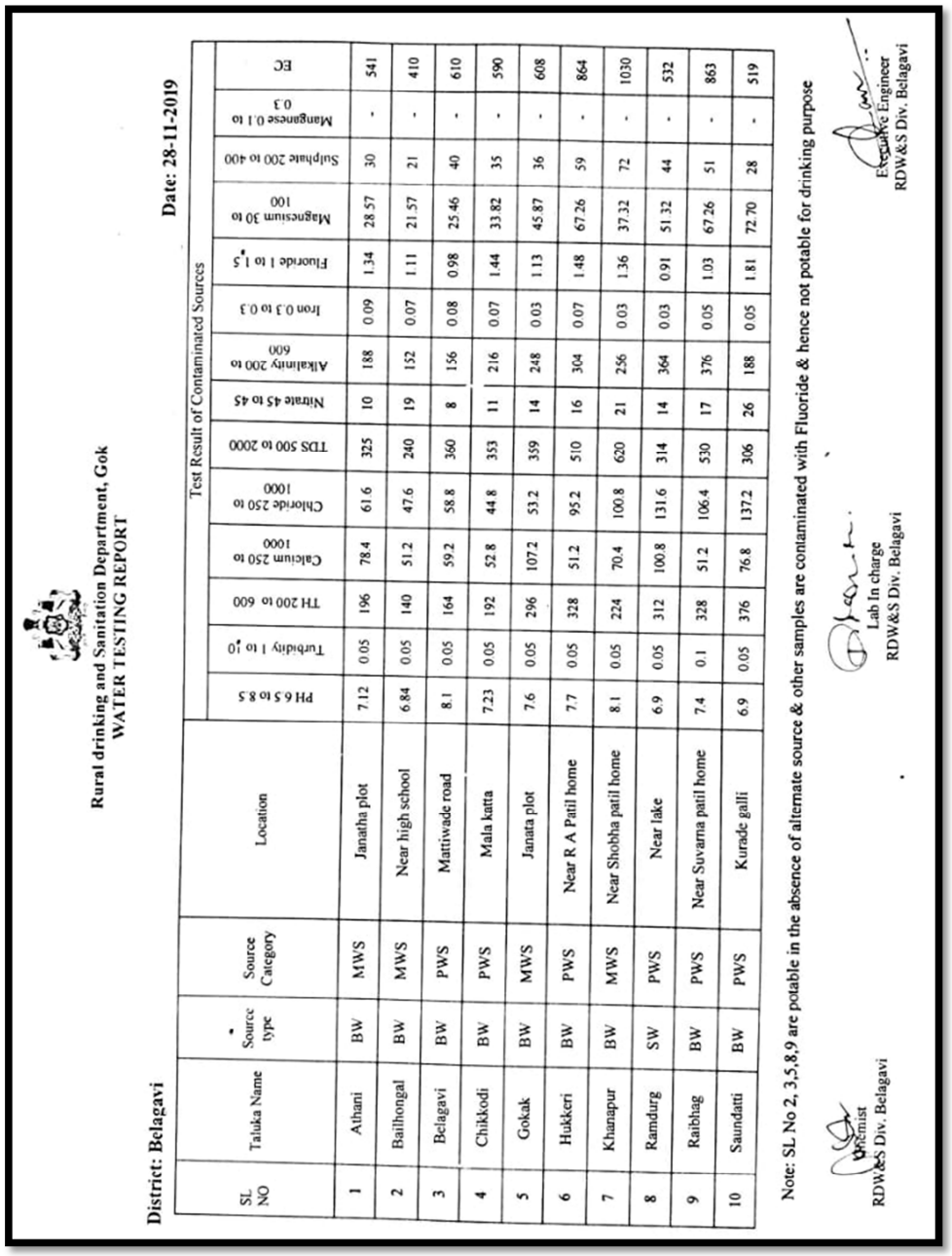
Dr Deepika. V
Post graduate
Department of Public Health Dentistry

Dr. Roopali M Sankeshwri
Guide
Reader, Department of Public Health Dentistry

Dr. Anil V Ankola
Professor and Head
Department of Public Health Dentistry

ANNEXURE – III - ALL TALUKA FLUORIDE REPORT

Water Fluoride level – Belagavi District



Rural drinking and Sanitation Department, Gok
WATER TESTING REPORT

District: Belagavi

Date: 28-11-2019

SL NO	Taluka Name	Source type	Source Category	Location	Test Result of Contaminated Sources														
					PH 6.5 to 8.5	Turbidity 1 to 10	TH 200 to 600	Calcium 250 to 1000	Chloride 250 to 1000	TDS 500 to 2000	Nitrate 45 to 45	Alkalinity 200 to 600	Iron 0.3 to 0.3	Fluoride 1 to 1.5	Magnesium 30 to 100	Sulphate 200 to 400	Manganese 0.1 to 0.3	EC
1	Athani	BW	MWS	Janatha plot	7.12	0.05	196	78.4	61.6	325	10	188	0.09	1.34	28.57	30	-	541
2	Bailhongal	BW	MWS	Near high school	6.84	0.05	140	51.2	47.6	240	19	152	0.07	1.11	21.57	21	-	410
3	Belagavi	BW	PWS	Mattiwade road	8.1	0.05	164	59.2	58.8	360	8	156	0.08	0.98	25.46	40	-	610
4	Chikkodi	BW	PWS	Mala katta	7.23	0.05	192	52.8	44.8	353	11	216	0.07	1.44	33.82	35	-	590
5	Gokak	BW	MWS	Janata plot	7.6	0.05	296	107.2	53.2	359	14	248	0.03	1.13	45.87	36	-	608
6	Hukkeri	BW	PWS	Near R A Patil home	7.7	0.05	328	51.2	95.2	510	16	304	0.07	1.48	67.26	59	-	864
7	Khanapur	BW	MWS	Near Shobha patil home	8.1	0.05	224	70.4	100.8	620	21	256	0.03	1.36	37.32	72	-	1030
8	Ramdurg	SW	PWS	Near lake	6.9	0.05	312	100.8	131.6	314	14	364	0.03	0.91	51.32	44	-	532
9	Raibhag	BW	PWS	Near Suvarna patil home	7.4	0.1	328	51.2	106.4	530	17	376	0.05	1.03	67.26	51	-	863
10	Saundatti	BW	PWS	Kurade galli	6.9	0.05	376	76.8	137.2	306	26	188	0.05	1.81	72.70	28	-	519

Note: SL No 2, 3,5,8,9 are potable in the absence of alternate source & other samples are contaminated with Fluoride & hence not potable for drinking purpose

Chemist
RDW&S Div. Belagavi

Lab In charge
RDW&S Div. Belagavi

Executive Engineer
RDW&S Div. Belagavi

ANNEXURE – IV - FLUORIDE REPORT

Water Analytical Reports

RURAL DRINKING WATER AND SANITATION DEPARTMENT, GoK

District Name: Belagavi Laboratory Name: - Belagavi District Lab

TEST REPORT

Address of the sampling location: Dr. Deepika. V, Chikkodi, District Belagavi	Report Date: 11-08-2021
	Reference: Test request form
	Sample receipt date: 11-08-2021
	Sample code: LAB
	Date of Sampling: 11-08-2021
	Analysis start date: 11-08-2021
	Analysis completion date: 11-08-2021
Sample particulars – Treated water	Sample quantity : 1000 ml

Sl No	Test	Results	Acceptable Limit IS 10500:2012	Permissible Limit IS 10500: 2012	Protocol
Description					
1	pH Value	-	6.5 – 8.5	No relaxation	IS 3025(Part 11): 1983
2	Specific Conductance, µS/cm	-	-	-	IS 3025(Part 14): 1984
3	Turbidity NTU	-	1	5	IS 3025(Part 10): 1984
4	Chloride as Cl, mg/L	-	250	1000	IS 3025(Part 32): 1988
5	Total Hardness as $CaCO_3$, mg/L	-	200	600	IS 3025(Part 21): 2009
6	Calcium as Ca	-	75	200	IS 3025(Part 40): 1991
7	Magnesium as Mg, mg/L	-	30	100	IS 3025(Part 45): 1994
8	Total dissolved solids mg/L	-	500	2000	IS 3025(Part 16): 1984
9	Sulphate as SO_4, mg/L	-	200	400	IS 3025(Part 24): 1986
10	Fluoride as F, mg/L	1.13	1	1.5	APHA 23rd Edition
11	Alkalinity as $CaCO_3$, mg/L	-	200	600	IS 3025(Part 23): 1986
12	Nitrate as NO_3, mg/L	-	45	No relaxation	APHA 23rd Edition
13	Arsenic as As, mg/L	-	0.01	No relaxation	IS 3025(Part 37): 1988
14	Iron as Fe, mg/L		1	No relaxation	IS 3025(Part 53): 2003
15	Total Coliform/ 100ml	-	Shall not be detected in 100ml sample		IS:1622:1981
16	E.coli/100ml	-	Shall not be detected in 100ml sample		IS:1622:1981

Remarks: The above parameter is within permissible limit, as per IS 10500-2012 RA 2018 Drinking water specification

Analyzed by

Senior Analyst/Junior Analyst/ Analyst

Authorized signatory

Quality Manager

RDWSD/WQMSP/TeR/01

Note:

The above results relate only to the sample tested

The report shall not be reproduced except in full without the prior approval of the Quality Manager

Traceability: Traceability of measurements is established using CRMs traceable to National/International standards

Samples will be discarded after 15 days from the date of report generation

Decision rule is applicable as per the procedure mentioned in RDWSD/WQMSP/DR-0

RURAL DRINKING WATER AND SANITATION DEPARTMENT, GoK

District Name: Belagavi Laboratory Name: - Belagavi District Lab

TEST REPORT

Address of the sampling location: Dr. Deepika. V, Chikkodi, District Belagavi	Report Date: 11-08-2021
	Reference: Test request form
	Sample receipt date: 11-08-2021
	Sample code: LAB
	Date of Sampling: 11-08-2021
	Analysis start date: 11-08-2021
	Analysis completion date: 11-08-2021
Sample particulars – Treated water	Sample quantity : 1000 ml

Sl No	Test	Results	Acceptable Limit IS 10500:2012	Permissible Limit IS 10500: 2012	Protocol
Description					
1	pH Value	-	6.5 – 8.5	No relaxation	IS 3025(Part 11): 1983
2	Specific Conductance, µS/cm	-	-	-	IS 3025(Part 14): 1984
3	Turbidity NTU	-	1	5	IS 3025(Part 10): 1984
4	Chloride as Cl, mg/L	-	250	1000	IS 3025(Part 32): 1988
5	Total Hardness as $CaCO_3$, mg/L	-	200	600	IS 3025(Part 21): 2009
6	Calcium as Ca	-	75	200	IS 3025(Part 40): 1991
7	Magnesium as Mg, mg/L	-	30	100	IS 3025(Part 45): 1994
8	Total dissolved solids mg/L	-	500	2000	IS 3025(Part 16): 1984
9	Sulphate as SO_4, mg/L	-	200	400	IS 3025(Part 24): 1986
10	Fluoride as F, mg/L	1.41	1	1.5	APHA 23rd Edition
11	Alkalinity as $CaCO_3$, mg/L	-	200	600	IS 3025(Part 23): 1986
12	Nitrate as NO_3, mg/L	-	45	No relaxation	APHA 23rd Edition
13	Arsenic as As, mg/L	-	0.01	No relaxation	IS 3025(Part 37): 1988
14	Iron as Fe, mg/L		1	No relaxation	IS 3025(Part 53): 2003
15	Total Coliform/ 100ml	-	Shall not be detected in 100ml sample		IS:1622:1981
16	E.coli/100ml	-	Shall not be detected in 100ml sample		IS:1622:1981

Remarks: The above parameter is within permissible limit, as per IS 10500-2012 RA 2018 Drinking water specification

Analyzed by

Senior Analyst/Junior Analyst/ Analyst

Authorized signatory

Quality Manager

RDWSD/WQMSP/TeR/01

Note:

The above results relate only to the sample tested

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Decision rule is applicable as per the procedure mentioned in RDWSD/WQMSP/DR-0

RURAL DRINKING WATER AND SANITATION DEPARTMENT, GoK

District Name: Belagavi Laboratory Name: - Belagavi District Lab

TEST REPORT

Address of the sampling location: Dr. Deepika. V, Bailhongal, District Belagavi			Report Date: 21-07-2021 Reference: Test request form Sample receipt date: 21-07-2021 Sample code: LAB Date of Sampling: 21-07-2021 Analysis start date: 21-07-2021 Analysis completion date: 21-07-2021		
Sample particulars – Treated water			Sample quantity : 1000 ml		
Sl No	Test	Results	Acceptable Limit IS 10500:2012	Permissible Limit IS 10500: 2012	Protocol
Description					
1	pH Value	-	6.5 – 8.5	No relaxation	IS 3025(Part 11): 1983
2	Specific Conductance, µS/cm	-	-	-	IS 3025(Part 14): 1984
3	Turbidity NTU	-	1	5	IS 3025(Part 10): 1984
4	Chloride as Cl, mg/L	-	250	1000	IS 3025(Part 32): 1988
5	Total Hardness as $CaCO_3$, mg/L	-	200	600	IS 3025(Part 21): 2009
6	Calcium as Ca	-	75	200	IS 3025(Part 40): 1991
7	Magnesium as Mg, mg/L	-	30	100	IS 3025(Part 45): 1994
8	Total dissolved solids mg/L	-	500	2000	IS 3025(Part 16): 1984
9	Sulphate as SO_4, mg/L	-	200	400	IS 3025(Part 24): 1986
10	Fluoride as F, mg/L	1.08	1	1.5	APHA 23rd Edition
11	Alkalinity as $CaCO_3$, mg/L	-	200	600	IS 3025(Part 23): 1986
12	Nitrate as NO_3, mg/L	-	45	No relaxation	APHA 23rd Edition
13	Arsenic as As, mg/L	-	0.01	No relaxation	IS 3025(Part 37): 1988
14	Iron as Fe, mg/L		1	No relaxation	IS 3025(Part 53): 2003
15	Total Coliform/ 100ml	-	Shall not be detected in 100ml sample		IS:1622:1981
16	E.coli/100ml	-	Shall not be detected in 100ml sample		IS:1622:1981
Remarks: The above parameter is within permissible limit, as per IS 10500-2012 RA 2018 Drinking water specification					
Analyzed by Senior Analyst/Junior Analyst/ Analyst				Authorized signatory Quality Manager	

RDWSD/WQMSP/TeR/01

Note:

The above results relate only to the sample tested

The report shall not be reproduced except in full without the prior approval of the Quality Manager

Traceability: Traceability of measurements is established using CRMs traceable to National/International standards

Samples will be discarded after 15 days from the date of report generation

Decision rule is applicable as per the procedure mentioned in RDWSD/WQMSP/DR-0

RURAL DRINKING WATER AND SANITATION DEPARTMENT, GoK

District Name: Belagavi Laboratory Name: - Belagavi District Lab

TEST REPORT

Address of the sampling location: Dr. Deepika. V, Belagavi, District Belagavi	Report Date: 12-07-2021
	Reference: Test request form
	Sample receipt date: 12-07-2021
	Sample code: LAB
	Date of Sampling: 12-07-2021
	Analysis start date: 12-07-2021
	Analysis completion date: 12-07-2021
Sample particulars – Treated water	Sample quantity : 1000 ml

Sl No	Test	Results	Acceptable Limit IS 10500:2012	Permissible Limit IS 10500: 2012	Protocol
Description					
1	pH Value	-	6.5 – 8.5	No relaxation	IS 3025(Part 11): 1983
2	Specific Conductance, µS/cm	-	-	-	IS 3025(Part 14): 1984
3	Turbidity NTU	-	1	5	IS 3025(Part 10): 1984
4	Chloride as Cl, mg/L	-	250	1000	IS 3025(Part 32): 1988
5	Total Hardness as $CaCO_3$, mg/L	-	200	600	IS 3025(Part 21): 2009
6	Calcium as Ca	-	75	200	IS 3025(Part 40): 1991
7	Magnesium as Mg, mg/L	-	30	100	IS 3025(Part 45): 1994
8	Total dissolved solids mg/L	-	500	2000	IS 3025(Part 16): 1984
9	Sulphate as SO_4, mg/L	-	200	400	IS 3025(Part 24): 1986
10	Fluoride as F, mg/L	0.98	1	1.5	APHA 23rd Edition
11	Alkalinity as $CaCO_3$, mg/L	-	200	600	IS 3025(Part 23): 1986
12	Nitrate as NO_3, mg/L	-	45	No relaxation	APHA 23rd Edition
13	Arsenic as As, mg/L	-	0.01	No relaxation	IS 3025(Part 37): 1988
14	Iron as Fe, mg/L		1	No relaxation	IS 3025(Part 53): 2003
15	Total Coliform/ 100ml	-	Shall not be detected in 100ml sample		IS:1622:1981
16	E.coli/100ml	-	Shall not be detected in 100ml sample		IS:1622:1981

Remarks: The above parameter is within permissible limit, as per IS 10500-2012 RA 2018 Drinking water specification

Analyzed by

Senior Analyst/Junior Analyst/ Analyst

Authorized signatory

Quality Manager

RDWSD/WQMSP/TeR/01

Note:

1) The above results relate only to the sample tested
2) The report shall not be reproduced except in full without the prior approval of the Quality Manager
3) Traceability: Traceability of measurements is established using CRMs traceable to National/International standards
4) Samples will be discarded after 15 days from the date of report generation
5) Decision rule is applicable as per the procedure mentioned in RDWSD/WQMSP/DR-0

RURAL DRINKING WATER AND SANITATION DEPARTMENT, GoK

District Name: Belagavi Laboratory Name: - Belagavi District Lab

TEST REPORT

Address of the sampling location: Dr. Deepika. V, Belagavi, District Belagavi			Report Date: 09-11-2021 Reference: Test request form Sample receipt date: 09-11-2021 Sample code: LAB Date of Sampling: 09-11-2021 Analysis start date: 09-11-2021 Analysis completion date: 09-11-2021		
Sample particulars – Treated water			Sample quantity : 1000 ml		
Sl No	Test	Results	Acceptable Limit IS 10500:2012	Permissible Limit IS 10500: 2012	Protocol
Description					
1	pH Value	-	6.5 – 8.5	No relaxation	IS 3025(Part 11): 1983
2	Specific Conductance, µS/cm	-	-	-	IS 3025(Part 14): 1984
3	Turbidity NTU	-	1	5	IS 3025(Part 10): 1984
4	Chloride as Cl, mg/L	-	250	1000	IS 3025(Part 32): 1988
5	Total Hardness as $CaCO_3$, mg/L	-	200	600	IS 3025(Part 21): 2009
6	Calcium as Ca	-	75	200	IS 3025(Part 40): 1991
7	Magnesium as Mg, mg/L	-	30	100	IS 3025(Part 45): 1994
8	Total dissolved solids mg/L	-	500	2000	IS 3025(Part 16): 1984
9	Sulphate as SO_4, mg/L	-	200	400	IS 3025(Part 24): 1986
10	Fluoride as F, mg/L	0.95	1	1.5	APHA 23rd Edition
11	Alkalinity as $CaCO_3$, mg/L	-	200	600	IS 3025(Part 23): 1986
12	Nitrate as NO_3, mg/L	-	45	No relaxation	APHA 23rd Edition
13	Arsenic as As, mg/L	-	0.01	No relaxation	IS 3025(Part 37): 1988
14	Iron as Fe, mg/L		1	No relaxation	IS 3025(Part 53): 2003
15	Total Coliform/ 100ml	-	Shall not be detected in 100ml sample		IS:1622:1981
16	E.coli/100ml	-	Shall not be detected in 100ml sample		IS:1622:1981
Remarks: The above parameter is within permissible limit, as per IS 10500-2012 RA 2018 Drinking water specification					
Analyzed by Senior Analyst/Junior Analyst/ Analyst				Authorized signatory Quality Manager	

RDWSD/WQMSP/TeR/01

Note:
The above results relate only to the sample tested
The report shall not be reproduced except in full without the prior approval of the Quality Manager
Traceability: Traceability of measurements is established using CRMs traceable to National/International standards
Samples will be discarded after 15 days from the date of report generation
Decision rule is applicable as per the procedure mentioned in RDWSD/WQMSP/DR-0

ANNEXURE – V - PERMISSION FROM PRINICIPAL

Permission letter

From,

Dr. Deepika. V
Second year postgraduate
Department of Public health dentistry
KLEVKIDS, Belagavi

To,

The Principal
KLEVKIDS, Belagavi

Sub: **Request for provision of Dental Van and required armamentarium for conducting my thesis**

Respected Ma'am,

I would like to start data collection for my thesis titled **"Fluoride concentration of drinking water and its association with intelligence quotient among 12 years old Government school children in Belagavi district – A cross sectional study"** from 22nd March 2021 onwards. Kindly provide the permission to use Mobile dental van and other armamentarium. I have attached the list of armamentarium required along with this letter.
Kindly do the needful.

Thanking You,

Dr. Deepika. V
Postgraduate

Dr. Roopali M Sankeshwari PhD, MDS
Reader, Guide

Dr. Anil .V. Ankola
Head of the department

Required Armamentarium

1. Mobile dental van with Driver
2. 4 Interns and 1 assisting postgraduate
3. 100 set of diagnostic instruments
4. 1 Non-teaching staff

Permitted

PRINCIPAL
KLE V.K. Institute of Dental Sciences
Nehru Nagar, BELAGAVI-590010

ANNEXURE – VI – SCHOOL PERMISSIONS

K L E
VISHWANATH KATTI
INSTITUTE OF DENTAL SCIENCES
Dept of Public Health Dentistry
J.N.M.C. Campus, Nehru Nagar, Belgaum-590 010, Karnataka, India
☎: 0831-2470362
FAX: 0831-2470640
Web: http://www.kledental-bgm.edu.in
E-mail: principal@kledental-bgm.edu.in

Permission letter

Belagavi
28/10/2021

From,

Dr. Anil V Ankola
Professor and Head
Department of Public Health Dentistry
KLEVKIDS Belagavi

To,

The School Principal
Government Kannada Higher Primary School, Kothali
Chikkodi
Belagavi district
Karnataka

Respected Sir/Madam,

Sub: Request for conducting a dental camp

Hereby Introducing Dr. Deepika. V, final year postgraduate of Department of Public Health Dentistry, KLEVKIDS Belagavi, conducting a study on "Assessment of relationship between water fluoride level and IQ level of Government school children in Belagavi District – A cross-sectional study" under the guidance of Dr. Roopali Sankeshwari, reader, Department of Public Health Dentistry. Kindly allow her to conduct the study in your prestigious institution.

Thanking You

You're sincerely,

Dr. Anil V. Ankola
Professor & Head
Department of Public Health Dentistry
Professor and Head
Dept of Public Health Dentistry
KLE VK Institute of Dental Scienc...
Nehru Nagar, Belgaum-10

The School Principal
Government Kannada Higher Primary School, Kothali
Chikkodi
Belagavi district

KLE
VISHWANATH KATTI
INSTITUTE OF DENTAL SCIENCES
Dept of Public Health Dentistry
J.N.M.C. Campus, Nehru Nagar, Belgaum-590 010, Karnataka, India
☎: 0831-2470362
FAX: 0831-2470640
Web: http://www.kledental-bgm.edu.in
E-mail: principal@kledental-bgm.edu.in

Permission letter

Belagavi
28/10/2021

From,

Dr. Anil V Ankola
Professor and Head
Department of Public Health Dentistry
KLEVKIDS Belagavi

To,

The School Principal
Government High School, Bailhongal
Belagavi district
Karnataka

Respected Sir/Madam,

Sub: Request for conducting a dental camp

Hereby Introducing Dr. Deepika. V, final year postgraduate of Department of Public Health Dentistry, KLEVKIDS Belagavi, conducting a study on "Assessment of relationship between water fluoride level and IQ level of Government school children in Belagavi District – A cross-sectional study" under the guidance of Dr. Roopali Sankeshwari, reader, Department of Public Health Dentistry. Kindly allow her to conduct the study in your prestigious institution.

Thanking You

You're sincerely,

Dr. Anil V. Ankola
Professor & Head
Department of Public Health Dentistry
Professor and Head
Dept. of Public Health Dentistry
KLE VK Institute of Dental Scien...
Nehru Nagar, Belgaum

The School Principal
Government High School, Bailhongal
Belagavi district
Karnataka

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INSTITUTE OF DENTAL SCIENCES
Dept of Public Health Dentistry
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☎: 0831-2470362
FAX: 0831-2470640
Web: http://www.kledental-bgm.edu.in
E-mail: principal@kledental-bgm.edu.in

Permission letter

Belagavi
28/10/2021

From,

Dr. Anil V Ankola
Professor and Head
Department of Public Health Dentistry
KLEVKIDS Belagavi

To,

The School Principal
Shri Siddharameshwar High School, Nehru Nagara
Belagavi district
Karnataka

Respected Sir/Madam,

Sub: Request for conducting a dental camp

Hereby Introducing Dr. Deepika. V, final year postgraduate of Department of Public Health Dentistry, KLEVKIDS Belagavi, conducting a study on "Assessment of relationship between water fluoride level and IQ level of Government school children in Belagavi District – A cross-sectional study" under the guidance of Dr. Roopali Sankeshwari, reader, Department of Public Health Dentistry. Kindly allow her to conduct the study in your prestigious institution.

Thanking You

You're sincerely,

Dr. Anil V. Ankola
Professor & Head
Department of Public Health Dentistry
Professor and Head
Dept. of Public Health Dentistry
KLE VK Institute of Dental Scien...
Nehru Nagar, Belgaum-59...

The School Principal
Shri Siddharameshwar High School,
Nehru Nagara
Belagavi district

K L E
VISHWANATH KATTI
INSTITUTE OF DENTAL SCIENCES
Dept of Public Health Dentistry
J.N.M.C. Campus, Nehru Nagar, Belgaum-590 010, Karnataka, India
☎: 0831-2470362
FAX: 0831-2470640
Web: http://www.kledental-bgm.edu.in
E-mail: principal@kledental-bgm.edu.in

Permission letter

Belagavi
28/10/2021

From,

Dr. Anil V Ankola
Professor and Head
Department of Public Health Dentistry
KLEVKIDS Belagavi

To,

The School Principal
Government Kannada Medium School, Chinchani
Chikkodi
Belagavi district
Karnataka

Respected Sir/Madam,

Sub: Request for conducting a dental camp

Hereby Introducing Dr. Deepika. V, final year postgraduate of Department of Public Health Dentistry, KLEVKIDS Belagavi, conducting a study on "Assessment of relationship between water fluoride level and IQ level of Government school children in Belagavi District – A cross-sectional study" under the guidance of Dr. Roopali Sankeshwari, reader, Department of Public Health Dentistry. Kindly allow her to conduct the study in your prestigious institution.

Thanking You

You're sincerely,

Dr. Anil V. Ankola
Professor & Head
Department of Public Health Dentistry

Professor and Head
Dept of Public Health Dentistry
KLE VK Institute of Dental Scien...
Nehru Nagar, Belgaum-58

The School Principal
Government Kannada Medium School,
Chinchani, Chikkodi
Belagavi district

K L E
VISHWANATH KATTI
INSTITUTE OF DENTAL SCIENCES
Dept of Public Health Dentistry
J.N.M.C. Campus, Nehru Nagar, Belgaum-590 010, Karnataka, India
☎: 0831-2470362
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Web: http://www.kledental-bgm.edu.in
E-mail: principal@kledental-bgm.edu.in

Permission letter

Belagavi
28/10/2021

From,

Dr. Anil V Ankola
Professor and Head
Department of Public Health Dentistry
KLEVKIDS Belagavi

To,

The School Principal
Sardar High school, Belagavi
Belagavi district
Karnataka

Respected Sir/Madam,

Sub: Request for conducting a dental camp

Hereby Introducing Dr. Deepika. V, final year postgraduate of Department of Public Health Dentistry, KLEVKIDS Belagavi, conducting a study on "Assessment of relationship between water fluoride level and IQ level of Government school children in Belagavi District – A cross-sectional study" under the guidance of Dr. Roopali Sankeshwari, reader, Department of Public Health Dentistry. Kindly allow her to conduct the study in your prestigious institution.

Thanking You

You're sincerely,

Dr. Anil V. Ankola
Professor & Head
Department of Public Health Dentistry
Professor and Head
Dept of Public Health Dentistry
KLE VK Institute of Dental Scien...
Nehru Nagar, Belgaum-...

The School Principal
Sardar High school, Belagavi
Belagavi district
Karnataka

ANNEXURE – VII - INFORMED CONSENT

ಅಸೆಂಟ್ಫಾರ್ಮ್

ಕೆಎಲ್ಇ ಅಕಾಡೆಮಿ ಆಫ್ಹಾಯರ್ ಎಜುಕೇಶನ್ ಅಂಡ್ರಿಸರ್ಚ್,

ಕೆ.ಎಲ್.ಇ.ವಿ.ಕೆಇನಿಸ್ಟಿಟ್ಯೂಟ್ ಆಫ್ಡೆಂಟಲ್ಸೈನ್ಸಸ್, ಬೆಳಗಾವಿ

ಸಾರ್ವಜನಿಕಆರೋಗ್ಯದಂತವೈದ್ಯಕೀಯಇಲಾಖೆ

ನನ್ನಹೆಸರುಡಾ.ದೀಪಿಕಾ. ವಿ

ನಾನುಸಾರ್ವಜನಿಕಆರೋಗ್ಯದಂತವೈದ್ಯ. ನಾನು "ಕುಡಿಯುವನೀರಿನಫ್ಲೋರೈಡಾನ್ರಂದ್ರತೆಮತ್ತುಬೇಲಗವಿಜಿಲ್ಲೆಯ 12 ವರ್ಷವಯಸ್ಸಿನಸರ್ಕಾರಿಶಾಲಾಮಕ್ಕಳಲ್ಲಿಗುಪ್ತಚರಆಂಶದೊಂದಿಗೆಅದರಸಂಬಂಧ - ಒಂದುಅಡ್ಡವಿಭಾಗೀಯಅಧ್ಯಯನ" ಕುರಿತುನಾನುಅಧ್ಯಯನಮಾಡುತ್ತಿದ್ದೇನೆ.

ಈಅಧ್ಯಯನದಬಗ್ಗೆನೀವುಹೊಂದಿರುವಯಾವುದೇಸಮಯದಲ್ಲಿನೀವುಪ್ರಶ್ನೆಗಳನ್ನುಕೇಳಬಹುದು.
ಅಲ್ಲದೆ,ನೀವುಯಾವುದೇಸಮಯದಲ್ಲಿಮುಗಿಸಬಾರದೆಂದುನಿರ್ಧರಿಸಿದರೆ, ನೀವುಬಯಸಿದಾಗಲೆಲ್ಲಾನೀವುನಿಲ್ಲಿಸಬಹುದು.
ಈಕಾಗದಕ್ಕೆಸಹಿಮಾಡುವುದುಎಂದರೆನೀವುಇದನ್ನುಓದಿದ್ದೀರಿಅಥವಾಅದನ್ನುನಿಮಗೆಓದಿದ್ದೀರಿಮತ್ತುನೀವುಅಧ್ಯಯನದಲ್ಲಿರಲು ಬಯಸುತ್ತೀರಿಎಂದರ್ಥ. ನೀವುಅಧ್ಯಯನದಲ್ಲಿರಲುಬಯಸದಿದ್ದರೆ, ಕಾಗದಕ್ಕೆಸಹಿಮಾಡಬೇಡಿ.
ಈಕೆಲಸಗಳನ್ನುಮಾಡಲುನಾನುನಿಮ್ಮನ್ನುಕೇಳುತ್ತಿದ್ದೇನೆಎಂದುನಿಮ್ಮಪೋಷಕರಿಗೆತಿಳಿದಿದೆ.
ಅಧ್ಯಯನದಲ್ಲಿರುವುದುನಿಮಗೆಬಿಟ್ಟದ್ದುಎಂದುನೆನಪಿಡಿ,
ಮತ್ತುನೀವುಕಾಗದಕ್ಕೆಸಹಿಮಾಡದಿದ್ದಲ್ಲಿಅಥವಾನಂತರನಿಮ್ಮಮನಸ್ಸನ್ನುಬದಲಾಯಿಸಿದರೂಯಾರೂಕೋಪಗೊಳ್ಳುವುದಿಲ್ಲ.

ಭಾಗವಹಿಸುವವರಸಹಿ ದಿನಾಂಕ

ತನಿಖಾಧಿಕಾರಿಯಸಹಿ ದಿನಾಂಕ

PH: 7353336101

9844837197

ಸಮ್ಮತಿ ಪತ್ರ

ಸಾರ್ವಜನಿಕಆರೋಗ್ಯದಂತವೈದ್ಯಶಾಸ್ತ್ರ
ಕೆಎಲ್ಇ ವಿ.ಕ.ದಂತ ಮಹಾವಿದ್ಯಾಲಯ

ನಾನು ಶ್ರೀ/ಶ್ರೀಮತಿ_____ಎಲ್ಲ ಮಾಹಿತಿಯನ್ನು
ಪಡೆದುಕೊಂಡಿದ್ದೇನೆಮತ್ತು ನನ್ನ ಮಗ/ಮಗಳು_____
ವಯಸ್ಸು_____ಈ ಸಂಶೋಧನೆಯಲ್ಲಿ ಭಾಗವಹಿಸಲು ಅನುಮತಿಯನ್ನು ನೀಡಿ ಸಹಕರಿಸುತ್ತೇನೆ.

೧. ನನ್ನ ಮಗ/ಮಗಳ ಬಗ್ಗೆಎಲ್ಲಾ ಮಾಹಿತಿ– ಹೆಸರು, ವಯಸ್ಸು, ಆರೋಗ್ಯದ ಬಗ್ಗೆ ಮಾಹಿತಿ ಕೊಡಲು ಒಪ್ಪುತ್ತೇನೆ.

೨. ನನ್ನ ಮಗ/ಮಗಳ ಬಾಯಿಯ ತಪಾಸನೆ ಹಾಗು ಚಿಕಿತ್ಸೆ ಮಾಡಲು ಸಹಕರಿಸುತ್ತೇನೆ.

೩. ನನ್ನ ಮಗ/ಮಗಳ ಬಾಯಿಯ ಹುಳುಕು ಹಲ್ಲುಗಳನ್ನು ಸ್ವಚ್ಚಗೊಳಿಸಿ ಬೇರು ನಾಳಿನ ಚಿಕಿತ್ಸೆ ಮಾಡಲು ಸಹಮತಿಯನ್ನು ನಿಡುತ್ತೇನೆ.

೪. ನಾನು ತಜ್ಞರು ಕೊಟ್ಟಿರುವ ಸೂಚನೆಗಳನ್ನು ಪಾಲಿಸುತ್ತೇನೆ.

೫. ಈ ಸಂಶೋಧನೆಯನ್ನು ಪ್ರಕಟಿಸಲು ಅನುಮತಿಯನ್ನು ಕೊಡುತ್ತೇನೆ.

೬. ನನ್ನ ಮಗ/ಮಗಳುಭಾಗವಹಿಸಿದ್ದಕ್ಕೆ ಪ್ರತಿಯಾಗಿ ಏನೂ ಕೇಳುವುದಿಲ್ಲ.

೭. ಈ ಚಿಕಿತ್ಸೆಯಲ್ಲಿ ಏನಾದರು ತೊಂದರೆಯಾದಲ್ಲಿ ತಜ್ಞರು ಎಲ್ಲಾ ಜವಾಬ್ದಾರಿಯನ್ನು ತೆಗೆದುಕೊಳ್ಳುತ್ತಾರೆ.

೮. ಯಾವುದೇಕಾರಣಕ್ಕಾಗಿ ನನ್ನ ಮಗ/ಮಗಳು ಭಾಗವಹಿಸಿದ್ದಲ್ಲಿ ಹಿಂತೆಗೆದುಕೊಳ್ಳಬಹುದು.

೯. ಎಲ್ಲಾ ಮಾಹಿತಿಯನ್ನುಗುಪ್ತವಾಗಿಡಲಾಗುವುದು.

೧೦. ಈ ಸಂಶೋಧನೆಯಲ್ಲಿಭಾಗವಹಿಸುವುದರಿಂದಯಾವ ಹಾನಿ/ಅಪಾಯಇಲ್ಲ.

೧೧. ಬೇರೆಚಿಕಿತ್ಸೆ ಬಗ್ಗೆಮಾಹಿತಿಕೊಡಲಾಗುವುದು.

ನಾನು ಮೇಲೆ ತಿಳಿಸಿದ ಎಲ್ಲಾವಿಷಯವನ್ನುಓದಿದ್ದೇನೆ ಮತ್ತುಅರ್ಥಮಾಡಿಕೊಂಡು ಸಹಿ ಮಾಡಿದ್ದೇನೆ.

ದಂತ ವೈದ್ಯರ ಹೆಸರು: **ಡಾ: ದೀಪಿಕಾವಿ**
ವಿಳಾಸ: **ಸಾರ್ವಜನಿಕಆರೋಗ್ಯದಂತವೈದ್ಯಶಾಸ್ತ್ರ**
ಕೆ ಎಲ್ಇ ವಿ.ಕ.ದಂತ ಮಹಾವಿದ್ಯಾಲಯ
ಬೆಳಗಾವಿ–೧೦

ಪಾಲಕರ ಹೆಸರು: **ಪಾಲಕರ ಸಹಿ:**

ಸಾಕ್ಷಿ ಹೆಸರು: **ಸಾಕ್ಷಿ ಸಹಿ:**

ದಿನಾಂಕ: **ಊರು:**

PH: 7353336101

9844837197

ANNEXURE – VII - STUDY PROFORMA

KLE VK INSTITUTE OF DENTAL SCIENCES, BELAGAVI

DEPARTMENT OF PUBLIC HEALTH DENTISTRY

Relationship between water fluoride level and IQ level of 12 year old Government school children of Belagavi District ; A cross-sectional study

SlNo:…….Name:……Age:……Date:……...

Gender: 1. Male 2. Female

Taluka:…….

Socioeconomic status:

I) **Occupation of the Head**

1. Legislators, Senior Officials & Managers - 10
2. Professionals - 9
3. Technicians and Associate Professionals - 8
4. Clerks - 7
5. Skilled Workers and Shop & Market Sales Workers - 6
6. Skilled Agricultural & Fishery Workers - 5
7. Craft & Related Trade Workers - 4
8. Plant & Machine Operators and Assemblers - 3
9. Elementary Occupation - 2
10. Unemployed - 1

II) Education of the head

1. Profession or Honours - 7
2. Graduate - 6
3. Intermediate or diploma - 5
4. High school certificate - 4
5. Middle school certificate - 3
6. Primary school certificate -2
7. Illiterate - 1

III) Family Income

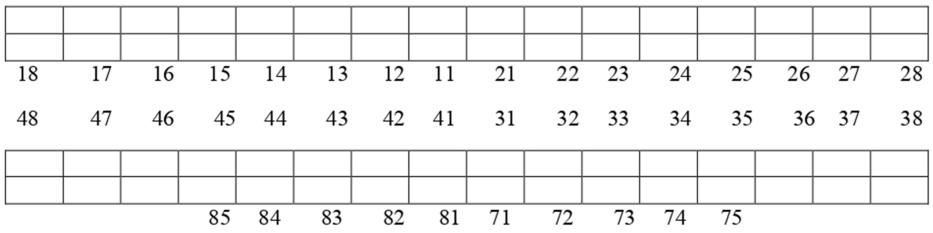
	Score	
1.	1	>78063
2.	2	39033 – 78062
3.	3	29200 – 39032
4.	4	19516 – 29199
5.	6	11708 – 19515
6.	10	3908 – 11707
7.	12	<3907

Socioeconomic Status - Score

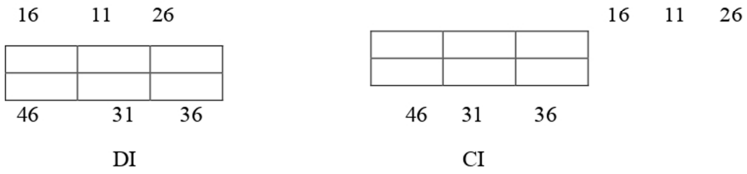
SL NO	SCORE	SES
1	26-29	Upper(I)
2	16-25	Upper Middle(II)
3	11-15	Lower Middle(III)
4	05-10	Upper Lower(IV)
5	<5	Lower(V)

1) Hard Tissue examination:

55 54 53 52 51 61 62 63 64 65



2) OHI-S Index:



3) Gingival Inflammation: 1) Present 2) Absent

4) Dental Trauma: 1) Present 2) Absent

In relation with:……. Cause:…….

Type: 1) Ellis Class I 2) Ellis Class II 3) Ellis Class III

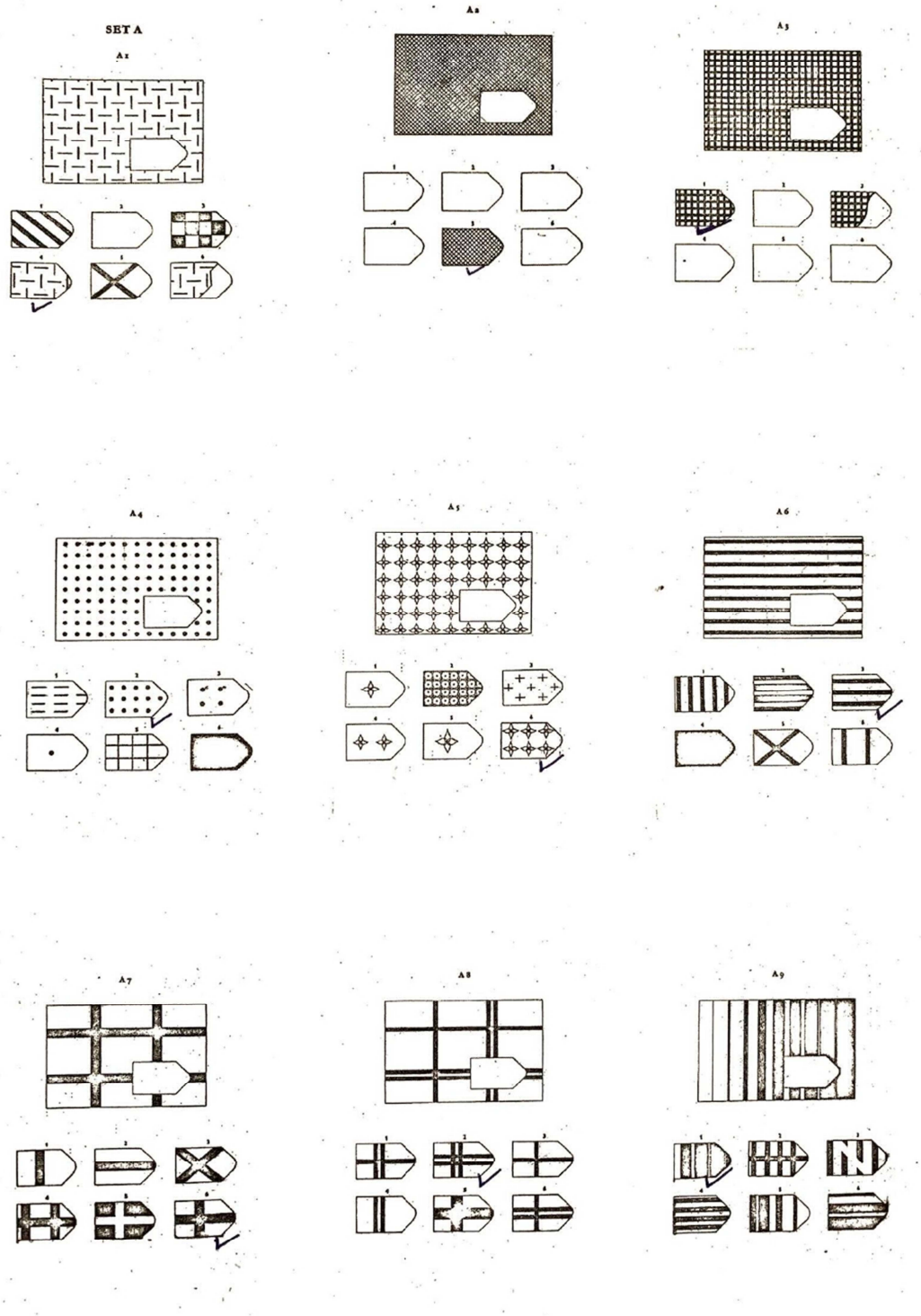
5) Type of Malocclusion: 1) Angle's Class I 2) Angle's Class II 3) Angle's Class III

6) Dental anomalies: 1)Talon's cusp 2) Fusion 3) Supernumerary teeth 4) Peg laterals 5) Microdontia 6) Hypodontia 7)Any other

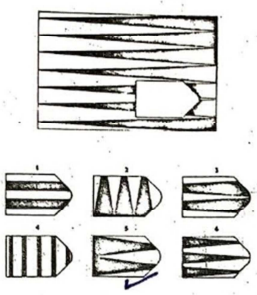
7) Dean fluorosis Index:
Two most affected teeth: ☐ ☐
Score:
   1. Normal - 0
   2. Questionable – 0.5
   3. Very Mild - 1
   4. Mild - 2
   5. Moderate - 3
   6. Severe - 4

8) Lower frenal attachment: 1) High 2) Low 3) Absent

9) Lip coverage: 1) Competent 2) Incompetent


SET A
A1
A2
A3
A4
A5
A6
A7
A8
A9

A10



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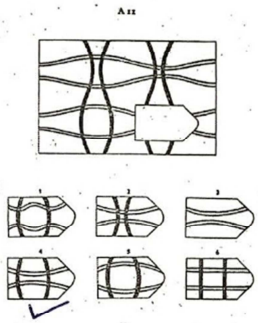

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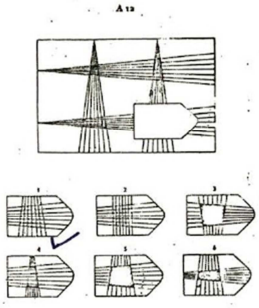
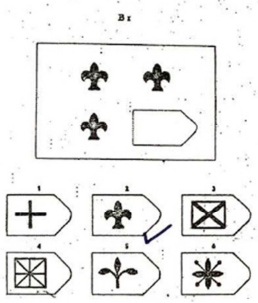
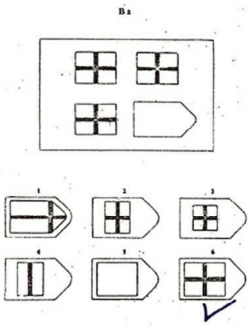


SET B

B1



B2



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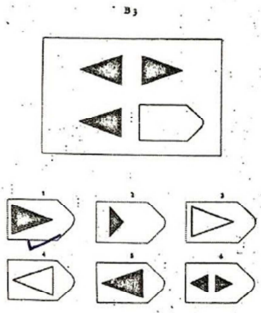
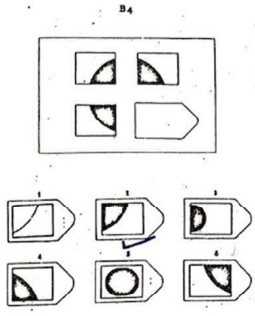


B4



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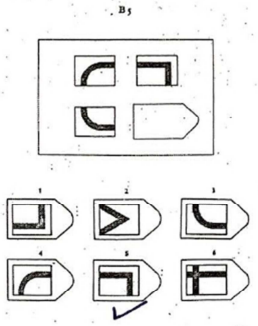
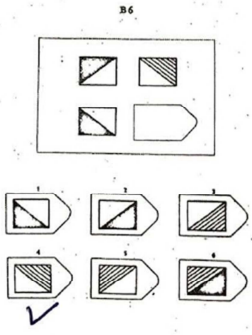
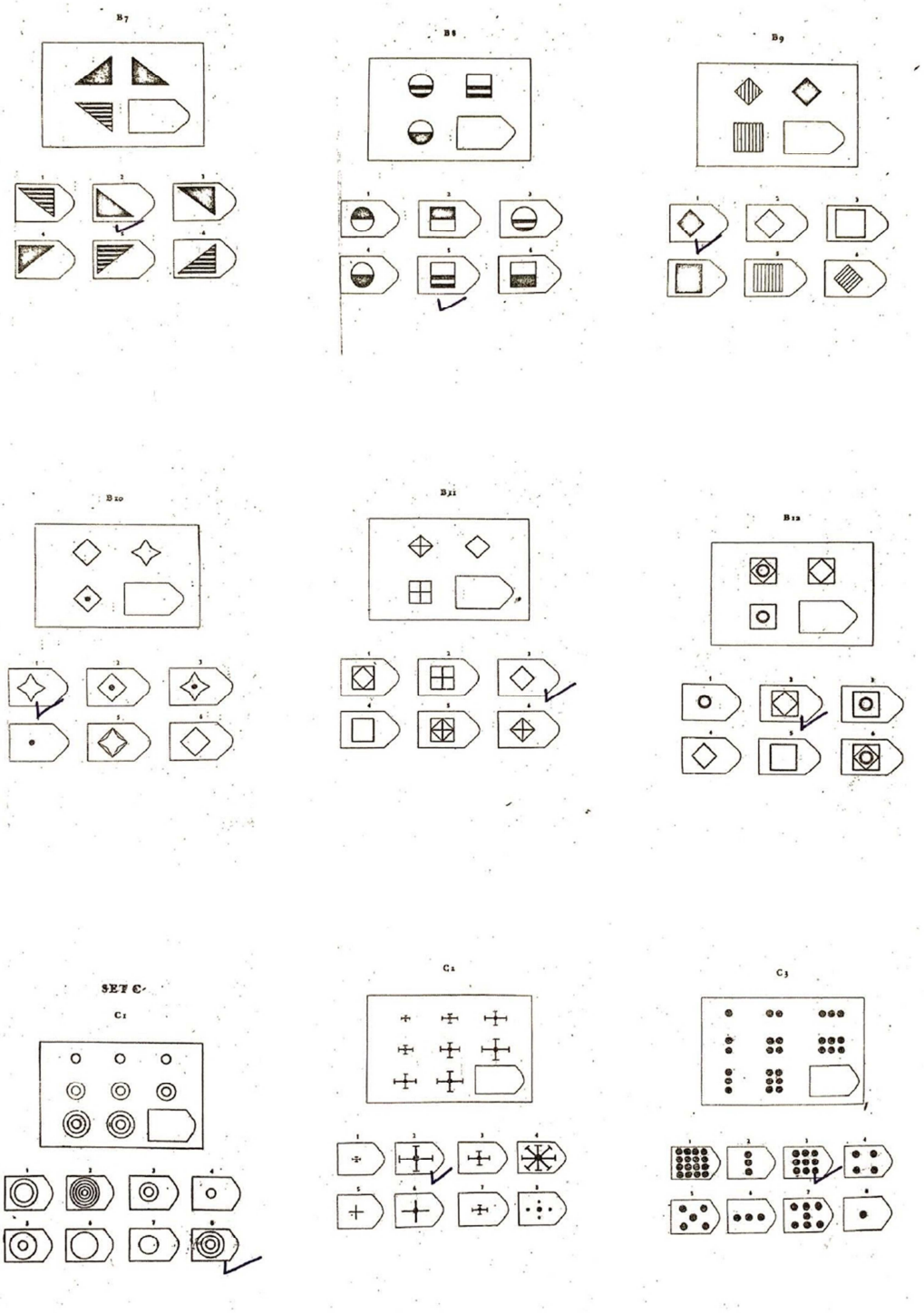
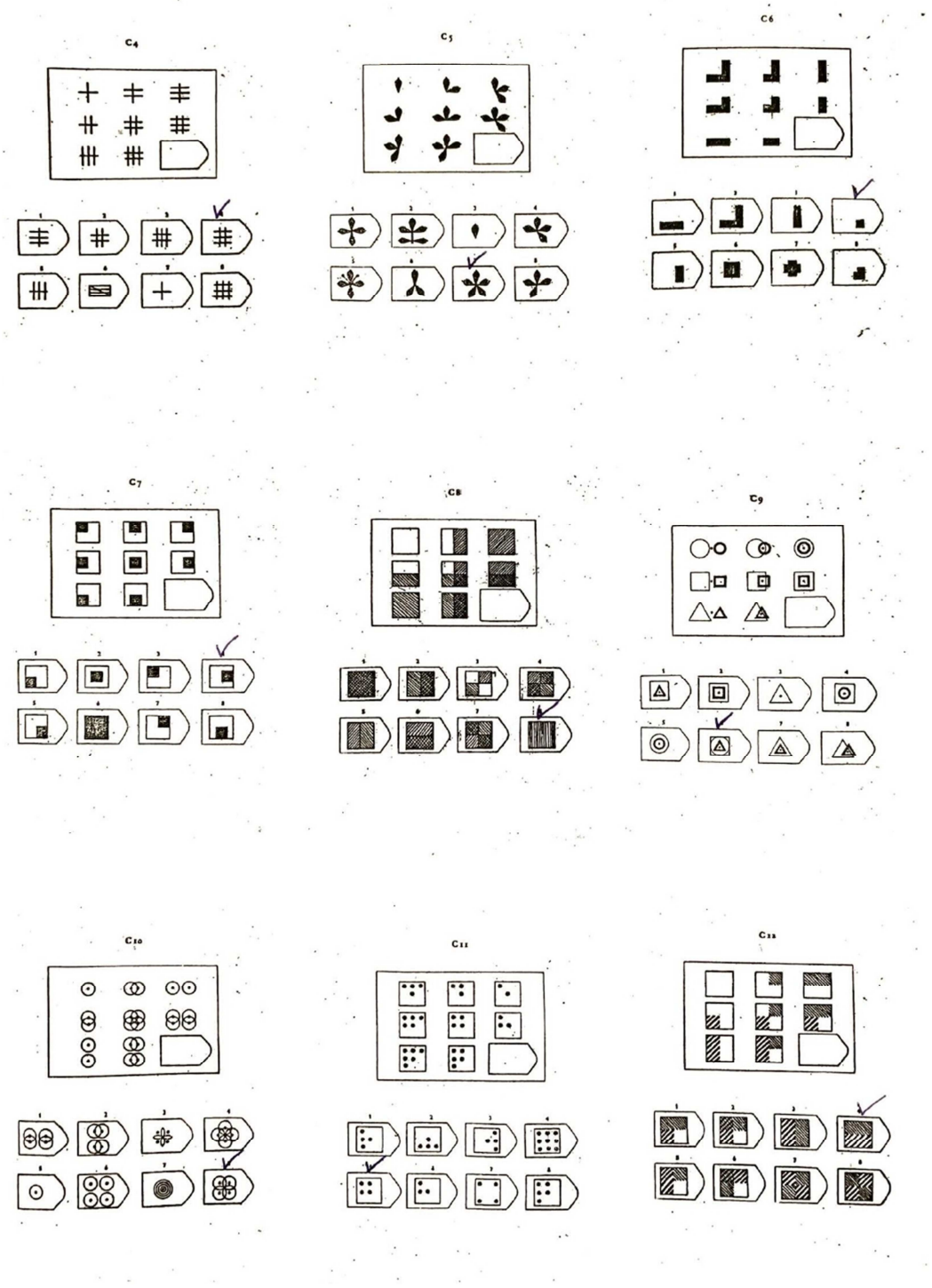


B6




B7
B8
B9
B10
B11
B12
SET C
C1
C1
C3


C4
C5
C6
C7
C8
C9
C10
C11
C12

ANNEXURE – VIII - DENTAL INDICES

1. DECAYED - MISSING - FILLED TEETH INDEX (DMFT INDEX)

The Decayed Missing -Filled Teeth Index (DMFT Index) was developed by Henry T. Klein, Carrole E. Palmer and Knutson J. W. in 1938 to determine the prevalence of coronal caries.

Procedure

The DMFT Index is applied only to permanent teeth. It is composed of three components,

D- Used to describe decayed teeth.

M- Used to describe missing teeth due to caries

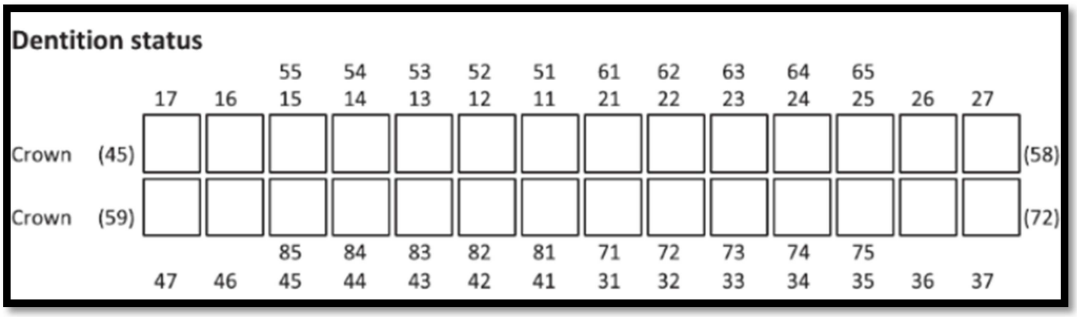
F- Used to describe teeth that have been previously filled due to caries.

Instruments used

- Mouth mirror

-Explorer

Calculation of the Index:

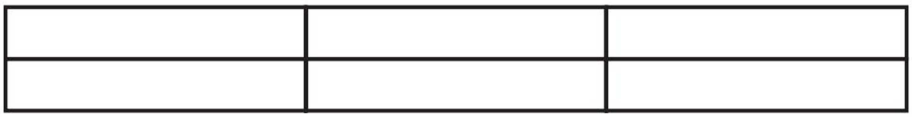


2. SIMPLIFIED ORAL HYGIENE INDEX (OHI-S)

(John C. Greene and Jack R. Vermillion in 1964)

DEBRIS INDEX–SIMPLIFIED (DI-S)

16 11 26



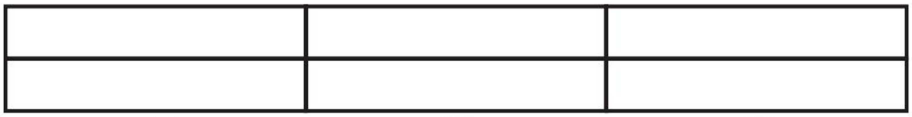
46 31 36

DI-S = Total score/no. of surfaces scored

= Interpretation = _____

CALCULUS INDEX–SIMPLIFIED (CI-S)

16 11 26



46 31 36

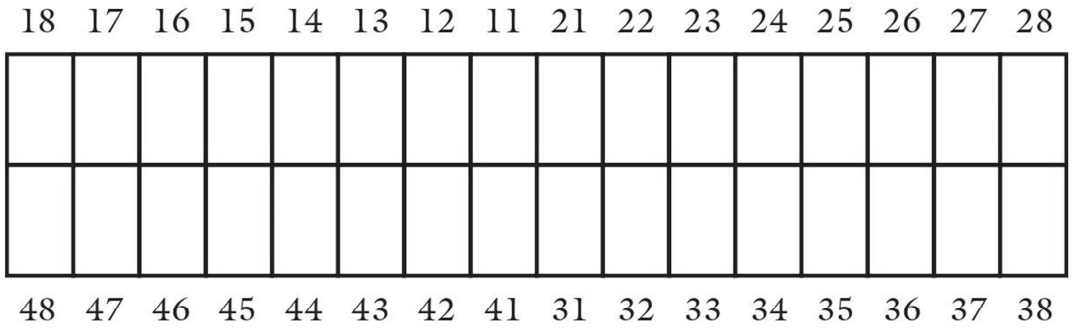
CI-S = Total score/no. of surfaces scored

= Interpretation = _____

OHI-S = DI-S + CI-S

= Interpretation = _____

3. DEAN'S FLUOROSIS INDEX - CRITERIA (1942) MODIFIED



Normal (0)

The Enamel represents the usual translucent semivitriform type of structure. The surface is smooth, glossy and usually of a pale, creamy white colour.

Questionable (0.5)

The enamel discloses slight aberrations from the translucency of normal enamel ranging from a few white flecks to occasional white spots. This classification is used in those instances where a definite diagnosis of the mildest form of fluorosis is not warranted and a classification of "normal" not justified.

Very Mild (1)

Small, opaque, paper white areas scattered irregularly over the tooth, but not involving as much as approximately 25% of the tooth surface. Frequently included in this classification are teeth showing no more than about 1-2 mm of white opacity at the tip of the summit of the cusps of bicuspids or second molars.

Mild (2)

The white opaque areas in the enamel of teeth are more extensive, but do not involve as much as 50% of tooth.

Moderate (3)

All enamel surfaces of the teeth are affected and surfaces subject to attrition show wear. Brown stain is frequently a disfiguring feature.

Severe (4)

All enamel surfaces of the tooth are affected and hypoplasia is so marked that the general form of the tooth may be affected. The major diagnostic sign of this classification is discrete or confluent pitting. Brown stains are widespread and teeth often present a corroded-like appearance.

4. ANGLES CLASSIFICATION (1899)

Class I malocclusion: A normal molar relationship is present, but there is crowding, misalignment of the teeth, rotations, cross-bites, and other alignment irregularities.

Class II malocclusion: The mesiobuccal cusp of the maxillary first molar occludes anterior to the buccal groove of the mandibular first molar. Class II is categorized into two further parts:

- **Class II, Division 1**: The anterior maxillary teeth are tilted forward or proclined, presenting a large overjet.
- **Class II, Division 2**: The anterior maxillary teeth are retroclined, creating a deep overbite.
- **Class III malocclusion**: The mesiobuccal cusp of the upper first molar falls posterior to the buccal groove of the lower first molar.

5. Ellis and Davey's Classification (1970) of tooth fracture

Class I	:	Enamel fracture
Class II	:	Enamel and dentin fracture without pulp exposure
Class III	:	Fracture involving enamel, dentin, and pulp
Class IV	:	Nonvital tooth
Class V	:	Avulsion
Class VI	:	Root fracture without involvement of crown structure
Class VII	:	Displacement of the tooth without fracture of the crown
Class VIII	:	Loss of crown en masse
Class IX	:	Trauma to the deciduous teeth