''COMMUNITY-BASED ASSESSMENT OF IODINE STATUS AMONG RURAL ANTE-NATAL WOMEN – A CROSS-SECTIONAL STUDY''

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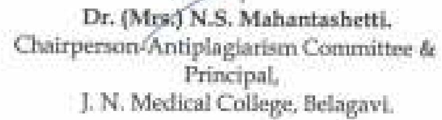

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LIST OF ABBREVIATIONS USED

S.No.	Abbreviations	Expansion of the abbreviations
1.	WHO	World health organization
2.	IDD	Iodine Deficiency Disorder
3.	NIDDCP	National Iodine Deficiency Disorders Control Programme
4.	NFHS	National Family Health Survey
5.	COVID	Coronavirus Disease
6.	MUIC	Median Urinary Iodine Concentration
7.	UIE	Urinary Iodine Concentration
8.	IQ	Intelligence Quotient
9.	μg	Microgram
10.	L	Liter
11.	TSH	Thyroid Stimulating Hormone
12.	ANC	Antenatal Care
13.	SES	Socio-Economic Status
14.	PPM	Parts Per Million
15.	IQR	Interquartile Range

16.	PHC	Primary Health Care
17.	ASHA	Accredited Social Health Activist
18.	SPSS	Statistical Package for Social Science
19.	CI	Confidence Interval
20.	OR	Odds Ratio
21.	AOR	Adjusted Odd’s Ratio
22.	χ 2	Chi – square
23.	PG	Post Graduate
24.	JNMC	Jawaharlal Nehru Medical College
25.	KAHER	KLE Academy of Higher Education & Research
26.	AIIMS	All India Institute of Medical Science
27.	ANOVA	Analysis of Variance
28.	NBAS	Neonatal Behavioral Assessment Scale
29.	DOME	Department of Medical Education
30.	PUC	Pre University Course
31.	ITI	Industrial Training Institutes

ABSTRACT

Title: ''COMMUNITY-BASED ASSESSMENT OF IODINE STATUS AMONG RURAL ANTE-NATAL WOMEN – A CROSS-SECTIONAL STUDY''

Introduction:

Globally more than 1.5 billion people are at the risk of Iodine deficiency disorders (IDD). Iodine is a very essential micronutrient. Iodine deficiency is one of the most common preventable micronutrient deficiencies in the world. Iodine requirement in pregnancy increases by 50%. Recommended dietary iodine intake is higher for pregnant mothers (250µg/L).Iodine deficiency is seen in individuals, whose dietary iodine intake is less than the recommended level.

Salt is the most common dietary source to supplement iodine for controlling and elimination of IDD. Urinary iodine excretion (UIE) is a sensitive marker, which is used to estimate the iodine status during pregnancy and in all other age groups. Iodine deficiency in antenatal women leads to congenital abnormality, miscarriage, still birth, low birth weight, perinatal death, neonatal hypothyroidism, affects brain development of the child and also causes endemic cretinism, stunted infant growth and retarded development. To assess the iodine status and dietary iodine status among antenatal women residing in rural field practice area.

Materials and Methods:

A community based cross-sectional study was conducted among 400 antenatal women who had completed 12 weeks of gestational age in the rural field practice area of Primary Health Centre, Kinaye, KAHER, Belagavi, Karnataka. The study was conducted for the period of one year three months from 1st January 2020 to 31st March

2021. Population proportionate sampling was done to select the number of study participants among registered antenatal women from each sub-centre, every fourth registered antenatal women with gestational age >12 weeks were included from antenatal camps and house to house visits. Pre-validated and tested questionnaire regarding knowledge, regarding iodine nutrition from Food Frequency Questionnaire. Salt and urine samples were collected from participants by using population proportionate sampling technique after obtaining the written informed consent. 20 g of household table salt was collected from each of the 200 Antenatal mothers and standard iodometric titration was done. 100 spot urine samples were collected from 100 antenatal women and analysis was done by ammonium persulfate method (Sandell-Kolthoff method).

Results:

The mean age of the study participants was 24.43±4.29 years. 51.2% had completed secondary level of education. 55.5% belonged to Class IV socio – economic status. 22.2% of the study participants were aware of iodized salt. 88.5% participants stored salt in a container with lid. 46.8% of the participants added salt in middle of cooking. 11.5% participants had grade-I goitre. Mean value of the salt iodine was 17.81 ± 12.21. Six out of ten salt samples were adequately iodized. 76% of the urine samples had moderate iodine deficiency, 13% had severe deficiency, 10% urine samples collected from study participants had mild iodine deficiency. Goitre was associated with low socioeconomic status p-0.038 (χ 2-10.983) and urinary excretion of iodine p-0.010 (χ 2-11.778). Household salt iodine concentration was associated with urinary excretion of iodine p-0.021 (χ 2-8.068).

Conclusion:

One out of ten participants in the study area had grade I Goitre, More than one third of the study participants were consuming inadequately iodized salt. Urinary excretion of iodine was deficient in almost all the participants. Salt iodine concentration was associated with median urinary excretion of iodine.

Keywords: Iodine Deficiency Disorders, Goitre, Median Urinary Excretion of Urine, Antenatal women, Rural area.

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INTRODUCTION

Globally more than 1.5 billion people are at the risk of Iodine deficiency disorders (IDD). Worldwide 1.572 million people who are living in developing countries are at risk of IDD. [1] In India more than 200 million people are living at the risk of IDD. Nearly 71 million people are living with goitre and other IDDs in our country. [2] Around 20 million babies are born annually, who are vulnerable to develop IDD within Asia Pacific region. Among them majority of babies who are not protected from IDD are born in China, India and Bangladesh. [3] Sample survey was conducted in 324 districts of 28 states and 7 union territories of India. Out of 324 districts, 263 districts were found to be endemic for IDD, where the prevalence was above 10%. October 21st is observed as 'World iodine deficiency day'.[2]

Iodine is a very essential micronutrient, which helps in regulation of normal thyroid function and also helps in growth and development of an individual. [2] Abundant amount of iodide is found in the sea (≈50 μg/L) and this iodide ion is returned to the soil by rain. Natural ecological loss like erosion of soil, overgrazing by livestock and cutting trees for firewood are some of the main reasons for the increasing and continuous loss of iodine from the soil, which leads to loss of iodine in plant-based food and ground water in the area.[4] Fish, seaweed, shrimp and other sea foods are rich in iodine. Dairy products like milk, yogurt, cheese, egg and water are the natural sources of iodine. Bread, iodized salt and iodized oil are some of the other sources of iodine.

Iodine deficiency is one of the most common preventable micronutrient deficiencies in the world.[4] Iodine requirement in pregnancy increases by 50%.

Increased demand of iodine during pregnancy is for producing additional amount of thyroid hormone, to transfer iodine via feto-placental circulation to the foetus and to compensate increased amount of urinary excretion of iodine.

Recommended dietary iodine intake is higher for pregnant mothers (250µg/L) compared to the women in normal reproductive age (150µg/L). [5,6,7] Most vulnerable population to develop iodine deficiency are pregnant women and children and most vulnerable period to develop iodine deficiency is from second trimester of pregnancy to till the child is three years of age. [2] Iodine deficiency is seen in individuals, whose dietary iodine intake is less than the recommended level.

Thyroid hormone is essential for growth and development of brain in children. Primary source of thyroid hormone for foetus is maternal thyroid hormone, prior to the development of the functional thyroid of the foetus. [8] To assess thyroid function, thyroid function tests are used and to rule out goitre status-physical examination by palpation method and ultrasound are used. [5]

Salt is the most common dietary source to supplement iodine for controlling and elimination of IDD. [9] Universal Salt Iodization programme was launched by the Govt of India in 1984. Under this programme, salt is fortified with iodine for human consumption. [1,10] Ban on sale of non-iodized salt was lifted by Govt. of India on September 2000 and again on 27th May 2005 ban on sale of non-iodized salt was re-imposed. [1] An estimated 1.88 billion people have inadequate iodine intake in their diet and most of them reside in South-East Asia and Europe. [10] Total household consumption of iodized salt in Karnataka was 92.8% according to NFHS-V (urban 97.7% and rural 89.4%). According to NFHS-V survey household's using iodized salt in Belagavi district was 95.2% in 2019-2020 (NFHS-V). [11]

More than 90% of the dietary iodine is excreted via urine. Urinary iodine excretion (UIE) is a sensitive marker, which is used to estimate the iodine status during pregnancy and in all other age groups. [5, 12]Normal iodine level is defined as population median urinary iodine concentration of pregnant mothers is 150 μg/L – 250 μg/L. Iodine deficiency is defined as median urinary iodine concentration <150 μg/L in pregnant women. [5]

Pregnant, lactating women and children <2 yrs of age are considered as high risk groups for Iodine deficiency disorders.[13] Iodine deficiency in antenatal women leads to congenital abnormality, miscarriage, still birth, low birth weight, perinatal death, neonatal hypothyroidism, affects brain development of the child and also causes endemic cretinism, stunted infant growth and retarded development. School children lose 13 IQ points, those who live in iodine deficient region, compared to the children who live in iodine sufficient region. [2, 6, 8]

Food iodine content depends on many factors. It mainly depends on diet and amount of iodine fortification in salt, method of transportation of the fortified salt, storage techniques in shops and at homes. It also depends on methods of cooking, timing of salt addition during food preparation etc. [14]

Many studies related to the assessment of iodine status have been conducted in hospital settings, which give us an idea about the iodine intake status of that particular individual, but it will not represent the iodine status of the community. Community based studies will reflect the iodine status of the community compared to hospital-based studies. Hence this study was planned to study the iodine status of rural population. Iodine status in the present study was assessed using WHO criteria, which includes goitre, salt iodine concentration and median urinary excretion of iodine concentration.

OBJECTIVE OF THE STUDY

- To assess the iodine status among antenatal women residing in rural field practice area.
- To assess the dietary Iodine status among rural antenatal women.

REVIEW OF LITERATURE

An observational study was conducted among 237 antenatal women who attended the antenatal clinics in Vivekananda Institute of Medical Sciences in 2014 in Kolkata, India. 199 (59%) antenatal women who participated in the study were between 20-29 years of age group, 35 (15%) were in 30-39 years, 3 (1%) were above 40 years of age group. Ammonium Persulfate method was used to measure median urinary iodine concentration. Out of 237 study participants, 88 (37%) had insufficient iodine status and their median urinary iodine excretion level was <150ug/L. Iodine deficiency was most prevalent in third trimester. Among 237 antenatal women, 87 participants were in third trimester; out of them 35 (40%) had insufficient iodine status. 110 were in second trimester; out of 110, 41 (37%) had insufficient iodine status and 40 were in first trimester; among them 12 (30%) had insufficient iodine level. [(1)]

A cross-sectional study was done among 188 antenatal women, residing in Kiriti Nagar slum, West Delhi, India. It was a community-based study, salt and urine samples were collected from 180 pregnant women. Mean age of the study participants was 24.7 ± 4.5 years. None of participants either had visible or palpable goitre on examination.70.6% of the antenatal mothers used salt with iodine level ≥15 ppm, which was adequately iodinated. Inadequately iodized salt (iodine level <15 ppm) was consumed by 17.2% of the pregnant women. 12.2% of the antenatal women were consuming salt with no iodine (0 ppm). Median urinary iodine (MUIC) of the pregnant women was 147.5 μg/L, indicated iodine deficiency in that study area. Participants with MUIC of <50μg/L was 13.9%, MUIC of <100 μg/L was 35%, MUIC of <150 μg/L was 51.1%. [(6)]

A cross-sectional study was conducted among 530 antenatal women, residing in 30 villages in Tonk district, Rajasthan in 2015. Mean age of the study participants was 23.4 ± 3.3 years. 75 (14.2%) antenatal women had goitre. 72 (13.6%) of 75 had grade I goitre. Total goitre rate was 14.2% (CI: 11.2-17.2) which indicated mild iodine deficiency in the study area. 220 salt samples were collected from the study participants; standard iodometric titration method was used to identify iodine level in salt. Mean iodine level of salt samples was 25.5 ± 13.4 ppm. 40 (20%) of the salt samples had inadequate iodine (<15ppm) at consumption level, out of 40, 3 salt samples had no iodine (0ppm). 180 (80%) salt samples had adequate iodine content (≥15 ppm). 226 urine samples were collected from the study participants and analyzed by wet digestion method. Mean urinary iodine concentration was 192.7 ± 90.6 µg/L and median urinary iodine concentration (UIC) was 174µg/L with IQR 116-300µg/L. 75 (33%) of the urine samples UIC <150µg/L was inadequate. Mean urinary iodine concentration in antenatal women who consumed salt with adequate iodine was 188.6 ± 91.5 µg/L and with inadequate iodine was 180.6 ± 88.5 µg/L among subjects, and it showed statistical no significance (p=0.42). Total goitre rate was higher in subjects with inadequate iodine intake compared to the subjects with adequate iodine intake, but it was found to be not statistically significant (p= 0.79, OR=1.13, CI=0.47-2.67).[8]

A cross-sectional study was conducted among 300 rural antenatal mothers in Lucknow, India in 2020. Mean age of study participants was 24.5± 3.26 years, 45% of the study participants belonged to the age group of 20-24 years. 95.7% of the participants were unemployed, 68% of participants lived in joint families. 48.3% of the participants belonged to lower middle class socioeconomic status. 200 salt samples were collected from the study participants, among them 152 (76%) of the

pregnant mothers were consuming adequate amount of iodine (≥15 ppm), 34 (17%) were consuming inadequate iodized salt (< 15 ppm), 14 (7%) salt samples showed no iodine in the salt (0 ppm). 90.5% of the ANC mothers used powdered salt and its mean iodine content was 25.67 ± 0.85 ppm. Out of 19 who used crystal salt and 9 (47.4%) salt samples of the participants showed nil iodine content. Wet digestion method was used to identify median urinary iodine concentration. Median urinary iodine concentration (MUIC) of the study participants was 246.5µg/L with interquartile range of 194.9–383.4µg/L.38 (20%) of the antenatal mothers (MUIC <150µg/L) had insufficient iodine intake. 66 (33%) of the antenatal mother iodine status was adequate. 86 (43%) had MUIC of 250-499µg/L, was above the requirement. Iodine deficiency was 39.5% in first trimester, 28.9% in second trimester and 31.6% in third trimester. [10]

A cross-sectional study was done in a tertiary care hospital among pregnant women in second trimester to rule out the correlation between urinary iodine level status and serum TSH level in Belagavi, India 2019. 63 pregnant women were in the age group of 20-24years and 8 pregnant women were above 30 years. Mean age of the study participants was 24.34± 3.51 years. The median urinary iodine concentration (MUIC) was 138.50 with range of 29.80-350.51 µg/L. Mean TSH was 1.90 with range of 0.17-7.46 mIU/L. 63 (60%) of the subjects had MUIC <150µg/L with Mean TSH of 2.04 mIU/L. 42 (40%) participants had MUIC >150µg/L with Mean TSH of 2.13 mIU/L. Karl Pearson's correlation coefficient showed no significant correlation between MUIC and serum TSH with ($r = 0.0873$, $t= 0.8899$, $p = 0.3756$). [12]

A hospital-based study was done among 237 pregnant women, 73 lactating women, 59 non- pregnant women, in Kolkata, 2016. Insufficient iodine nutrition was

found in 88(37%) pregnant women, their UIE was < 150µg/l. 61 (69%) of the pregnant women consumed inadequately iodized salt (<15ppm). Out of 88 iodine insufficient pregnant woman, 88% of the pregnant women were having habit of adding salt in initial stages of cooking. 15 (10%) out of 149 pregnant women whose iodine status was adequate, used to add salt in final or middle stage of cooking. It showed addition of salt in later stages of cooking retained the iodine content of food. Iodine content in water after adding 25g and 50gm adequately iodized salt was 186.89µg/100g and 373.80µg/100g, after boiling the water, iodine content reduced to 183.15µg/100g and 366.32µg/100g respectively. 5gm of boiled lentils was cooked with 25g and 50gm adequately iodized salt, before boiling the iodine content was 116.52µg/100g and 216.63µg/100g, after boiling iodine content was reduced values were 114.28 µg/100g and 206.6 µg/100g respectively. This study identified that there is negligible loss of iodine content after boiling the water, with an open pan. (14)

A study was conducted among 1,711 pregnant mothers in Himachal Pradesh to know their iodine status, in 2012. Participants were from the districts of Kullu (n = 551), Kangra (n = 647) and Solan (n =513). Mean age of the participants was 25.1± 3.3years in Kangra, 23.3± 3.4 years in Kullu and 24.7±3.7 years in Solan. The prevalence of goitre grade I was 40.2%, grade II was 2%, Total Goitre Rate was 42.2%, 511(68.3%) were consuming adequately iodized salt, 368 urine samples were collected; Internal Quality control method was used for urine iodine analysis, Median UIC was 200µg/L in Kangra. Prevalence of grade I goitre was 41%, grade II was 1%, 436(60.3%) were using adequately iodized salt, Median UIC was 149µg/L in Kullu, indicated iodine deficiency in Kullu and prevalence of goitre grade I was 19.7%, grade II was 0.2%, 336(48.5%) were using adequately iodized salt, Median UIC was 130µg/L in Solan, indicating iodine deficiency. (17)

A cross-sectional study was done in secondary care hospital in Ballabgarh, Haryana, 2015 among 1,031 pregnant women who attended ANC clinic of sub-district hospital. 96.4% of the pregnant women were between 18-30 years of age. 48% of the participants belong to lower socioeconomic group, 93.7% were homemaker. Median salt consumption was 8.3 with IQR of 6.7-11.1 g/ day. 7% of the study participants reduced daily intake of salt after getting pregnant. 89.4% of the antenatal women did not change their pattern of salt consumption after getting pregnant. 90% of the participants were taking adequately iodized salt ≥15 ppm. MUIC was 260 with IQR of 199-323 μg/L. 13.5% of the participants had inadequate MUIC was <150 μg/L. More than half of the participants MUIC was >250μg/L, which was more than adequate. No significant difference was found in median UIC levels (Kruskal- Wallis test, p=0.54) during three trimesters of pregnancy. There was a significant association (Kruskal-Wallis test, p= 0.04) found between MUIC levels and per day salt intake per person.[18]

A cross-sectional study was conducted among 538 pregnant women to identify iodine status in Tripura, India in 2017-2018. Ammonium Persulfate method was used to analyze urine samples for MUIC. Median value of UIC (MUIC) in pregnant and non-pregnant was 155.0μg/L. 22 (4.1%) of the pregnant women had severe iodine deficiency (<20μg/L), 81 (15.1%) had moderate (20-49μg/L) iodine deficiency and 159(29.6%) had mild iodine deficiency (50-149μg/L), 115 (21.4%) had adequate iodine (150-249μg/L).However, 155 (28.8%)had iodine level above requirement (250-499μg/L), 6 (1.1%) had excessive iodine. (≥500μg/L) was found in 115 (21.4%) had iodine insufficiency. 48.8% were found to have iodine deficiency in pregnancy. 68.6% pregnant women were consuming adequately iodized salt (≥15 ppm). No

significant association was found between urinary iodine concentration and consumption of adequately iodized salt (Kruskal-Wallis test, p<0.08). [19]

A cross-sectional study was conducted in rural communities of Ada district, Ethiopia in 2014. 356 pregnant women were involved in the study to identify prevalence of iodine deficiency in that region. Digital electronic iodine checker was used to identify salt iodine concentration. Inductively-coupled-plasma mass spectrometry was used to analyze urinary concentration of iodine. Prevalence of goitre among the participants was 20.2% (95% CI: 16–24). Median iodine concentration of the participant household salt samples was 12.2 (IQR: 6.9–23.8 ppm). 39.3% (95% CI: 34.0–44.0%) of the participants were consuming adequately iodized salt (≥15 ppm). 60.7% of the participants consumed no or inadequately iodized salt. Median urinary iodine concentration (MUIC) of the participants was 85.7 interquartile range (IQR): 45.7–136μg/L. 77.6% (95% CI: 73.0–82.0%) of the study participants were showing insufficient iodine intake (MUIC < 150 μg/L. Goitre prevalence was significantly higher in 30–44 years age group (AOR = 2.32 (95% CI: 1.05–5.14)) than among younger women (AOR = 2.71 (95% CI: 1.54–4.79)). Women with parity of one had 2.28 (95% CI: 1.01–5.16), two had 2.81 (95% CI: 1.17–6.74) and three or more had 4.41 (95% CI: 1.58–12.26) times higher risk of goitre compared to nulliparous women. [20]

A longitudinal study was done among 125 pregnant women to identify iodine deficiency in Sefwi Wiawso municipal hospital, Ghana in 2016. Of 125, 62 participants were in the age group of 20-29 years, 17 were below 20 years, 16 women were above 35 years. Ammonium Persulfate method was used to estimate urinary iodine concentration. At 11 weeks of gestation prevalence of iodine deficiency

(<150µg/L) among the participants was 59 (47.2%) and 76 (60.8%) of the participants found to have iodine deficiency (<150µg/L) at 20 and at 32 weeks of gestation. 18.4% participants using adequately iodized salt had iodine deficiency at 11 weeks of gestation; at 20 weeks of gestation 20% of the pregnant women using iodized salt had iodine sufficiency, and at 32 weeks of gestation 24% of the pregnant women using iodized salt had iodine sufficiency. (21)

A cross-sectional study was conducted to identify the knowledge about iodine requirements during pregnancy in Ireland, 2015. 30%, 9% and 15% had respectively identified fish, dairy and eggs as the main sources of dietary iodine. 22% of the nulliparous women, 49% of the multiparous women identify seafood as a good source of iodine (Mann-Whitney test, p = 0.006). 45% of the participants were not able to identify any iodine rich foods. Five-point Likert scale was used to grade the information given to the participants about iodine, calcium, folic acid, iron and vitamin D. No significant differences were identified between multiparous and nulliparous women or between trimesters. (22)

A cross sectional study was conducted to identify the knowledge about iodine nutrition among pregnant women in Turkey, 2016. Questionnaire and face-to-face interview were conducted among 150 pregnant women. 68% answered that iodine deficiency during pregnancy can cause serious consequences, 30% did not know about iodine deficiency. 77.3% knew salt is the main source of iodine, 68.0% & 20.0% had answered that main dietary source of iodine is fish and milk respectively. Mean iodine knowledge score was 8.5±4.5. Higher knowledge scores significantly associated with pregnant women educational status (higher educated) (Independent t-test, P<0.05). 44.7%, 35.6%, 13.2%, 3.9% and 2.6% of the participants obtained

knowledge about iodine through internet, healthcare personnel, TV, relatives and friends and books respectively. Iron-82.0%, iodine-free multivitamins - 57.2%, folic acid- 23.3%, magnesium- 3.2%, calcium, vitamin-C, B12, omega 3 were taken as supplementary pills. 89.1% participants had consumed adequately iodized salt. 26% of the participants said that while buying salt they were reading the information given on the package. 56.7% of the participants were adding salt, just before finishing cooking. 52.7% of the participants answered that iodine is important for effective functioning of thyroid gland. [23]

A cross- sectional study was done in a tertiary care hospital, Wardha, Maharashtra state, India, 2017. 250 pregnant women attending antenatal clinic in Mahatma Gandhi Institute of Medical Sciences & Hospital were involved in the study. Mean age of the study participants was 26.53±3.67 years. 15.15% women from lower class, 22.41% from lower middle class, 5.76% from middle class, and 3.22% from upper middle class, had iodine deficiency. 75% of the illiterate women had iodine deficiency. 23 out of 211, (10.9 %) from rural area and 4 out of 39 (10.25%) from urban areas were suffering from Iodine deficiency. Iodine deficiency was similar in rural and urban population; there was no statistically significant difference. 18.51% participants from rural area and 68.60% participants from urban area were taking iodine rich food. 25.92% of the participants from rural area and 69.95% participants from urban area were using iodized salt for food preparation. [24]

A longitudinal study was conducted to identify iodine status and related neonatal and infant outcomes among 234 pregnant women attending antenatal clinic in Pune, India, 2004-2006.118 pregnant women participated from rural primary health-care centre and 116 from urban health care centre. Median urinary iodine

concentration (MUIC) of women at 17 weeks of pregnancy was 203µg/L, MUIC at 34 weeks of pregnancy 211µg/L. Individual MUIC values ranged from 26 to 800µg/L. No significant association was found in urinary iodine measurements done at 17 and 34 weeks of pregnancy, (t-test, P = 0.681). 24% participants' MUIC was in the lowest quartile at 17 weeks remained in the same lowest quartile at 34 weeks after follow-up. 34% of the participants were in the highest quartile at 17 weeks, remained same in highest quartile at 34 weeks after follow-up. Multivariate linear regression showed socio-economic status and educational status were significantly high for those MUIC is in the highest UIC quartile at 34 weeks ($p < 0.05$). T-test showed consumption of milk and milk products was significantly higher for the pregnant women, UIC in the highest quartile at 34 weeks ($p = 0.002$). Multiple linear regression model showed that at 34 weeks adjusted UIC was higher by 0.73 (95 % CI 0.33µg/L, 1.12µg/L) for extra consumption of milk and milk products at each serving. [25]

A hospital-based study was conducted among 150 pregnant women and 50 non-pregnant controls in AIIMS, New Delhi. Mean age of the pregnant women was 26.35 ± 4.05 years, control group mean age was 26 ± 4.04 years with no significant difference between the groups ($p = 0.54$). Median urinary iodine concentration (MUIC) was analyzed by Sandell–Koltoff reaction by wet ashing method. MUIC of the pregnant women was found to be 304µg/L and MUIC of the control group was 305µg/L. No significant difference was found between the pregnant women and non-pregnant controls MUIC value. Median MUIC in first trimester was 285µg/L, second trimester was 318µg/L, and in third trimesters was 304.5µg/L. MUIC was raised in first and second trimester, followed by fall in third trimester; no statistical significance was found. 78% of pregnant women had more than adequate iodine nutrition, but 2% had iodine deficiency. [26]

A community-based study was conducted in a block primary health centre to identify iodine status among 1139 pregnant women, in West Bengal. 634 (55.66%) of study participants were between the age group of 21-26 years and 627 (55.04%) were second gravida. 597 (52.41%) participants had goitre in the study population. Urinary iodine concentration measured by FAST B method; 418 (36.69%) had inadequate iodine concentration, MUIC was <150µg/L. 500 (43.89%) of the pregnant woman had adequate level of iodine in urine, MUIC was 150-249µg/L. Out of 1139 women, 429 (37.66%) of the participants gave birth to low birth-weight babies. Significant association was found between inadequate iodine status during pregnancy and low birth weight of their babies. [27]

A cross-sectional study was conducted to identify maternal and neonatal iodine status, among 250 pregnant women in a tertiary care hospital in Dakshina Kannada, Karnataka state, India in 2017 - 2018. Median age of the participants was 28 years IQR: 7years. Median TSH value of the antenatal women was 1.54mIU/l. Sandell-Koltoff method was used to measure concentration of urine excretion of iodine. Median maternal UIC was 352µg/L. 3 (1.2%) ANC mothers presented with inadequate iodine status (<150µg/L), 23 (9.2%) had adequate iodine status (150–249µg/L) and 224 (89.6%) had above the level of iodine requirement (250–499µg/L). Median urinary Iodine Concentration (MUIC) of newborn was 344.5µg/L. Statistical significance ($p = 0.028$) was found between maternal and newborn median UIC, weak positive correlation ($r = 0.139$) was identified by using Spearman correlation test. All mothers were using adequately iodized salt, 225 (90%) participants were fish eaters. Median birth weight of the neonates was 3,000gm with IQR: 565gm, median birth length was 49.5cm with IQR: 2.8cm and head circumference was 34cm with IQR: 2cm. No correlation was found between median UIC and TSH in both mother and

newborn. Spearman correlation showed positive correlation between newborn head circumference ($r = 0.129$; $p = 0.041$) and maternal UIC. [28]

A prospective study was conducted to identify the effect of iodine status during pregnancy on infant outcomes in Nagpur, Maharashtra, India. 220 pregnant women were involved in the study. Mean gestational age during first visit and second visit was 17.5± 2.1 weeks and 34.5± 0.5 weeks respectively. Mean age of infants during postpartum visit was 2.5±0.4 weeks. The MUIC of pregnant women at first visit was 106µg/L, which later decreased to 71 µg/L at the second visit (paired t-test, $p = 0.006$) indicating the study population was suffering with iodine deficiency. NBAS (abnormal reflexes; habituation, orientation, motor maturity 22.3 (3.1); range of state, regulation of state, autonomic stability) cluster scores for term infants were 123.5 and for preterm 127.7 ($p = 0.249$). No significant difference was found between pre-term and term infants total NBAS scores. But motor maturity cluster score showed significantly higher in term infants 22.3 than premature infants 20.3 ($p = 0.003$). Multivariate analysis showed that the variables like duration of gestation, maternal age, salt iodine concentration, location and maternal education < 8 years were significantly associated with maternal urine iodine concentration (MUIC). Urine iodine concentration (MUIC) decreased by 5% (95% CI: 1%, 8%) for every one year increase in maternal age, Urine iodine concentration (MUIC) decreased by 2% (95% CI: 1%, 2%) for every one week increase in gestation. [29]

A prospective study was conducted to assess the iodine status during the pregnancy among 425 pregnant women in Galle district, Sri Lanka in 2012-2014. Mean age of the participants was 28.2 yrs, study participants belonged to 16 – 44 years age group. Ammonium Persulfate digestion method was used to analyse urine

samples. Median Urinary Iodine Concentration (MUIC) was 170.9 µg/L, IQR of 100.0–261.10µg/L in first trimester, during second trimester was 123.80 µg/L IQR of 73.50–189.50µg/L and MUIC 105.95 µg/L IQR 67.00–153.50µg/L in third trimester ((Z-test = 4.11, $p < 0.001$) respectively. Median thyroid stimulating hormone (TSH) level was 1.30 (0.80–1.80)µIU/ml in the first trimester. This value significantly ((Z-test = 6.4, $p < 0.001$) increased in third trimester to 1.60 (1.20–2.10)µIU/ml. 67 (16.0 %) women were found to have grade II goitre, 55 (13.1 %) had a grade I goitre, which was palpable but not visible. Weight was the only independent variable found to have statistically significant correlations ($r = 0.124$, $p = 0.02$) with urinary iodine concentration during first trimester. [30]

A cross-sectional study was conducted to identify iodine status among pregnant women, where previously IDD was endemic among 1,370 pregnant women in Zhejiang Province, China in 2014- 2015. 1304 pregnant women who participated in the study provided a household table salt sample and a random spot urine sample. Arsenic-cerium catalytic spectrophotometry was used to determine urinary iodine concentration (UIC). Sodium thiosulphate titration method was used to identify Iodine content in salt. Participants mean age was 28.0±4.5 years. Median Urinary Iodine Concentration (MUIC) 129.34 µg/L (IQR: 83.05– 201.67 µg/L). Among 1304 participants, 773 (59.3%) had MUIC < 150µg/L shows iodine deficiency and 337 (25.8%) had MUIC 150–249µg/L. Out of 773 iodine deficient pregnant women, 438 (56.7%) had MUIC <100 µg/L and 335 (43.3%) had MUIC 100–149 µg/L. Study participants consuming adequately iodized salt had a significantly higher MUIC - 133.13 µg/L than the pregnant women using non-iodized or inadequately salt, who had MUIC- 96.95µg/L (Mann–Whitney test, $P = 0.001$). Positive association found between median UIC and iodine content (Mann–Whitney test, $p< 0.000$). Probability

of having iodine deficiency among non-iodized salt using participants was 4.72 times higher than the participants who were consuming adequately iodized salt (Mann–Whitney test, $p < 0.001$). [31]

A cross-sectional study was conducted in a tertiary care hospital, to know the iodine status among 257 urban pregnant women, who were attending antenatal clinic of Taipei Veterans General Hospital in Taiwan, 2018. Inductively coupled plasma mass-spectrometry was used to determine UIC. Median UIC of the participants was 225.3μg/L (IQR: 109.1–514.2 μg/L). Median urine iodine concentration (MUIC) varied from 222.8- 230.8μg/L in different age groups. 35.4% of participants had iodine concentration <150μg/L which was inadequate.17.1% of the pregnant women had a MUIC- 150–249 μg/L, 21.8% of the study participants had MUIC between 250 and 499 μg/L, 25.7% of the participants had a MUIC >500 μg/L. 204 (79.4%) participants were taking multivitamin every day, but 53 (20.6%) never took multivitamin during the pregnancy. Higher median UIC was noticed in the groups with prenatal multivitamin intake, no statistical significance was found (Mann–Whitney U test, $p = 0.70$). Statistically significance was observed between consumption frequencies of seafood and MUIC (Mann–Whitney U test, $p= 0.002$). [31]

A countrywide study was done among 829 pregnant women to identify iodine status in Latvia in 2013. Ammonium Persulfate method was used to estimate urinary iodine concentration among 696 pregnant women. Median creatinine (Cr)-standardized urinary iodine concentration of the participants was 80·8 (IQR 46·1–130·6μg/g) Cr, MUIC was 69·4 (IQR 53·9–92·6) μg/l). Median creatinine (Cr)-standardized urinary iodine concentration was 56·0 (IQR 36·4–100·6) μg/g Cr in first trimester, 87·5 (IQR 46·4–141·7) μg/g Cr in second trimester and 86·9 (IQR 53·8–

140·6) µg/g Cr in third trimester. The median standardized UIC was significantly higher in second and third trimesters than first trimesters (p <0·001). 6·8 % of the participants were taking supplements containing ≥150 µg iodine, which showed non-significantly higher MUIC in the group who took iodine supplements than the women without supplementation. Median fT4 (free thyroxin) concentration in first trimester was 14·4 pmol/l, second trimester - 13·1 pmol/l and third trimester 12·5 pmol/l (p<0·001). A significant negative correlation was observed between fT4 concentration and gestational week (Spearman's ρ =− 0·367, p<0·001). [32]

A cross-sectional study was conducted among 884 pregnant women in Tehran, Iran in 2015-2016. Sandell-Koltoff technique was used to measure UIC. Mean age of the participants was 29.14 ± 2.5 years, mean gestational week of participants was 38.4 ± 7.3 weeks. The median (IQR) urinary iodine concentration in the third trimester was 176 (165–196) µg/L, 838 (94.8%) had MUIC >150µg/L and 46 (5.2%) had MUIC <150µg/L, which was inadequate. Multivariate logistic regression showed- weight gain during pregnancy was identified as influencing factor on iodine deficiency in pregnancy (OR =0.88, 95% CI: 0.82–0.95), interval between the pregnancies (OR = 0.78, 95% CI: 0.64–0.95), nutritional consumption (OR = 3.64, 95% CI: 1.44–9.1), number of previous pregnancies (OR = 0.59, 95% CI: 0.39–0.89), planned pregnancies (OR = 2.92, 95% CI: 1.29–6.58) preterm birth (OR = 3.29, 95% CI: 1.51–7.1) and NICU admission (OR = 4.64, 95% CI: 1.81–11.9) were significantly associated with maternal iodine deficiency. ANOVA test showed that there were no statistical differences (p=0.47) between different maternal complications during pregnancy and MUIC. [33]

A population-based study was done to identify factors associated with Urinary Iodine Concentration among reproductive age group women in Tanzania in 2015-2016. Median urinary iodine concentration among 20-49year age group women consuming inadequately iodized salt was 93.6 μg/L; 25th percentiles: 43.1 μg/L,75th percentiles: 197.9 μg/L. Multivariable analysis showed that the pregnant women had 1.21 μg/L lower MUIC than the non-pregnant women ($\beta = -1.21$; 95% CI: −3.42, −0.12. Illiterate women had UIC of 1.88μg/L, which was lower compared to those who had secondary or higher education ($\beta = -1.88$; 95% CI: −4.58, −0.36). Women consuming no iodine or inadequate iodized salt had 6.55μg/L lower MUIC than those consuming sufficiently iodized salt ($\beta = -6.55$; 95% CI: −9.24, −4.33). (35)

A systematic review of assessing iodine nutrition status of pregnant women in India was performed in 2011. Nine cross sectional studies (1993 to 2008) were taken for review. Five studies were community based and other four studies were hospital based. Sample size for each study was ranging from 149 to 768. 59.5% to 95% percentage of pregnant women consumed adequately iodized salt. MUIC of six studies were 95μg/L to 178μg/L. 30.45% to 95.3% of the pregnant women showed MUIC <150μg/L with range of 1.9% to 45% showed goitre. (36)

METHODOLOGY

A community based cross – sectional study was conducted to assess iodine status among rural ante-natal women more than 12 weeks of gestation in the field practice area of Primary Health Centre, Kinaye under the Department of Community Medicine, Jawaharlal Nehru Medical College, KAHER (KLE Academy of Higher Education & Research), Belagavi, Karnataka. Because of COVID-19 pandemic, data collection done for one year and three more months. The study was conducted for one year three months from 1st January 2020 to 31stMarch 2021.

Sample size calculation was done by using the formula $n = 4pq/d^2$, taken the prevalence (p) of IDD in antenatal women as 35% and allowable error as 5%. The estimated sample size was 364 and was rounded of 400 (based on the original study done by Vivekananda Institute of Medical Sciences, Kolkata. 2014). [1] The information regarding the number of registered antenatal women in the year 2018-2019 was obtained from the ANC registers of Primary Health Centre, Kinaye, Belagavi.

The rural field practice area of Primary Health Centre, Kinaye has nine sub - centres with a mid – year population of 72,299 as on year 2018-19. The total number of ANCs registered in the year 2018 – 2019 was 1,533. Population proportionate sampling method was used to select the number of study participants from each sub – centre. Sampling interval was 3.8, so every 4th registered antenatal women was chosen from the antenatal register who fulfilled the inclusion criteria.

The number of study participants from each sub - centre included in the study are shown below:

Name of the sub center in Kinaye PHC	Total No of ANCs registered in one year	Calculation for proportional sampling	No of ANCs selected for study
Desur	127	127/1533 X 400	33
Karle	133	133/1533 X 400	34
Kinaye	119	119/1533 X 400	31
Khadarwadi	194	194/1533 X 400	51
Macche-I	126	126/1533 X 400	33
Macche-II	249	249/1533 X 400	65
Peeranwadi	317	317/1533 X 400	83
Santi bastwad	146	146/1533 X 400	38
Waghwade	124	124/1533 X 400	32
Total	**1533**		**400**

Inclusion Criteria:

1. All registered antenatal women more than 12 weeks gestational age.
2. Permanent residents of the field practice area of Primary Health Centre, Kinaye area during the study period.

Exclusion Criteria:

1. Antenatal women with known history of thyroid disorders.
2. Those who were already on iodine containing medications.

Ethical clearance was obtained from the Institutional Ethics Committee for Human Subjects' Research of the Medical College dated 24.12.2019 vide under letter (MDC / DOME / 26) (**ANNEXURE – I**). ICMR- Grant(**ANNEXURE – II**). Written informed consent was obtained from all the study participants before the data collection (**ANNEXURE – III**).

Data collection was done among antenatal women by conducting antenatal checkup camps at each sub-centre. Every month the details of the registered antenatal women more than 12 weeks of gestational age was collected from the Auxiliary Nurse Midwife of each sub – centre under the Primary Health Centre, Kinaye. Number of study participants among registered antenatal women from each sub centre was chosen based on population proportionate sampling technique. From antenatal register every 4th registered antenatal women (pregnancy confirmed by UPT & USG), whose gestational age was >12 weeks were chosen to participate in the study. Antenatal camps were conducted in the sub-centers and data was collected from the study participants. Those who were not available during antenatal camp, data's were collected house to house visits. The houses of the study participants were located with

the help of Accredited Social Health Activist (ASHA) of the respective village. Pre-validated and tested questionnaire regarding knowledge, regarding iodine nutrition from Food Frequency Questionnaire. Salt and urine samples were collected from participants by using population proportionate sampling technique after obtaining the written informed consent. 20g of household table salt was collected from each of the 200 Antenatal mothers and 100 spot urine samples were collected from 100 antenatal women (**ANNEXURE – IV**).

The questionnaire had the following sections:

1) Socio-demographic information
2) Obstetric information
3) Knowledge about dietary iodine sources and iodine deficiency
4) Practices on intake of iodine rich food intake
5) Knowledge and Practices on mineral intake
6) Practices on household salt storage, consumption
7) Medical history on thyroid status
8) Goitre Examination

Physical examination of thyroid was conducted by palpation method & grading of goitre was done as per WHO Criteria. [44]

Grade 0- No palpable or visible goitre.

Grade 1- A goitre that is palpable but not visible when the neck is in the normal position

Grade 2- A swelling in the neck that is clearly visible, when the neck is in normal position and is consistent with an enlarged thyroid gland when the neck is palpated.

Scoring was done for knowledge, attitude and practice.

Knowledge about iodized salt and iodine deficiency disorders included the following seven elements:

1. Knowledge to identify iodized salt
2. Knowledge about iodine deficiency disorders
3. Source of information about iodine deficiency disorders
4. Knowledge about iodized salt
5. Source of information of iodized salt
6. Knowledge about iodine requirement during pregnancy
7. Recommendation to take iodized salt

To get the total knowledge score, each of these seven elements were given a score "1 & 2" if the response was correct and a score '0' if the response was neutral or not correct. The levels of knowledge were classified into Good, Average and Poor. The total score was 9. Scores <5 was considered as 'poor' knowledge, score in the range of 5-7 was considered as 'average' knowledge and score 8-9 was considered as 'good' knowledge about iodized salt and iodine deficiency disorder.

Attitude towards iodized salt and iodine deficiency disorders:

There were seven statements under this section. For positive statements, the scores given were four, three, two for choosing correct factors one for 'agree' and zero for 'disagree' and 'don't know'. The total score was 10. Scores >7 was considered as positive attitude, <7 was considered as 'negative attitude'.

Iodized salt practice included the following eight elements:

1. Type of salt used
2. Intake of multivitamins
3. Intake of dairy products
4. Intake of eggs
5. Purchase of salt (branded/ unbranded/ loose/ no fixed pattern)
6. Usage of iodized/ non- iodized salt
7. Storage of salt in kitchen
8. Adding of salt at what time of cooking

Good practice was given a score of '1 & 2' if the practice was not correct, score '0' was given. The total score was 10. If the participants scored 9-10 was considered as good practice, 6-8 was considered as moderate level of practice and <5 was considered as poor practice.

Laboratory investigations:

Salt Analysis:

200 household salt samples were collected in auto seal polythene pouches, As per NIDDCP guidelines (National Iodine Deficiency Disorders Control Programme) of Govt. of India, one fifth of the total sample size that is, 80/400 salt samples should be collected during the survey. We have taken half of the total sample size (200) to collect household salt samples. [16] 20 gms of salt samples were stored away from sunlight and transported to the laboratory on the same day. Salt samples were stored at room temperature in biochemistry lab. Salt samples were analyzed to estimate iodine content by standard iodometric titration method in biochemistry lab of the medical college.

10 gm of salt sample was dissolved in 50 ml of double distilled water. 1- 2 ml of 2N sulphuric acid and 5 ml of 10% potassium iodide was added to the solution. It was shaked until it turned into yellow colour. Flask mouth was closed and kept in dark for about 10 minutes. Samples were removed from dark and titrated against the sodium thiosulphate solution, until it turned into pale yellow. 1-5ml of 1% starch solution was added, when the solution was turned into deep purple colour. Thiosulphate solution was added drop by drop until the solution turned colourless. Final reading was noted down and calculated by using following formula:

$$\text{Iodine content (ppm)} = \frac{R \times 100 \times 10^3 \times 0.127 \times N}{6}$$ [9]

Iodine concentration was calculated and recorded as, [5]

0 = No Iodine

<15ppm = Inadequate

>15ppm = Adequate.

Urine Analysis:

As per NIDDCP guidelines, half of the salt sample size should be collected for urine analysis. [16]Accordingly, 100 urine samples were collected from 50% of 200 ANC women.

20-30ml of spot mid-stream urine samples were collected from 100 selected antenatal women in a sterile plastic container, and the samples were transported in alabelledvaccine carrier with ice packs within 4 hours to the lab and the urine samples were stored at -20ºC in biochemistry lab in deep freezer until the analysis. Analysis was done by ammonium Persulfate method (Sandell-Kolthoff method) in biochemistry laboratory of the medical college.

Urine sample was mixed until the sedimentation of suspends occurred. 250µl urine sample was added to test tubes. Iodine standard was added to test tube. Water was added to make final volume to 250µl. Duplicated iodine standards and a set of internal urine standards were included in each assay. 1ml of 1M ammonium Persulfate was added to each tube and each test tubes opening were covered with silver foil. All the tubes were heated in oven for 100ºC for 60 minutes. Later the tube was allowed to cool down at room temperature.

2.5 ml of aresenious acid solution was added. Solution was mixed and left it for 15 minutes. 300µl of ceric ammonium sulphate solution was added and mixed. Solution was kept at room temperature. After 30 minutes of adding ceric ammonium sulphate to the first tube. Readings were taken by using absorbance t420nm and calculated later. Readings were cross checked by the post graduate and by the faculty from Department of biochemistry. (9, 15)

Interpretation of Urinary Iodine Concentration was categorized according to WHO recommendations: (5)

Median urinary Iodine	Iodine intake	Iodine status
<50 µg/l	Insufficient	Severe deficiency
50-99 µg/l	Insufficient	Moderate
100-149 µg/l	Insufficient	Mild
150-250 µg/l	Adequate	Adequate
250-499 µg/l	Above requirements	Above requirements
≥ 500 µg/l	Excessive	Excessive

Definition of study variables:

1. **Age**: Age was recorded to the nearest completed years (as on last birthday).

2. **Education**: (as per the Census of India criteria, 2011).

Illiterate – A person who cannot read / write with understanding in any language and who has completed seven years of age.

Primary - Person who had studied from 1stto 5thstandard.

Secondary – Person who had studied from 6thto 10thstandard.

PUC / ITI / Diploma - A person who had completed education up to PUC or any diploma or ITI.

Degree / Graduate - A person who had completed any graduation degree course or any under-graduation course

Post graduate - A person who had completed any post - graduation course. (38)

3. **Occupation**

Homemaker – A person whose primary activity was carrying out household tasks without being paid.

Self – employed – A person who produced goods for sale or earns an

Income through provision of services to different people and / or who spends significant amount of time working for family business, farming or other similar activity.

Non – government employee – A person who was hired to work and is paid a salary or wages. This included any employee not working for the government.

4. **Socio – economic status**

Information regarding per capita income of the family (in rupees / month) was collected and socio-economic status was classified using modified B.G. Prasad's classification for the study period of 2020.

$$\text{Monthly Per Capita Income} = \frac{\text{Total monthly income of family}}{\text{Total number of family members}}$$

Modification was done using the Correction Factor.

Correction Factor (CF) was obtained as below, the study period was from 1st January to 31st December 2020 and hence, the mean Consumer Price index for that period was taken.

Average Consumer price index for the year 2020 (by 2001 base) = 330.

$$CF = \frac{\text{Value of consumer index average (2020)} \times 4.93 \times 4.63}{100}$$

$$= \frac{330 \times 4.93 \times 4.63}{100}$$

= 75.33 [39]

Modified B. G. Prasad's Classification = Per capita family monthly income of 1961 (B. G. Prasad) x CF

Socio economic class	Prasad's classification 1961 (per capita income in rupees / month)	Modified Prasad's classification 2020 (per capita income in rupees / month)
I	100 and above	7533 and above
II	50-99	3766-7532
III	30-49	2260-3765
IV	15-29	1130-2259
V	<15	1129 and below

5. **Gravida** – A pregnant state both present and past, irrespective of the period of gestation (40)

6. **Primigravida** – A woman who is pregnant for the first time. (40)

7. **Multigravida** – A woman who has been pregnant for more than once. (40)

8. **Gestational age** – Fetal development period from the time of conception until birth. (40)

9. **Trimester**

First Trimester – Completion of 12 weeks of gestation.

Second Trimester – Above 12 weeks to 28 weeks of gestation.

Third Trimester – Above 28 weeks of gestation. (40)

10. **Still birth** – Any baby born with no signs of life at or after 28 weeks of gestation. [41]

11. **Live birth** – Complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of the pregnancy, which, after such separation, breaths or shows any other evidence of life.[42]

12. **Abortion** – Expulsion or extraction from its mother of an embryo or fetus weighing 500 gram or less when it is not capable of independent survival.[40]

13. **Antenatal Care** - Systematic supervision (examination and advice) of a woman during pregnancy. [40]

14. **Iodine deficiency disorders (IDD)** - The consequences of iodine deficiency in a population that can be prevented by ensuring that the population has an adequate intake of iodine. [7]

15. **Hypothyroidism-** Decreased function of the thyroid gland caused by decreased stimulation, by governing hormones (TSH or TRH). [43]

16. **Hyperthyroidism-** Elevate function of the thyroid gland caused by increased stimulation, by governing hormones (TSH or TRH). [43]

17. **Thyroid cancer-** Malignant (cancer) cells form in the tissues of the thyroid gland. [43]

18. **Cretinism** – Congenital hypothyroidism resulting in growth retardation, developmental delay and other abnormal features. [43]

Data analysis:

The collected data were coded and entered in MS Excel sheet. To analyze the data SPSS 25.0 trial version was used. Frequency and percentages were calculated. Knowledge, attitude and practice scores were calculated and graded into different levels. Chi-square test was used to find the association between the explanatory variables and the outcome variables. To compare continuous variables over groups Mann-Whitney U-test was used. Multiple logistic regression was used to find the association between dependent and independent variables. Multiple linear regression was used to find out the association between the predictors and the outcome.

RESULTS

Table 1: Distribution of study participants according to age (n=400)

Age in years	Number	Percentage
18-20	67	16.8
21-29	285	71.3
30-39	45	11.3
40-45	3	0.8
Total	**400**	**100**

The mean age of the 400 study participants was 24.43±4.29 years. The age of the participants ranged from 18- 45 years. 285 (71.3%) participants were in the 21-29 years age group, 67 (16.8%) were in the age group of 18-20 years, 45 (11.3%) were in the age group of 30-39years and only 3 (0.8%) were in the age group of 40-45 years.

Graph 1- Distribution of study participants according to age (n=400)

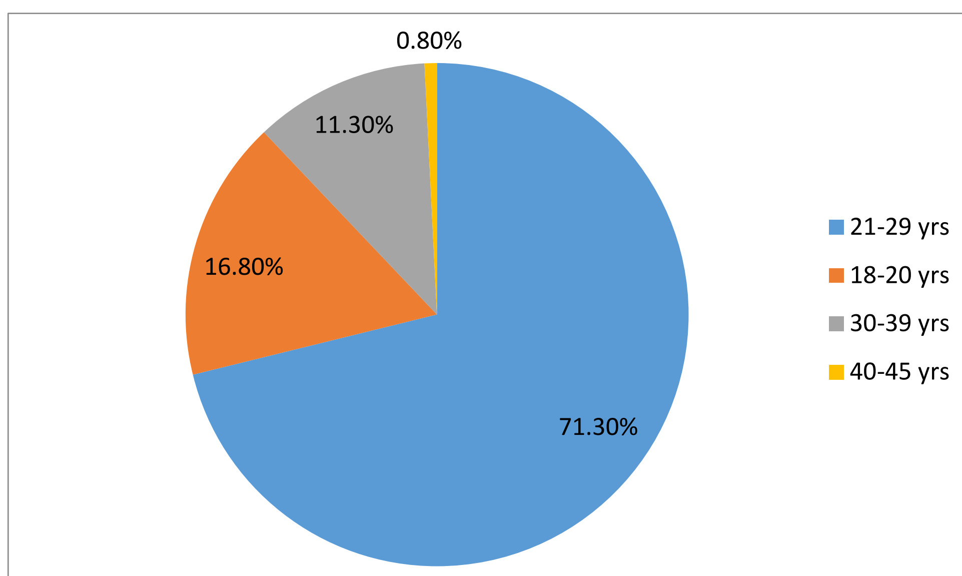


Table 2: Distribution of study participants according to education (n=400)

Education	Number	Percentage
Illiterate	22	5.5
Primary (1-5th)	18	4.5
Secondary (6-10th)	205	51.2
PUC (11-12th)/ Diploma / ITI	104	26.0
Graduate	51	12.8
Total	**400**	**100**

Educational status of the study participants showed that 205 (51.2%) had completed secondary level of education, 104 (26 %) had attended pre-university college/ diploma/ ITI, 51 (12.8%) were graduates, 22 (5.5%) were illiterates and 18 (4.5%) had completed primary level of education.

Graph 2: Distribution of study participants according to education (n=400)

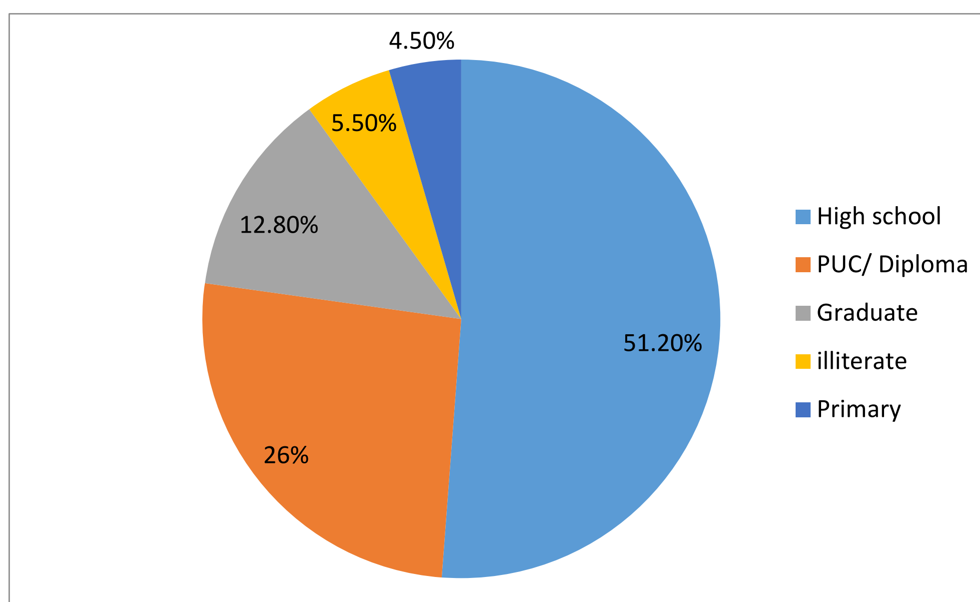


Table 3: Distribution of study participants according to occupation (n=400)

Occupation	Number	Percentage
Home maker	354	88.5
Government employee	1	0.3
Private employee	23	5.8
Farmer	11	2.8
Daily Wage Worker	11	2.8
Total	**400**	**100**

Among the 400 study participants, 354 (88.5%) were homemakers, 23 (5.8%) were employees in private sector, 11 (2.8%) were farmers, 11 (2.8%) were daily wage workers and only one (0.3%) was working in Government sector.

Graph 3: Distribution of study participants according to occupation (n=400)

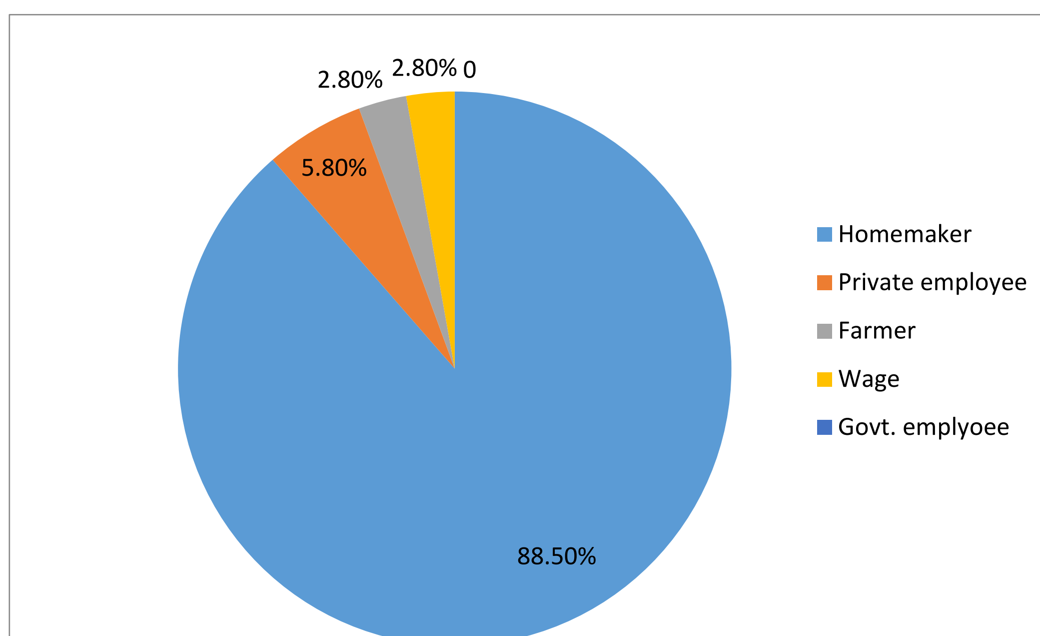


Table 4: Distribution of study participants according to socioeconomic status (According to modified B.G. Prasad's classification, 2020) (n=400)

Socio Economic Status	Number	Percentage
Class I	11	2.8
Class II	21	5.3
Class III	97	24.3
Class IV	222	55.5
Class V	49	12.3
Total	**400**	**100**

In the present study, according to modified B.G. Prasad's classification of socio-economic status, 222 (55.5%) participants belonged to Class IV, 97 (24.3%) belonged to Class III, 49 (12.3%) belonged to Class V, 21 (5.3%) belonged to Class II and only 11 (2.8%) of them belonged to Class I.

Graph 4: Distribution of study participants according to socioeconomic status (According to modified B.G. Prasad's classification, 2020) (n=400)

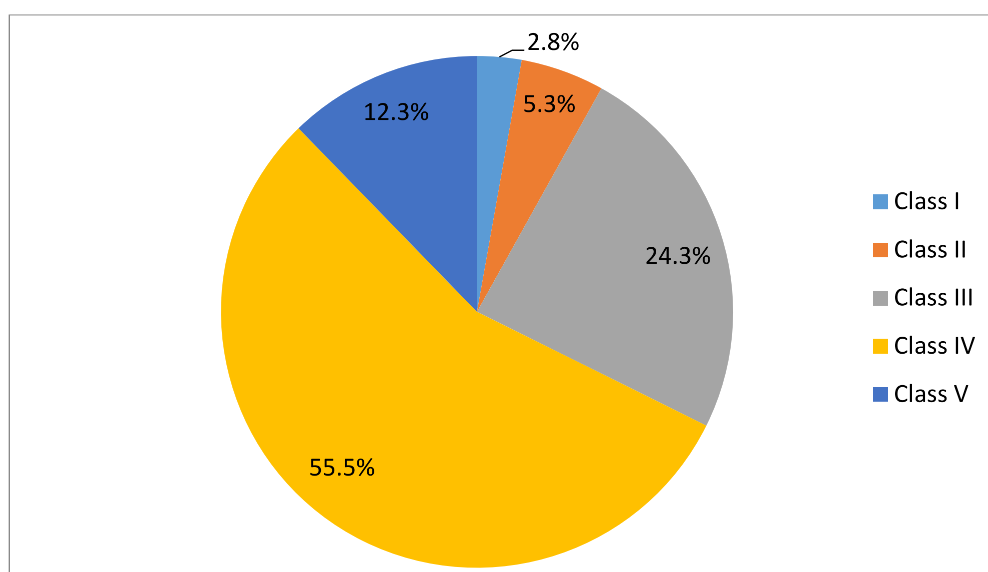


Table 5: Distribution of study participants according to their Residing area (n=400)

Area	Number	Percentage
Desur	32	8.0
Karle	32	8.0
Kinaye	36	9.0
Khadarwadi	51	12.8
Mache-I	32	8.0
Mache-II	63	15.8
Peeranwadi	80	20.0
Santibastwad	40	10.0
Waghwade	34	8.5
Total	**400**	**100**

Population proportionate sampling method was used to select the number of study participants from each sub – centre. Sampling interval was 3.8, so every 4 th registered antenatal women was chosen. Out of 400 participants, 80 (20%) were from Peeranwadi, 63(15.8%) were from Mache-II, 51(12.8%) were from Khadarwadi, 40 (10%) were from Santibastwad, 36 (9%) were from Kinaye, 34 (8.5%) were from Waghwade, 32 (8%) were from Desur and other 32 (8%) were from Karle, sub centre in PHC Kinaye area.

Graph 5: Distribution of study participants according to sub centre area (n=400)

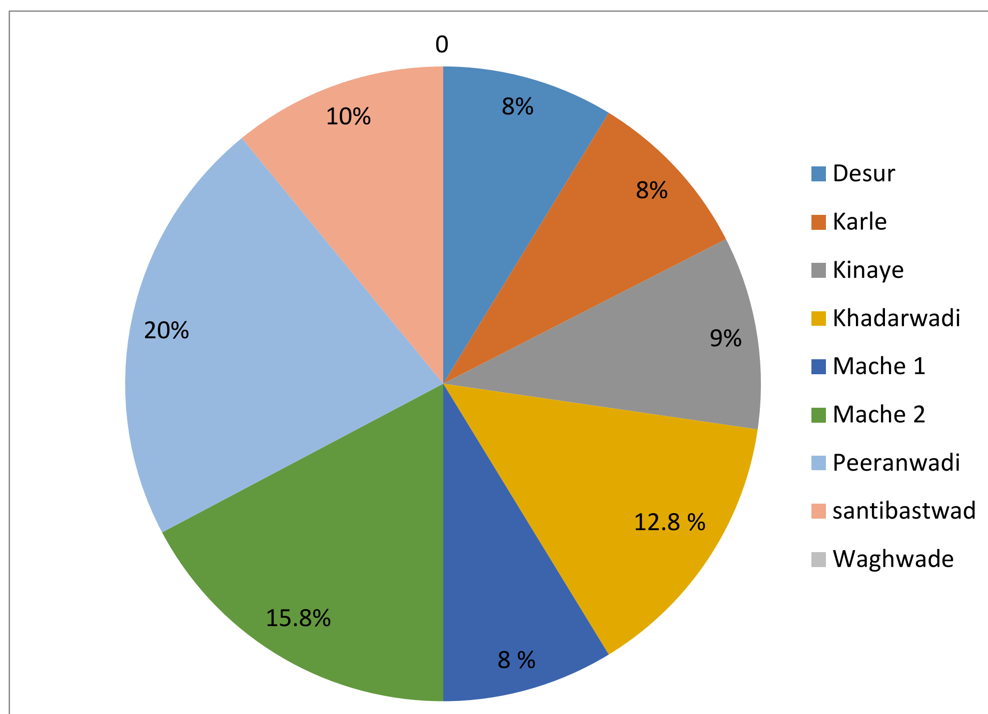


Table 6: Distribution of study participants according to their awareness about Iodized salt (n=400)

Do you know about iodized salt?	Number	Percentage
Yes	89	22.2
No	311	77.8
Total	**400**	**100**

Out of 400, 89 (22.3%) were aware about iodized salt and the remaining 311 (77.8%) participants were not aware about iodized salt.

Table 7: Distribution of study participants according to the source of information on Iodized salt (n=89)

Source	Number	Percentage
Mass Media	70	78.6
Friends	2	2.2
Neighbours	2	2.2
Teachers	7	7.8
Books/ periodicals	1	1.1
Healthcare workers	7	7.8
Total	**89**	**100**

70 (78.6%) participants came to know about iodized salt from media, 7 (7.8 %) from their teachers, 7 (7.8 %) by healthcare workers, 2 (2.2 %) were by friends, 2 (2.2 %) were by neighbours and 1(1.1%) were by books/periodicals.

Graph 6: Distribution of study participants according to the source of information on Iodized salt (n=89)

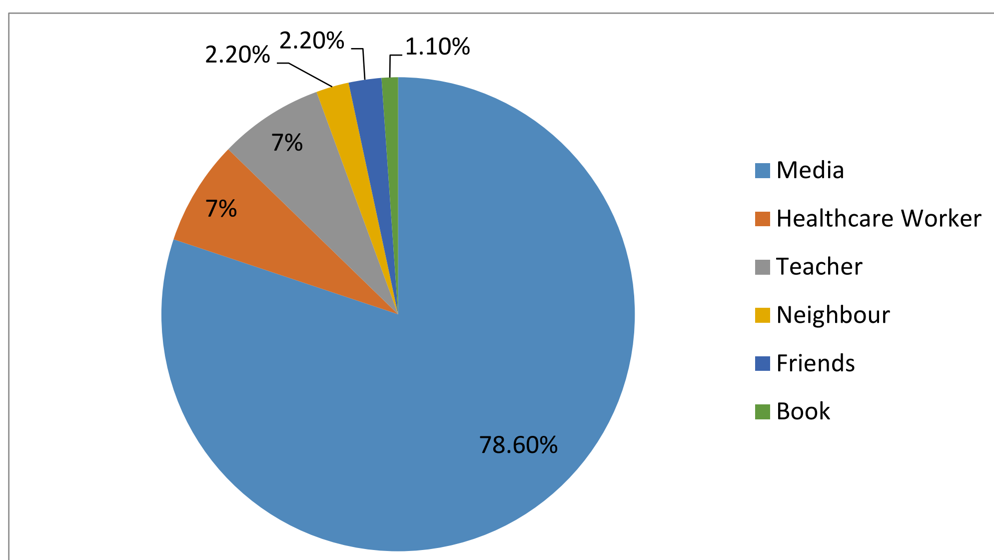


Table 8: Distribution of study participants according to awareness about iodine requirement during pregnancy (n=400)

Amount of Iodine	Number	Percentage
Don't know	323	80.8
Same	55	13.8
More	9	2.3
Less	13	3.3
Total	**400**	**100**

Out of 400 study participants, 323 (80.8%) did not know the importance of extra iodine requirement during pregnancy, 55 (13.8%) were aware that same amount of iodine is required during pregnancy, 13 (3.3%) answered that less amount of iodine is required during pregnancy and 9 (2.3%) answered that more amount of iodine is required during pregnancy.

Graph 7: Distribution of study participants according to awareness about iodine requirement during pregnancy (n=400)

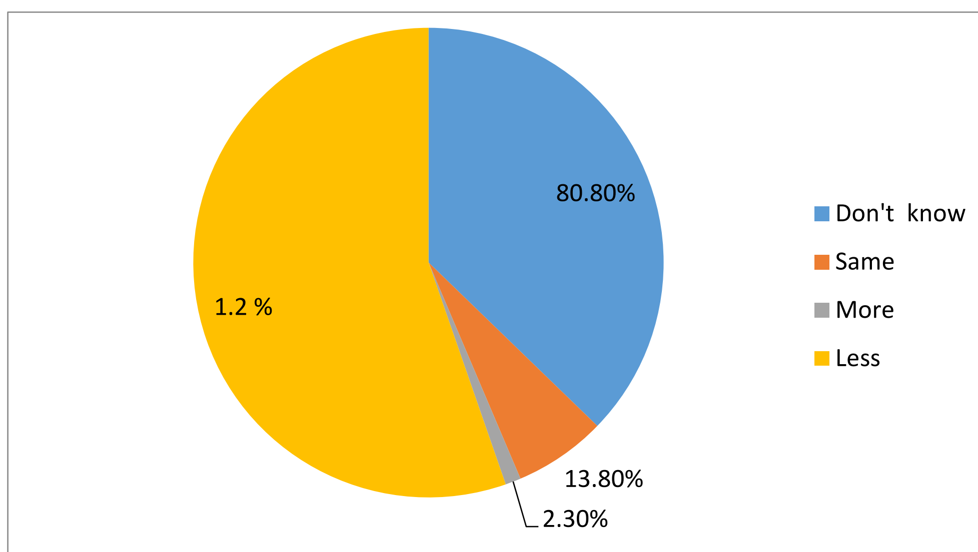


Table 9: Distribution of study participants according to their knowledge about IDD (n=400)

Do you know about IDD?	Number	Percentage
Yes	25	6.3
No	375	93.7
Total	**400**	**100**

Out of 400 study participants, 375 (93.7%) were not having knowledge about IDD and the rest 25 (6.3%) had knowledge about IDD.

Table 10: Distribution of study participants according to source of information about IDD (n=25)

Source	Number	Percentage
Mass Media	19	76
Friends	1	4
Teachers	2	8
Health workers	3	12
Total	**25**	**100**

Out 25 participants who were aware of IDD. mass media was the source of knowledge for 19 (76%) participants, healthcare workers were the source of knowledge for 3 (12%) participants, 2 (8%) were teachers and only one (4%) was friend for the source of knowledge respectively.

Table 11: Distribution of study participants based on their attitude about adding salt to food is beneficial to health, lack of iodine can cause goitre and mental retardation (n=400)

Attitude	Agree		No opinion		Disagree	
	Number	Percent age	Numbe r	Percent age	Number	Percent age
IDD public health problem worldwide and in India	19	4.8	370	92.5	11	2.8
Adding salt to food is not beneficial for health	20	5	187	46.7	193	48.3
Lack of iodine can cause goitre	24	6	373	93.3	3	0.8
Lack of iodine can cause mental retardation	11	2.8	382	95.5	7	1.8

Out of 400 study participants, only 19 (4.8%) agreed and 11 (2.8%) disagreed that IDD is a public health problem worldwide and in India. Majority 92.5% participants did not have opinion about IDD as a public health problem worldwide and in India. 20 (5%) of the participants agreed, 187 (46.7%) had no opinion and 193 (48.3%) disagreed that adding salt to food is not beneficial for health, regarding this and another. 24 (6%) agreed, 373 (93.3%) had no opinion and 3 (0.8%) disagreed about the fact that "lack of iodine can cause goitre". About 11 (2.8%) agreed, 382 (95.5%) had no opinion and 7 (1.8%) of the study participants disagreed that lack of iodine can cause mental retardation.

Graph 8: Distribution of study participants based on their knowledge about adding salt to food is beneficial for health, lack of iodine can cause goitre and mental retardation (n=400)

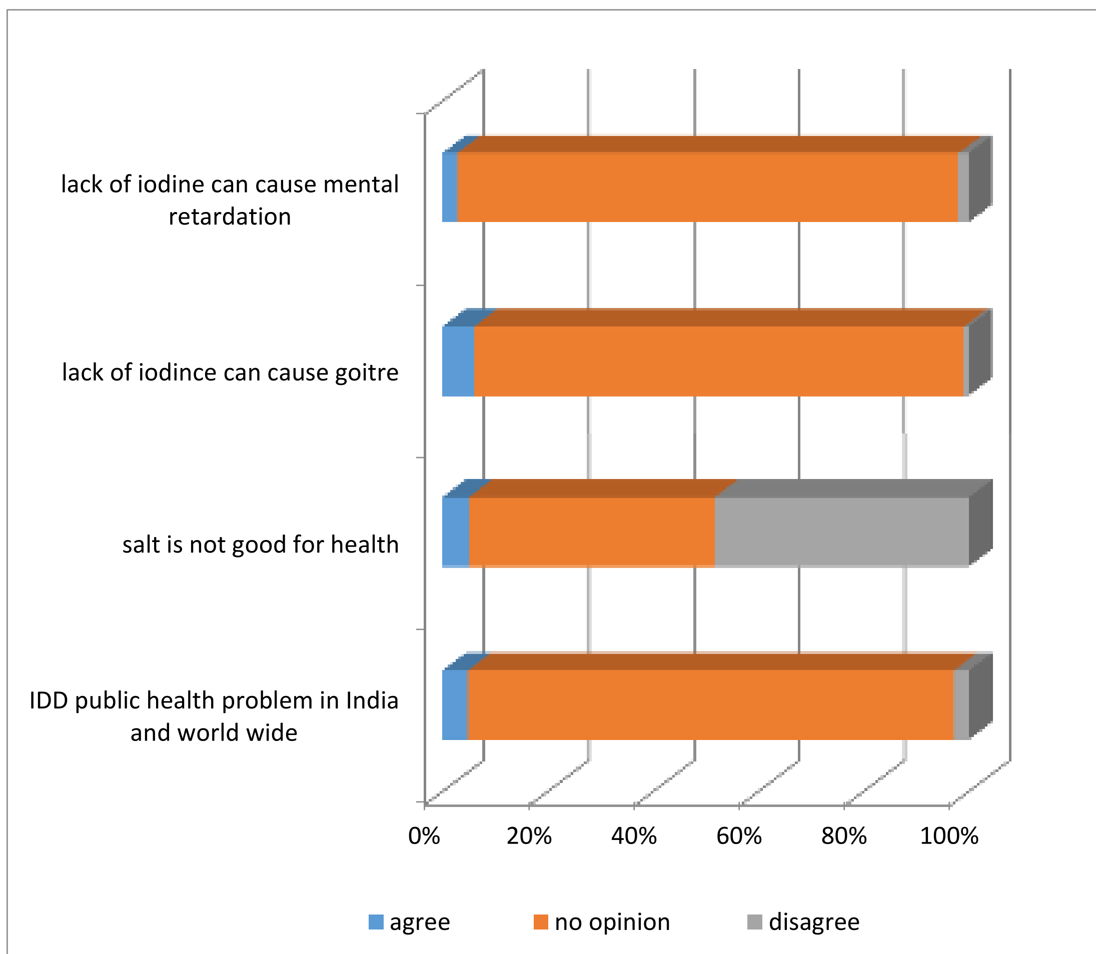


Table 12: Distribution of study participants according to their knowledge about benefits of taking iodized salt (n=67)

Benefits	**Number**	**Percentage**
Prevents goitre	4	6
Prevents cretinism	1	1.4
Good health	33	49.3
Prevents Goitre & Prevents cretinism	2	3
Prevents Goitre & good health	8	11.9
School performance	1	1.5
Good health & school performance	4	6
Prevents Goitre, good health & Prevents cretinism	5	7.5
Prevents Goitre, good health, Prevents cretinism & intelligence	2	3
Good health & intelligence	4	5.9
Good health, school performance & intelligence	3	4.5
Total	**67**	**100**

In this present study, 67 participants were aware of any one of the benefits of iodized salt. 33 (49.3%) of the participants answered that good health is the benefit of iodized salt. 8 (11.9%) answered that intake of iodized salt will prevent goitre and gives good health. 5 (7.5%) participants answered that iodized salt will prevent goitre and cretinism and it also gives good health. 4 (6%) participants answered that it will prevent goitre and another 4 (6%) told that adding iodized salt to food gives good

health and intelligence. 3 (4.5%) answered that it provides good health, improves school performance and intelligence as well, 2 (3%) of the participants answered that intake of iodized salt prevents goitre& cretinism, 2 (3%) of the participants answered that it prevents goitre and cretinism and also it improves health and intelligence, only one (1.5%) answered that iodized salt will prevent cretinism and another (0.3%) answered that it helps in better school performance.

Table 13: Distribution of study participants according to the reason for choosing salt (n=400)

Criteria for choosing salt	Number	Percentage
Price	132	33
Brand	65	16.3
Packaging	160	40
Iodized	40	10
Others	3	0.8
Total	**400**	**100**

Out of 400 participants, 160 (40%) had packaging as the criteria to choose salt and 132 (33%) had considered price as the main criteria while purchasing salt. About 65 (16.3%) used to purchase only branded salt, 40 (10%) of them preferred iodized salt and only 3 (0.8%) had not mentioned any criteria for choosing the salt.

Table 14: Distribution of study participants according to the type of salt used (n=400)

Type of salt	Number	Percentage
Crystal	12	3.0
Powdered	334	86.7
No fixed pattern	41	10.3
Total	**400**	**100**

Out of 400, 334 (86.7%) were using powdered salt, 41 (10.3%) answered that they do not follow any fixed pattern, 12 (3%) were using crystal salt.

Table 15: Distribution of study participants according to their knowledge about identification of iodized salt (n=400)

Identification	Number	Percentage
Clean	21	5.3
Pure	3	0.8
Logo	7	1.8
Written	49	12.3
Do not know	320	80.1
Total	**400**	**100**

Most of them were not aware about identification of iodized salt (80.1%). 49 (12.3%) participants identified iodized salt by seeing the label. 21 (5.3%) and 3

(0.8%) participants answered that the iodized salt will look clean and pure respectively. About 7 (1.8%) identified the iodized salt by seeing the logo.

324 (81%) had no opinion on recommending iodized salt. 74 (18.5%) participants recommended intake of iodized salt, 9 (2%) said that no need of taking iodized salt.

Graph 9: Distribution of study participants according to their knowledge about identification of iodized salt (n=400)

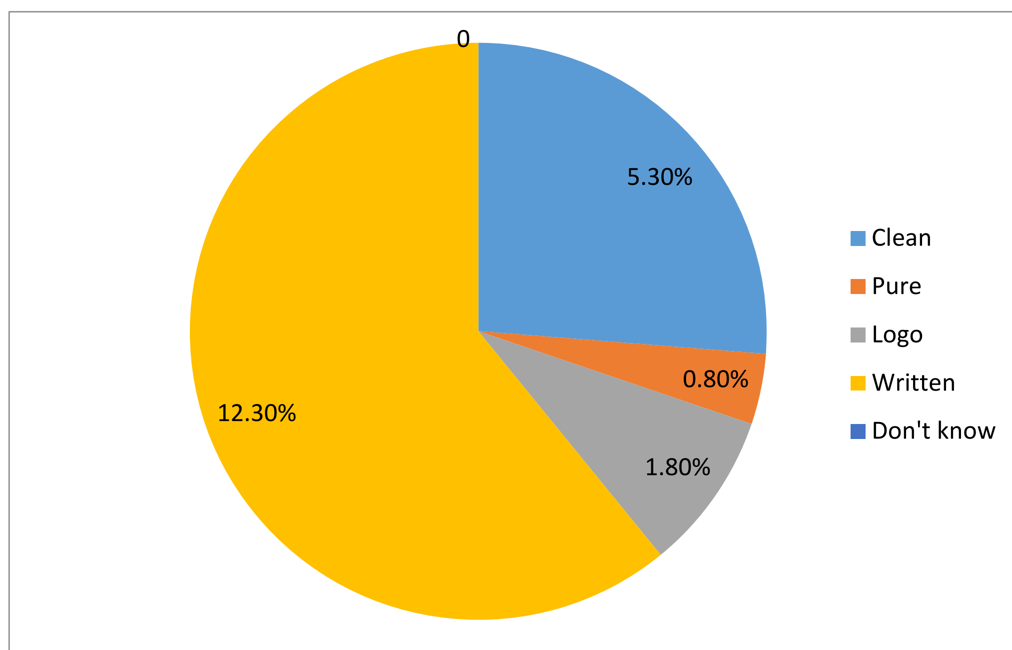


Table 16: Distribution of study participants according to their intake of iodine containing dietary supplements (n=400)

''Dietary supplements''	**Number**	**Percentage**
Dairy products (Milk & Curd)	289	72.25
Nil	111	27.8
Total	400	100
''Egg consumption''	**Number**	**Percentage**
Yes	229	57.3
No	171	42.8
Total	400	100

Out of 400, 229 (57.3%) of participants were consuming egg.289 (77.25%) were consuming any one dairy products, out of them 139 (34.7%) were taking both milk and curd, 136 (34%) were consuming only milk and 14 (3.5%) were consuming only curd. 111 (27.8%) were not consuming any dairy products.

Table 17: Distribution of study participants according to practice of salt storage (n=400)

Storage of salt	Number	Percentage
Same packet	40	10
Container with lid	354	88.5
Container without lid	6	1.5
Total	**400**	**100**

Out of 400, 354 (88.5%) participants had a practice of storing salt in the container with lid, 40 (10%) stored salt in the same packet and 6 (1.5%) of the participants stored salt in a container without lid at home.

Table 18: Distribution of study participants based on the time of adding salt during cooking (n=400)

Adding of salt	Number	Percentage
Beginning of cooking	149	37.3
Halfway through cooking	187	46.8
Towards end of cooking	58	14.5
After cooking	6	1.5
Total	**400**	**100**

Out of 400, 187 (46.8%) participants added salt in halfway through cooking. One third of the participants added salt in the beginning of cooking 149 (37.3 %). Only 58 (14.5%) used to add salt towards the end of cooking and about 6 (1.5 %) had a practice of adding salt after cooking.

Graph 10: Distribution of study participants based on the time of adding salt during cooking (n=400)

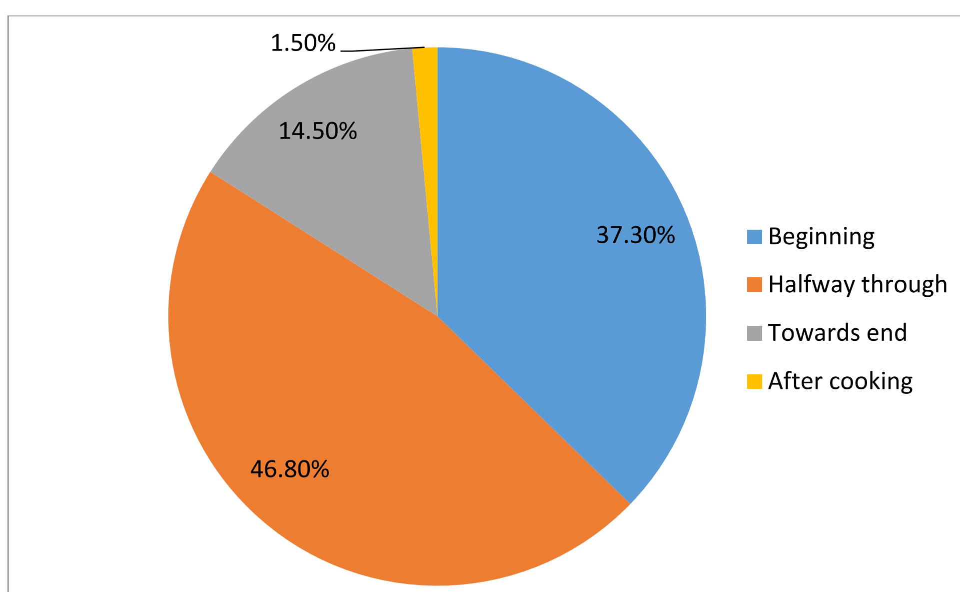


Table 19: Distribution of study participants according to Goitre status as per WHO (n=400)

Goitre grading	Number	Percentage
Grade 0	354	88.5
Grade I	46	11.5
Total	**400**	**100**

Out of 400 antenatal mothers, 46 (11.5%) had grade-I goiter and none had grade-II goiter.

Graph 11: Distribution of study participants according to Goitre status (n=400)

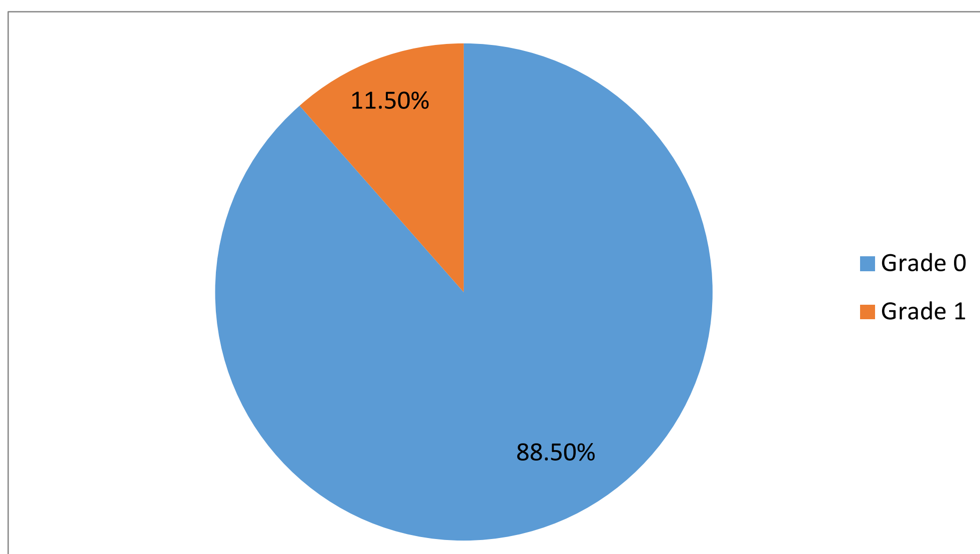


Table 20: Distribution of study participants according to the level of household salt iodine content (n=200)

Household Salt iodine level	Iodine status	Number	Percentage
0	No Iodine	10	5
<15ppm	Inadequate	66	33
>15ppm	Adequate	124	62
Total		**200**	**100**

The Mean value of the salt iodine level was 17.81±12.21. Two thirds 124 (62%) of the participants consumed adequately iodized salt (>15ppm), 66 (33%) participants consumed inadequately iodized salt (<15ppm) and 10 (5%) participants consumed salt with no iodine content (0ppm).

Graph 12: Distribution of study participants according to the level of household salt iodine content (n=200)

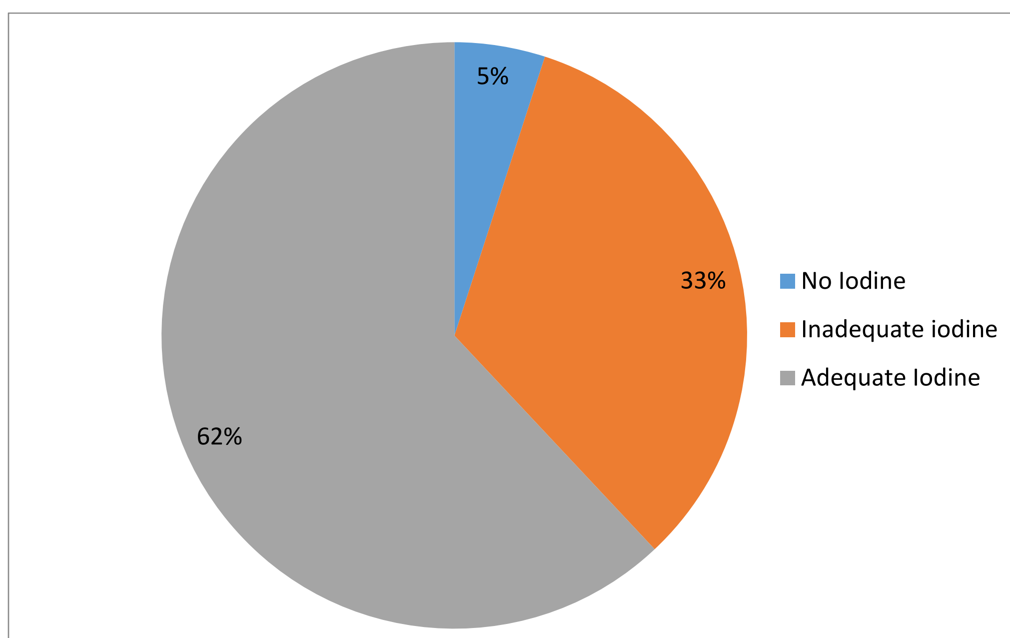


Table 21: Distribution of study participants according to Urinary excretion of iodine (n=100)

Urinary iodine concentration	Iodine status	Number	Percentage
<50 µg/l	Severe deficiency	13	13
50-99 µg/l	Moderate	76	76
100-149 µg/l	Mild	10	10
150-250 µg/l	Adequate	01	01
Total		**100**	**100**

The mean UEI of the study participants was 80.27± 25.32. Out of 100 participants, more than ¾ th76 (76%) of them had moderate iodine deficiency (MUIC- 50-99 µg/l), 13 (13%) had severe deficiency (MUIC<50 µg/l), 10 (10%) participants had mild iodine deficiency (MUIC- 100-149 µg/l) and 1 participants had adequate level of Urinary iodine concentration (MUIC of 150-250 µg/l).

Graph 13: Distribution of study participants according to urinary excretion of iodine (n=100)

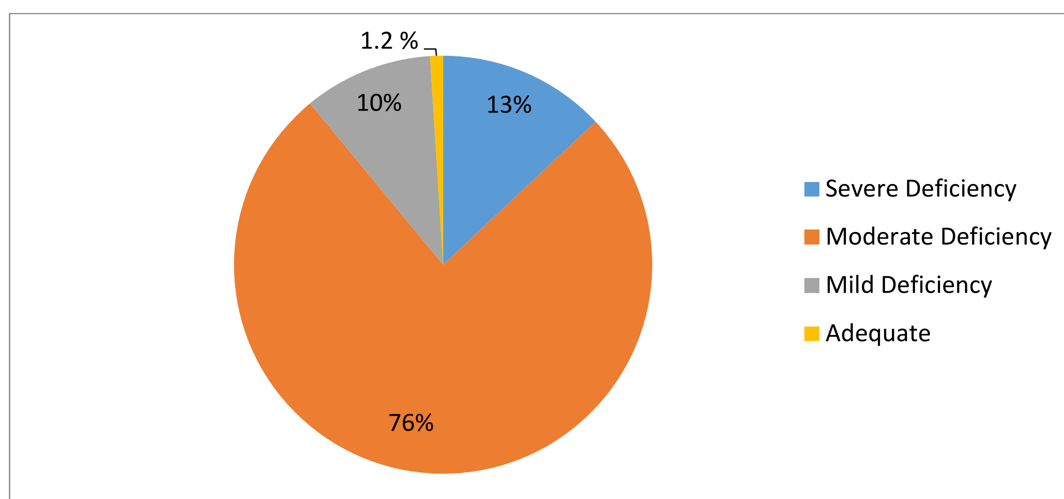


Table 22: Distribution of study participants according to their goitre status, salt iodine and Urinary excretion of iodine

Area	Goitre Grading (n=400)				Salt iodine (n=200)				Urinary excretion of iodine(n=100)			
	0		1		Adequate		Inadequate		Adequate		Deficient	
	n	%	n	%	n	%	n	%	n	%	n	%
Desur	28	87.5	4	12.5	12	70.5	5	29.4	0	0	8	100
Karle	27	84.4	5	15.6	8	50	8	50	0	0	10	100
Kinaye	29	80.6	7	19.4	10	62.5	6	37.5	0	0	9	100
Khadarwadi	49	96.1	2	3.9	19	73	7	27	0	0	13	100
Mache-I	30	93.8	2	6.3	13	81.25	3	18.75	1	12.5	7	87.5
Mache-II	60	95.2	3	4.8	22	68.75	10	45.25	0	0	14	100
Peeranwadi	70	87.5	10	12.5	26	65	14	35	0	0	20	100
Santibastwad	27	67.5	13	32.5	14	66.67	7	33.33	0	0	10	100
Waghwade	28	82.4	6	17.6	13	81.25	3	19	0	0	8	100

This table shows goitre status, salt iodine status and urinary iodine concentration of different areas. In Santibastwad 13 (32.5%) had grade I goitre, 7 (33.33%) of the participants used inadequately iodized salt and 10 (100%) were deficient of iodine concentration in urine. In Mache-I 3 (4.8%) had grade I goitre, 7 (18.75%) of the participants used inadequately iodized salt and 7 (87.5%) were deficient of iodine concentration in urine.

Table 23: Association between socio-demographic characteristics and goitre grade (n=400)

Socio-demographic characteristics		Goitre grade 0		Goitre grade 1		Chi-square	P-value
		Number	Percentage	Number	Percentage		
Area (sub-centre)	Desur	28	87.5	4	12.5	24.425	**0.004***
	Karle	27	84.4	5	15.6		
	Kinaye	29	80.6	7	19.4		
	Khadarwadi	49	96.1	2	3.9		
	Mache-I	30	93.8	2	6.3		
	Mache-II	60	95.2	3	4.8		
	Peeranwadi	70	87.5	10	12.5		
	Santibastwad	27	67.5	13	32.5		
	Waghwade	28	82.4	6	17.6		
Age group	18 to 24 yrs	179	86.5	28	13.5	0.111	0.946
	25 to 29 yrs	128	87.7	18	12.3		
	>=30 yrs	41	87.2	6	12.8		
Education	Illiterate	17	77.3	5	22.7	2.669	0.609
	Elementary	15	83.3	3	16.7		
	High school	178	86.8	27	13.2		
	Higher secondary/Diploma	93	89.4	11	10.6		
	Graduate	45	88.2	6	11.8		

Occupation	Homemaker	308	87	46	13	0.984	0.594
	Private/Government employee	22	91.7	2	8.3		
	Farmer/Laborer	18	81.8	4	18.2		
SES class	I	9	81.8	2	18.2	10.983	**0.038**
	II	17	81	4	19		
	III	86	88.7	11	11.3		
	IV	200	90.1	22	9.9		
	V	36	73.5	13	26.5		

Out of 400 participants, Grade I Goitre was observed more in Santibastwad (32.5%), followed by Kinaye (19.4%), Waghwade (17.6%) goitre was less in Khadarwadi (3.9%), when it compares to other area. Difference in Goitre grading in different areas was associated, which was statistically significant with p-0.004 (χ 2-24.425). Grade I Goitre was high in Class V Socioeconomic status people (26.5%), difference in Goitre grading in different class of Socioeconomic status was associated, which was statistical significance with p-0.038 (χ 2-10.983). Grade I Goitre was maximum (22.7%) among illiterates & minimum in those who completed higher secondary (10.6%). Maximum grade I goitre was found in the age group of 18- 24 yrs compare to other age group people. Goitre was higher in laborers / farmers (18.2%) compared to the participants with other occupation, less number of goitre was observed in participants those who worked in Government & Private sector (8.3%). Association of age group, education, occupation with goitre status was not statistically significant.

Table 24: Association between socio-demographic characteristics and salt iodine concentration (n=200)

Socio-demographic characteristics		Salt iodine concentration						Chi-square Value	P-value
		Adequate		Inadequate		No iodine			
		Number	Percentage	Number	Percentage	Number	Percentage		
Area (sub-centre)	Desur	12	70.6	5	29.4	0	0	28.396	**0.031**
	Karle	8	50.0	7	43.75	1	6.25		
	Kinaye	10	62.5	4	25	2	12.5		
	Khadarwadi	19	73.1	6	23.1	1	3.8		
	Mache-I	13	81.3	2	12.5	1	6.3		
	Mache-II	15	46.9	17	53.1	0	0		
	Peeranwadi	19	47.5	21	52.5	0	0		
	Santibastwad	14	66.7	5	23.8	2	9.5		
	Waghwade	13	81.3	2	12.5	1	6.3		
Age group	18 to 24 yrs	65	61.9	36	34.3	4	3.8	9.061	0.057
	25 to 29 yrs	45	60	29	38.7	1	1.3		
	>=30 yrs	13	65	4	20	3	15		
Education	Illiterate	8	72.7	3	27.3	0	0	2.982	0.947
	Elementary	3	42.9	4	57.1	0	0		
	High school	68	63	35	32.4	5	4.6		
	Higher secondary/ Diploma	28	59.6	17	36.2	2	4.3		
	Graduate	16	59.3	10	37	1	3.7		
Occupation	Homemaker	110	62.1	59	33.3	8	4.5	6.164	0.195

	Private/ Government employee	5	38.5	8	61.5	0	0		
	Farmer/ Laborer	8	80	2	20	0	0		
SES	I	2	33.3	4	66.7	0	0	8.034	0.406
	II	4	40	5	50	1	10		
	III	32	65.3	17	34.7	0	0		
	IV	73	62.9	37	31.9	6	5.2		
	V	12	63.2	6	31.6	1	5.3		

Maximum number of salts without iodine were used by the participants from Kinaye (12.5%), inadequate iodine contained salt was maximum in Mache-II (53.1%), minimum was in Waghwade (12.5%) & Mache-I (12.5%). Adequately iodized salt was used by maximum number of participants from Waghwade (81.3%), Mache-I (81.3%), minimum from Mache-II (46.9%). Difference in salt iodine concentration in different areas was associated, which was statistically significant with p-0.031 (χ 2-28.396). Maximum amount of salt with no iodine concentration was used by the participants whose age group is >30 yrs (15%), minimum was seen in 25-29yrs age group people (1.3%). Inadequate iodine contained salt was maximum used by 25-29yrs age group (38.7%). Age and salt iodine concentration was nearly significant p-0.057 (χ 2-9.061). Inadequate iodine salt was more used by those who completed elementary education (57%). Other variables like education, occupation, socioeconomic status was not statistically significant.

Table 25: Association between salt iodine concentration and goitre grade (n=200)

Salt iodine concentration	Goitre grade				Chi-square value	P-value
	0		1			
	Number	Percentage	Number	Percentage		
Adequate	106	86.2	17	13.8	1.004	0.618
Inadequate	57	82.6	12	17.4		
No iodine	6	75	2	25		

Prevalence of goitre was high (25%) in the study participants those who consumed salt with no iodine, followed by the participants those who consumed inadequate iodine (17.4%) and minimum percentage of goitre was observed in the participants who consumed adequate amount of iodine (13.8%). Though the difference in percentage was seen, association was not statistically significant p-0.618, (χ 2-0.618).

Table 26: Multiple logistic regression to check the influence of factors on household salt iodine concentration (n=200)

Variables		**Multivariable model**	
		adjusted OR (95% CI)	**P-value**
Area (sub-centre)	Waghwade (Reference)	1.00	
	Desur	0.27 (0.42-1.76)	0.171
	Karle	0.10 (0.01-0.67)	**0.016***
	Kinaye	0.33 (0.05-2.04)	0.236
	Khadarwadi	0.47 (0.087-2.59)	0.390
	Mache-I	0.80 (0.11-5.47)	0.827
	Mache-II	0.42 (0.09-2.11)	0.297
	Peeranwadi	0.30 (0.06-1.44)	0.136
	Santibastwad	0.30 (0.05-1.72)	0.179
Age	< 24 yrs	1.00	
	> 24 yrs	1.12 (0.53-2.36)	0.766
Education	Graduate (Reference)	1.00	
	Illiterate	0.28 (0.03-2.21)	0.233
	Elementary	0.15 (0.01-1.45)	0.102
	High school	0.33 (0.08-1.23)	0.099

	Higher secondary/Diploma	0.48 (0.11-1.96)	0.306
SES class	V(Reference)	1.00	
	I	0.43 (0.04-4.13)	0.469
	II	0.60 (0.10-3.68)	0.588
	III	2.33 (0.59-9.11)	0.224
	IV	1.28 (0.39-4.19)	0.683
Adding of salt	Towards end/After cooking (Reference)	1.00	
	In the beginning	0.13 (0.03-0.52)	**0.004***
	Halfway through	0.19 (0.05-0.71)	**0.014***

Multiple logistic regression was used to assess the predictors of low salt iodine concentration. As compared to people from Waghwade, Karle people are 0.10 (adjusted OR: 0.10, 95% CI: 0.01- 0.67) times likely to be in adequately iodized salt category, which was statistically significant (p-0.016). Participants from Peeranwadi was 0.30 (adjusted OR: 0.30, 95% CI: 0.06-1.44) and Mache- II is 0.30 (adjusted OR: 0.30, 95% CI: 0.05-1.72) times to be in adequate salt iodine concentration group as compared to Waghwade. As compared to the participants who were graduate, participants who completed elementary education 0.15 (adjusted OR: 0.15, 95% CI: 0.01-1.45) times likely to be in adequate salt iodine concentration group. As compared to the participants belonging to class V socioeconomic status, participants belonged to class III socioeconomic status, 2.33 (adjusted OR: 2.33, 95% CI: 0.59-9.114) times to be in adequately iodized salt group. Participants who added the salt in the beginning of cooking were 87% (adjusted OR: 0.13, 95% CI: 0.03-0.52) less

likely to be in adequately iodized group as compared to those people who added salt in the end of cooking, which was statistically significant (p-0.004). People who added the salt in the middle of cooking are 0.19 (adjusted OR: 0.19, 95% CI: 0.05-0.73) times likely to be in adequately iodized group as compared to those people who added salt in the end, which was statistically significant (p-0.014).

Table 27: Association between socio-demographic characteristics and urinary excretion of iodine (n=99)

Socio-demographic characteristics		Mild deficiency		Moderate and severe deficiency		Chi-square value	p-value
		Number	Percentage	Number	Percentage		
Area (sub-centre)	Desur	1	12.5	7	87.5	17.998	**0.001****
	Karle	0	0	10	100		
	Kinaye	5	59.9	4	44.4		
	Khadarwadi	1	7.7	12	92.3		
	Mache-I	0	0	7	100		
	Mache-II	0	0	14	100		
	Peeranwadi	0	0	20	100		
	Santibastwad	2	20	8	80		
	Waghwade	1	12.5	7	87.5		
Age group	18 to 24yrs	4	8.9	41	91.1	0.657	0.719
	25 to 29yrs	4	9.5	38	90.5		
	>-30 yrs	2	16.7	10	83.3		
Education	Illiterate	1	20	4	80	3.317	0.578
	Elementary	0	0	2	100		
	High school	6	10.7	50	89.3		
	Higher secondary/ Diploma	3	14.3	18	85.7		

	Graduate	0	0	15	100		
Occupation	Homemaker	9	10.3	78	89.7	2.557	0.757
	Govt. employee	0	0	1	100		
	Pvt. Employee	1	25	3	75		
	Farmer	0	0	3	100		
	Daily Wage	0	0	4	100		
SES	I	0	0	2	100	1.836	0.771
	II	1	12.5	7	87.5		
	III	3	14.3	18	85.7		
	IV	6	10.3	52	89.7		
	V	0	0	10	100		

20 (100%) from Peeranwadi, 14 (100%) from Mache-II, 7 (100%) from Mache-I, 10 (100%) participants from Karle, 4 (44.4%) from Kinaye were in moderate to severe iodine deficiency. 5 (59.9%) from Kinaye, 2 (20%) from Santibastwad, 1(12.5%) from Desur and 1(12.5%) from Waghwade were in mild iodine deficiency. Area and urinary excretion of iodine is statistically significant with p value <0.001 (χ 2- 87.029). 18-24 years age group 41(91.1%) participants were in moderate to severe iodine deficiency and 2 (16.7%) >30 years, were in mild iodine deficiency. Association of other variables like age, education, occupation, socioeconomic status with urinary excretion of iodine was not statistically significant.

Table 28: Median (IQR) urinary excretion of iodine according to trimester (n=100)

Urinary excretion of iodine		Z value	P-value
Trimester II (n=50)	Trimester III (n=50)		
83.41(70.66,89.59)	86.30(73.55,96.82)	-1.106	0.269

This table shows Median (IQR) urinary excretion of iodine according to trimester by using Mann Whitney u test. There is no significance in distribution of urinary excretion of iodine in the participants in IInd& IIIrd trimester p- 0.269 (Z-1.106).

Table 29: Association between salt iodine concentration and urinary excretion of iodine (n=99)

Salt iodine concentration	Urinary excretion of iodine						Chi-square value	P-value
	Mild		Moderate		Severe deficiency			
	Number	Percent age	Number	Percent age	Number	Percent age		
Adequate	9	13	53	76.9	7	10.1	8.068	**0.021**
Inadequate	1	4	21	84	3	12		
No iodine	3	60	2	40	0	0		

Most of the participants taking adequately iodized salt had insufficient iodine level in urinary excretion of iodine. Salt iodine concentration and urinary excretion of iodine was associated, which was statistically significant p-0.021 (χ 2-8.068).

Table 30: Association between urinary excretion of iodine and goitre grade (n=100)

<table>
<tr><th rowspan="3">Urinary excretion of iodine</th><th colspan="4">Goitre grade</th><th rowspan="3">Chi-square</th><th rowspan="3">P-value</th></tr>
<tr><th colspan="2">0</th><th colspan="2">1</th></tr>
<tr><th>Number</th><th>Percentage</th><th>Number</th><th>Percentage</th></tr>
<tr><td>Adequate</td><td>1</td><td>100</td><td>0</td><td>0</td><td rowspan="4">11.778</td><td rowspan="4">0.010</td></tr>
<tr><td>Mild</td><td>4</td><td>40</td><td>6</td><td>60</td></tr>
<tr><td>Moderate</td><td>65</td><td>85.5</td><td>11</td><td>14.5</td></tr>
<tr><td>Severe deficiency</td><td>10</td><td>76.9</td><td>3</td><td>23.1</td></tr>
</table>

Out of 100, 6 (60%) participants with mild iodine deficiency had grade I Goitre. 3 (23.1%) and 11 (14.5%) participants presented with grade I Goitre in severe and moderate iodine deficiency group. Goitre was not seen in the participants with adequate urinary excretion of iodine. Urinary excretion of iodine and goitre status was statistically significant p-0.010 (χ 2-11.778).

Table 31: Median (IQR) urinary excretion of iodine according to food consumption (n=100)

Consumption of food		Median (IQR) Urinary Excretion of iodine	Z value	P-value
Dairy	Yes (n=72)	85.75(74.26,95.89)	-0.971	0.331
	No (n=28)	79.75(66.00,90.27)		
Egg	Yes (n=64)	86.07(75.46,95.37)	-1.368	0.171
	No (n=36)	81.52(51.50,92.40)		
Bread	Yes (n=3)	95.18(75.94,101.35)	-1.031	0.303
	No (n=97)	85.51(71.98,93.85)		

72% of the participants consumed diary products, 28% did not consume diary products. There was no significant difference in the distribution of urinary excretion of iodine in people those who were taking dairy products and those who were not taking dairy products. 64% of the participants consumed egg, 36% did not take egg, and only 3% of the participants ate bread, 97% did not consume bread. There was no difference observed in their urinary excretion of iodine between those who had taken egg & bread and those who are not taking.

Table 32: Predictors of salt iodine concentration (n=200)

Variables	**β estimate (95% CI)**	**P-value**
(Intercept)	21.00(7.87,34.12)	0.002
Area: Karle	-9.93(-15.93,3.92)	**0.001**
Area: Kinaye	-8.63(-14.66,2.61)	**0.006**
Area: Khadarwadi	-4.45(-9.98,1.09)	0.117
Area: Mache-I	-5.63(-11.52,0.27)	0.063
Area: Mache-II	-4.67(-9.80,0.47)	0.076
Area: Peeranwadi	-3.88(-8.96,1.20)	0.136
Area: Santibastwad	-4.83(-10.54,0.88)	0.099
Area: Waghwade	-7.22(-13.41,0.03)	**0.023**
Age	-0.17(-0.48,0.13)	0.260
Education: Elementary	2.81(-5.61,11.22)	0.514
Education: High school	0.15(-5.47,5.77)	0.958
Education: Higher Secondary/Diploma	1.35(-4.61,7.31)	0.657
Education: Graduate	2.03(-4.65,8.71)	0.553
Occupation: Government employee	-5.19(-22.73,12.36)	0.563
Occupation: Private employee	0.69(-4.51,5.90)	0.794
Occupation: Farmer	3.92(-6.42,14.26)	0.459
Occupation: Laborer	4.34(-2.36,11.03)	0.206
SES level	-0.31(-1.89,1.27)	0.698

Multiple linear regression was performed to assess the predictors of salt iodine concentration. This constant 21.00 is the average salt iodine concentration of people who belong to Desur, who were illiterates, who were homemakers and whose mean age was 24.43±4.29 yrs. The expected average decrease in salt iodine concentration in Karle as compared to Desur was found to be 9.93 ppm (p-0.001) (β: -9.93; 95% CI: -15.93, -3.92).The expected average decrease in salt iodine concentration in Kinaye as compared to Desur was found to be 8.63 ppm (p-0.006) (β: -8.63; 95% CI: -14.66, -2.61). The expected average decrease in salt iodine concentration in Waghwade as compared to Desur was found to be 7.22 ppm (p-0.023) (β: -7.22; 95% CI: -13.41, -1.03). Area (Karle, Kinaye, Waghwade) were found to be significant predictor of salt iodine concentration.

Table 33: Predictors of urinary excretion of iodine (n=100)

Variables	β estimate(95% CI)	P-value
(Intercept)	84.86 (39.38,130.34)	<0.001
Area: Karle	-15.49 (-34.52,3.55)	0.115
Area: Kinaye	4.78 (-15.18,24.73)	0.640
Area: Khadarwadi	1.28 (-17.08,19.63)	0.892
Area: Mache-I	13.49 (-6.06,33.03)	0.180
Area: Mache-II	-17.88 (-35.24,-0.52)	**0.047**
Area: Peeranwadi	-44.79 (-62.17,-27.42)	**<0.001**
Area: Santibastwad	-9.21 (-28.64,10.22)	0.356
Area: Waghwade	-6.44 (-26.51,13.64)	0.532
Age	0.43 (-0.56,1.41)	0.396
Education: Elementary	51.24 (16.01,86.47)	**0.006**
Education: High school	22.28 (2.56,42.01)	**0.030**
Education: Higher Secondary/Diploma	18.76 (-2.67,40.19)	0.090
Education: Graduate	7.87 (-14.93,30.67)	0.501
Occupation: Government employee	-0.13 (-42.94,42.69)	0.995
Occupation: Private employee	15.87 (-4.97,36.71)	0.139
Occupation: Farmer	-8.37 (-34.78,18.04)	0.536
Occupation: Laborer	-11.15 (-32.12,9.82)	0.301
SES level	-2.66 (-7.96,2.64)	0.328
Attitude score	3.96 (0.33,7.59)	**0.036**
Practice score	-2.91 (-6.33,0.51)	0.099

Multiple linear regression was performed to assess the predictors of urinary excretion of iodine. Constant 84.86 is the average concentration of urinary excretion of iodine of people who belonged to Desur, who were illiterates, who were homemakers and whose mean age was 24.43 ± 4.29 yrs. Area, education and attitude score was found to be significant predictor of urinary excretion of iodine. The expected average decrease in urinary excretion of iodine in Peeranwadi as compared to Desur was found to be 44.79µg/l with (p-<0.001) (β: -44.79; 95% CI: -62.17, -27.42), which was associated and statistically significant. The expected average decrease in urinary excretion of iodine in Mache-II as compared to Desur was found to be 17.88µg/l with (p-0.047) (β: -17.88; 95% CI: -35.24, -0.52), which was associated and statistically significant. The expected average increase in urinary excretion of iodine concentration in Mache-I as compared to Desur was found to be 13.49µg/l (β: 13.49; 95% CI: -6.06, 33.03). Expected average increase in urinary excretion of iodine in Kinaye as compared to Desur was found to be 4.78µg/l (β: 4.78; 95% CI: -15.18, 24.73). Mache-II, Peeranwadi areas and urinary excretion of iodine was associated, which was statistically significant. In average, the urinary excretion of iodine concentration in women with elementary education is expected to increase by 51.24µg/l with (p-0.006) (β: 51.24; 95% CI: 16.01, 86.47) as compared to illiterate women. Similarly, in average, the urinary iodine in women, those who completed high school education was expected to increase by 22.28µg/l with (p-0.030) (β: 22.28; 95% CI: 2.56, 42.01) as compared to illiterate women. In education those who have completed elementary school, high school and urinary excretion of iodine was statistically significant. The expected average increase in urinary excretion of iodine in private employee as compared to homemaker was found to be 15.87µg/l (β: 15.87; 95% CI: -4.97, 36.71). Since

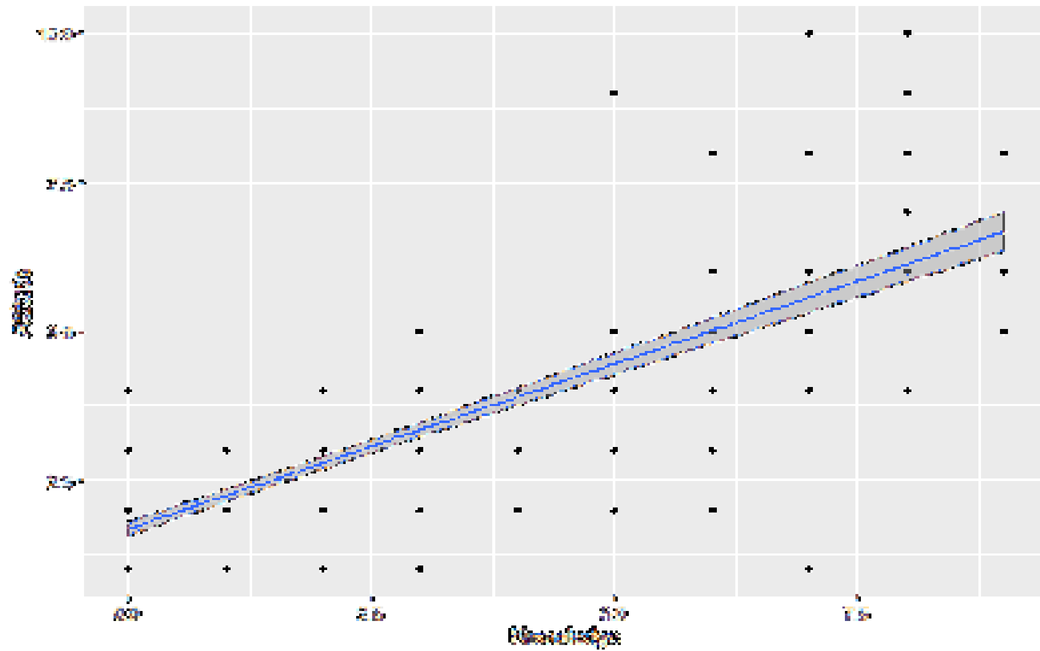
correlation of knowledge & attitude score was having very high correlation. So knowledge score variable was dropped from multiple linear regression. With each unit increase in attitude score, there was 3.96 times increase in urinary excretion of iodine with (p-0.036) (β: 3.96; 95% CI: 0.33, 7.59) keeping other variables constant. Attitude score and urinary excretion of iodine was statistically significant.

Table 34: Correlation between knowledge, attitude and practice (n=400)

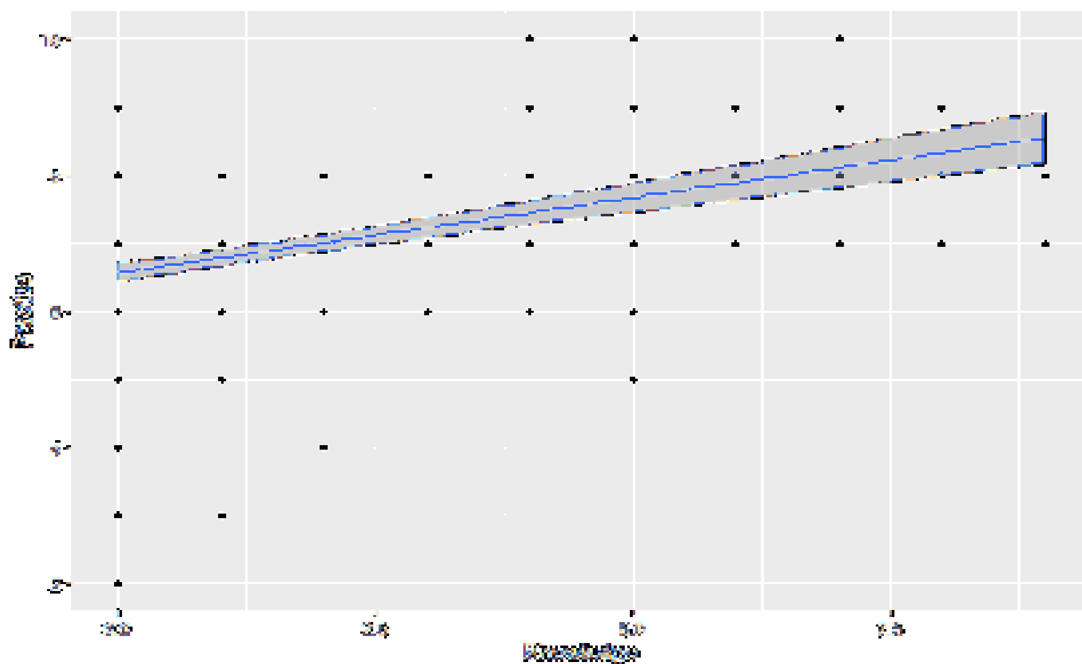
Variables	Correlation coefficient (95% CI)	p-value
Knowledge and Attitude	0.805 (0.767,0.837)	<0.001
Knowledge and Practice	0.414 (0.329,0.492)	<0.001
Attitude and Practice	0.364 (0.275,0.446)	<0.001

Mean knowledge score was 1.30 ± 2.47, there was high and positive statistically significant correlation between knowledge and attitude (p<0.01). Mean attitude score was 2.40 ± 1.70, there was moderate and positive statistically significant correlation between knowledge and practice (p<0.01). Mean practice score was 6.86 ± 1.31, there was statistically slight and positive significant correlation between attitude and practice (p<0.01).

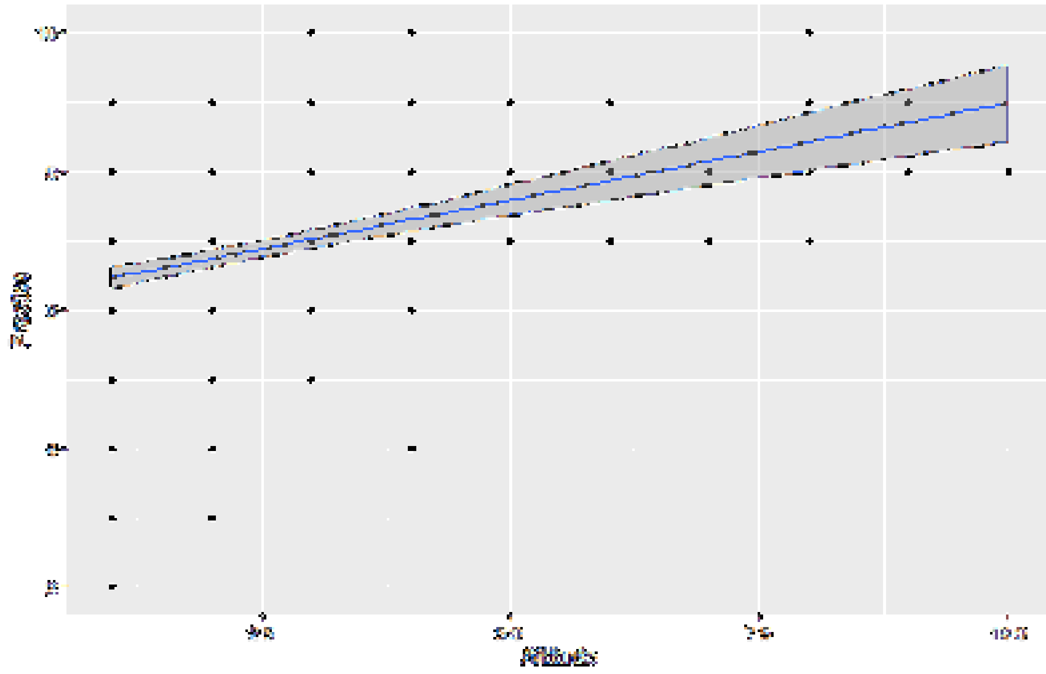
Graph 14: Scatter plot showing correlation between knowledge and attitude (n=400)



Graph 15: Scatter plot showing correlation between knowledge and practice (N=400)



Graph 16: Scatter plot showing correlation between attitude and practice (N=400)



DISCUSSION

"Community-based assessment of iodine status among rural ante-natal women – A cross-sectional study" was conducted in the rural field practice areas of Kinaye, Belagavi, attached to the Department of Community Medicine, J. N. Medical College, KAHER, Belagavi. The study population consisted of 400 pregnant women who were more than 12 weeks of gestational age.

Table 1: Distribution of study participants according to their age

In the present study, 71.3 % of the pregnant women were in the age group of 21 – 29 years.

Table 2: Distribution of study participants according to their education

In the present study, 51.2 % had completed secondary level of education and 26 % had completed Pre – University College (PUC)/ diploma.

Table 3 & 4: Distribution of study participants according to their occupation and socio – economic status

In the present study, most of the study participants (88.5 %) were homemakers and more than half of the participants (55.5%) belonged to Class IV socio – economic status and 24.3% belonged to Class III socio – economic status as per modified B G Prasad's scale.

Table 5: Distribution of study participants according to residing area

In this present study, participants were recruited from nine different areas which come under rural field practice of Kinaye PHC. 51.3% participants were in third trimester, 49.8% were in second trimester.

Table 6: Distribution of study participants according to their awareness about Iodized salt

In this present study, 22.2% of the study participants were aware about iodized salt.

A cross- sectional study was conducted among 356 antenatal women in Ethiopia, [18] in 2014 found that 26% of the study participants were aware about iodized salt. This was higher compared to the present study. [20]

Table 7: Distribution of study participants according to the source of information on Iodized salt

In this study, mass media was the source of information for 78.6% of the participants, school teachers were the source of information for 7.8% of the participants, 7.8% by healthcare workers, 2.2% by friends, 2.2% by neighbors and 1.1% by books/ newspaper.

In a study conducted in 2014 among 356 antenatal women in Ethiopia. Health extension workers were the source of information for 31.9%, which was higher compared to the present study. Mass media was the main source of information for 30.9% participants which was lesser compared to the present study. [20] A study was conducted among 150 antenatal women in Turkey in 2016. The source of information

for 57.9% of the participants was mass media, which was lesser compared to the present study. Healthcare personnel were the source of information for 35.6%, which was higher compared to the present study. [23]

Table 8: Distribution of study participants according to awareness about iodine requirement during pregnancy

In the present study only 2.3% had awareness about increased iodine requirement during pregnancy. Awareness about iodine requirement was very poor.

A study was conducted in Ireland among 200 pregnant women in 2015. 20% had awareness about higher requirement of iodine during pregnancy, which was higher compared to the present study. In both the studies majority were unaware about iodine requirement during pregnancy. [22]

Table 9: Distribution of study participants according to the knowledge about IDD

In the present study only 6.3% participants were aware of IDD.

A study was conducted in Turkey in 2016 among 150 antenatal women revealed that 68% of participants were aware about iodine deficiency disorders, which was higher compared to the present study. Another study was conducted in Western Turkey among 275 antenatal mothers, 16.7% of the participants were aware of iodine deficiency disorders, which was higher compared to the present study. [22]

Table 10: Distribution of study participants according to source of information about IDD

In the present study mass media was the source of information for 76% participants about IDD, 12 % by health workers, 8% by teachers and 4% by friends.

Table 11: Distribution of study participants based on their about awareness about considering IDD as public health problem worldwide and in India, adding salt to food is beneficial to health & lack of iodine can cause goitre and mental retardation

In the present study, only 4.8 % agreed that IDD is a public health problem in India and Worldwide. In the present study, 6% of the participants agreed that lack of iodine can cause goitre, 2.8% of the participants agreed that lack of iodine can cause mental retardation.

Table 12: Distribution of study participants according to their knowledge about benefits of taking iodized salt

In the present study, 49.3 % participants knew that good health is the benefit of intake of iodized salt, 11.9% had knowledge that intake of iodized salt will prevent Goitre & Cretinism, 7.5% had knowledge that it will prevent Goitre & Cretinism and also provide good health.

A study was conducted among antenatal women of 150, 19-45 yrs age group in Turkey, 2016 found that 68% of participants knew that iodine deficiency can cause serious problems during pregnancy, but they did not mention the problems caused by iodine deficiency specifically. The knowledge was higher compared to the present study. [(23)]

Table 13: Distribution of study participants according to the reason for choosing salt

In the present study, 40% of the participants chose salt based on packaging, 33% by price, 16.3% chose by brand and 10% chose based on iodization.

Table 14: Distribution of study participants according to the type of salt used

In the present study, 86.7% participants used powdered salt, 10.3% did not follow any fixed pattern and 3% of participants used crystal salt.

A cross sectional study was conducted in a Primary Health Centre of Lucknow, Uttar Pradesh among 300 antenatal women, which revealed 90.5% of the study participants used powdered salt, which was similar to the present study. < 10% participants used crystal salt, which was more compared to the present study. [10] A study was conducted in 2014 among 356 antenatal women in Ethiopia revealed that 94.4% of the antenatal women were using crystal salt, which was higher compared to the present study. 5.4% used powdered salt at the time of survey, which was lesser compared to the present study. [20]

Table 15: Distribution of study participants according to their knowledge about identification of iodized salt

In the present study, 12.3% participants could read the information (Iodized salt was mentioned over the pack) to identify the iodized salt, which was given on the salt packet. 1.8% identified the iodized salt by identifying the logo of iodized salt.

A study was conducted among 150 antenatal women between 19-45 yrs age group in Turkey, 2016 found that 26.0% of the study participants could read the information on the salt package, which was higher compared to the present study. [23]

Table 16: Distribution of study participants according to their intake of iodine containing dietary supplements

In the present study, 57.3% participants were consuming iodine rich food (egg). 77.25% were consuming iodine rich foods (milk and other dairy products).

A national wide cross-sectional study was conducted in 2013 among 739 pregnant women in Latvia revealed that 87.8 % of the participants were consuming iodine rich foods (milk and other dairy products) daily, which was higher, compared to the present study. [33]

Table 17: Distribution of study participants according to practice of salt storage at home

In this study, 88.5% used to store salt in a container with lid, 10% participants used to store salt in the same packet and 1.5% participants stored salt in a container without lid.

Similar results were found in a study, which was conducted among 356 antenatal women in Ethiopia, 2014 found that 98.9% of the participants stored the salt in a container with a lid. [20]

Table 18: Distribution of study participants based on the time of adding salt during cooking

In this present study, 46.8% of the participants added salt in halfway through cooking, 37.3% participants added salt in the beginning of cooking, 14.5% used to add salt towards the end of cooking and 1.5% used to add salt after cooking.

In a study conducted in Kolkata, West Bengal, among 237 antenatal mothers found that 88% of the participants had practice of adding in the beginning of cooking, which was higher compared to the present study. 10% used to add salt in the middle of cooking, which was lesser compared to this study. 2% used to add salt in the end of cooking, which was lesser compared to the present study. A study was conducted among 150 antenatal women in Turkey in 2016 found that 56.7% used to add salt just before the end of cooking, which was higher compared to the present study.(14) A study was conducted among 356 antenatal women in Ethiopia in 2014, found that 50% of participants used to add salt in the end of cooking, which was higher compared to this study. 8.1% added salt after cooking, which was higher compared to the present study. (20)

Table 19: Distribution of study participants according to their Goitre status

In the present study, 11.5% had grade-I goitre, which was similar to a study conducted in Rajasthan among 510 pregnant women in 2015. 13.6% participants had grade I Goitre as per WHO classification. (8)

Table 20: Distribution of study participants according to the level of household salt iodine content

In the present study, mean value of the salt iodine was 17.81± 12.21. Six out of ten salt samples were adequately iodized, three out of ten salt samples were inadequately iodized and rest 5% samples were with no iodine content.

In a study 200 salt samples were collected from antenatal mothers in Lucknow, Uttar Pradesh, 2016-2017 revealed that 77% of participants were consuming adequately iodized salt, which was higher compared to the present study. 17% were using inadequately iodized salt, which was lower compared to the present study. 7% salt samples had no iodine, which was higher compared to the present study.[10]

A study was conducted in Kolkata, West Bengal among 237 antenatal mothers found that 73% household salt samples had adequate iodine concentration, which was higher compared to the present study. 20% household salt samples had inadequate iodine concentration which was lower compared to the present study. [14]

In a study conducted in Rajasthan among 510 pregnant women, in 2015, 220 salt samples were collected from the study participants. Mean value of the salt samples was 25.48 ± 13.383, which was higher compared to the present study. 80% of salt samples had adequate iodine concentration, which was higher compared to the present study. 20% samples had inadequate iodine concentration, which was low compared to the present study. 1.4% had no iodine content at consumption level, which was lesser compared to the present study. [8]

Table 21: Distribution of study participants according to their Urinary excretion of iodine

In the present study, Mean value of 100 urine samples for urinary excretion of iodine was 80.27 ± 25.32. 1% of sample had adequate median urinary iodine concentration. 76% of urine sample had moderate iodine deficiency, 13% had severe deficiency, 10% of urine samples had mild iodine deficiency. Urinary excretion of iodine, depend on many factors like iodine content in Soil and Water in that area, where the foods consumed by the participants are grown, intake of iodine rich foods and consumption iodine fortified food items like salt, bread, oil etc.

A study was conducted among three districts of Himachal Pradesh among 311 antenatal women in 2012, which was similar to the present study, 100% of the urine samples had insufficient iodine concentration. [17]

A cross-sectional study was conducted in Tripura, among 538 antenatal women in 2018 found that 19.2 % urine samples showed severe iodine deficiency, which was higher compared to the present study. Totally 48.8% had iodine deficiency, which was lesser compared to the present study. [19] A study was conducted among 356 antenatal women in Ethiopia in 2014, revealed that 77.6% had inadequate concentration of iodine in urine, which was lesser compared to the present study. 22.4% had adequate concentration of iodine in urine, which was higher compared to the present study. [20] A study was conducted in Kolkata,2016, among 237 antenatal mothers, 63% found that they had adequate iodine concentration in urine, which was higher compared to the present study, 37% had inadequate iodine concentration in urine, which was lesser compared to the present study. [1]

Table 22: Distribution of study participants according to their goitre status, salt iodine and Urinary excretion of iodine

In the present study, 32.5% participants from Santibastwad had grade I goitre, 33.33% used inadequately iodized salt and 100% were deficient of iodine concentration in urine. In Mache-I, 4.8% participants had grade I goitre, 18.75% used inadequately iodized salt and 87.5% were deficient of iodine concentration in urine.

Table 23: Association between socio-demographic characteristics and goitre grade

In the present study, Goitre status was associated with different areas, which was found to be statistically significant with p-0.004 (χ 2-24.425). Goitre status was associated with socioeconomic status, which was found to be statistically significant with p-0.038 (χ 2-10.983).

Table 24: Association between socio-demographic characteristics and salt iodine concentration

In the present study, association was found between different study area and difference in salt iodine concentration, which was statistically significant with p-0.031 (χ 2-28.396). Association between age and salt iodine concentration was observed, which was nearly significant with p- 0.057 (χ 2-9.061).

Table 25: Association between salt iodine concentration and goitre grade

In the present study, salt iodine concentration and goitre grading were not associated and it was not statistically significance p-0.618, (χ 2-0.618).

Table 26: Multiple logistic regression to check the influence of factors on household salt iodine concentration

In the present study, multiple logistic regression was performed. Karle participants were 0.10 (adjusted OR: 0.10, 95% CI: 0.01- 0.67) times likely to be in adequately iodized salt group, which was statistically significant (p-0.016). Participants who added the salt in the beginning of cooking were 87% (adjusted OR: 0.13, 95% CI: 0.03-0.52) less likely to be in adequately iodized group as compared to those people who added salt in the end of cooking, which was statistically significant (p-0.004). People who added the salt in the middle of cooking were 0.19 (adjusted OR: 0.19, 95% CI: 0.05-0.73) times likely to be in adequately iodized group as compared to those people who added salt in the end, which was statistically significant (p-0.014).

Table 27: Association between socio-demographic characteristics and urinary excretion of iodine

In the present study, Area was associated with urinary excretion of iodine, which was statistically significant with p- <0.001 (χ 2- 87.029). There was no association between age and urinary excretion of iodine and was not statistically significant (p- 0.719).

Similar results were found in a study, which was conducted in China, in 2014-2015 among 1304 antenatal women, area was associated with urinary excretion of iodine, which was statistically significant (p-<0.001). There was no association found between age and urinary excretion of iodine, which was not statistically significant (p-0.945).[31]A cross- sectional study was conducted in 2018, in Northern Taiwan among

antenatal women in which results were similar to the present study, there was no association between age and urinary excretion of iodine, which was not statistically significant (p- 0.90).[32]

Table 28: Median (IQR) urinary excretion of iodine according to trimester

There was no difference in median urinary excretion of iodine distribution between different trimester and urinary excretion of iodine p- 0.269 (Z-1.106).

A cross sectional study was conducted in a PHC in Lucknow, Uttar Pradesh among 300 antenatal women, found the similar results that there was no association between different trimesters and urinary excretion of iodine (p- 0.405).[10] A cross-sectional study was conducted in 2018, in Northern Taiwan among antenatal women. Similar results were observed that there was no association between trimesters and urinary excretion of iodine and it was not statistically significant (p- 0.320).[32]

Table 29: Association between salt iodine concentration and urinary excretion of iodine

The present study showed, association was found between salt iodine concentration and urinary excretion of iodine, which was statistically significant p- 0.021(χ 2-8.068) and similar result was found in a study which was conducted in Haryana in 2015, in which association was found between salt iodine concentration and median urinary excretion of iodine, which was statistically significant (p-0.04).[18]

Table 30: Association between urinary excretion of iodine and goitre grade

The present study showed that urinary excretion of iodine was associated with goitre status, which was statistically significant p-0.010 (χ 2-11.778).

Table 31: Median (IQR) urinary excretion of iodine according to food consumption

The present study showed that there was no association between the groups those who had taken iodine rich foods and those who were not taking iodine rich foods. Similar results were found in a study which was conducted in Tehran among 884 antenatal women in 2015-2016, there was no association found between the groups who took iodine rich foods and those who did not take, which was not statistically significant.

Table 32: Predictors of salt iodine concentration

In the present study, multiple linear regression showed that area was the predictor of salt iodine concentration. The expected average decrease in salt iodine concentration in the area (Karle) was found to be 9.93 ppm (p-0.001) (β: -9.93; 95% CI: -15.93, -3.92) as compared to the reference area. Kinaye salt iodine concentration was found that there was 8.63 ppm (p-0.006) (β: -8.63; 95% CI: -14.66, -2.61) less as compared to the reference area. Residence area was found to be significant predictor of salt iodine concentration.

Table 33: Predictors of urinary excretion of iodine

In the present study, multiple linear regression showed that area was the predictor of urinary excretion of iodine. Expected average decrease in urinary

excretion of iodine in one area (Mache-II) as compared to the reference was 17.88μg/l with (p-0.047) (β: -17.88; 95% CI: -35.24), in Peeranwadi 44.79μg/l with (p-<0.001) (β: -44.79; 95% CI: -62.17, -27.42) decrease in urinary excretion of iodine compared to the reference area. On an average, the urinary excretion of iodine concentration in women with elementary education were expected to increase by 51.24μg/l with (p-0.006) (β: 51.24; 95% CI: 16.01, 86.47) as compared to illiterate women. Similarly, on average, the urinary iodine in women with high school education were expected to increase by 22.28μg/l with (p-0.030) (β: 22.28; 95% CI: 2.56, 42.01) as compared to illiterate women. With each unit increase in attitude score, there was 3.96 times increase in urinary excretion of iodine with (p-0.036) (β: 3.96; 95% CI: 0.33, 7.59) keeping other variables constant. Area, Education and Attitude score were the statistically significant predictors for urinary excretion of iodine. Socioeconomic status (p-0.328) and age (p-0.396) were not statistically significant.

A study was conducted in 2008 in Nagpur, Maharashtra, among pregnant mothers. The results were similar to the present study, Area (p-< 0.001) (β: 0.58; 95% CI: 0.47, 0.71) and maternal education (p-0.007) (β: 0.79; 95% CI: 0.67, 0.94) were significant predictors for urinary excretion of iodine. [29]

A study was conducted among 425 pregnant women in 2012-2014 in Sri Lanka. Multiple linear regression showed that Socioeconomic class (p-0.87) (β: 0.074) and age (p-0.89) (β: -0.002) were not the significant predictors of urinary excretion of iodine. [30]

Table 34: Correlation between knowledge, attitude and practice

Mean knowledge score was 1.30 ± 2.47, there was high positive correlation, between knowledge and attitude of participants, which was statistically significant ($p<0.01$). Mean attitude score was 2.40 ± 1.70, there was moderate positive correlation between knowledge and practice of participants, which was statistically significant ($p<0.01$). Mean practice score was 6.86 ± 1.31, there was statistically slight positive between attitude and practice of participants, which was statistically significant ($p<0.01$).

CONCLUSION

- One out of ten participants in the study area had grade I Goitre as per WHO criteria
- More than one third of the study participants were consuming inadequately iodized salt.
- Urinary excretion of iodine was deficient in almost all the participants.
- Salt iodine concentration was associated with median urinary excretion of iodine.
- Goitre was associated with class V socioeconomic status and Median urinary excretion of iodine.
- Iodine status was less in the participants those who used inadequately iodized salt, who stored the salt in a container without lid, who added salt in the beginning time of cooking.
- Overall knowledge, attitude & practice about iodized salt and iodine deficiency disorder was found to be less.
- Positive correlation between Knowledge & Attitude, Knowledge & Practice and Attitude & Practice of participants regarding iodized salt and iodine deficiency disorder was found.

RECOMMENDATIONS:

Household Level

- Iodine rich foods should be consumed by every individual at household.
- Adequately iodized salt should be purchased and used.
- Iodized salt should be always stored in a container with tight lid and it should be added in the end of cooking or after cooking the food.

PHC Level

- Awareness programs about importance of iodine for good health and consuming iodized salt, iodine rich foods and availability of iodized salt by health talks using audio-visual aids, pictorial illustrations and pamphlets.
- Periodic health checkups can be done to identify goitre and to initiate early treatment among them.
- Health care workers should do periodic household salt iodine survey in their area.
- Further studies can be conducted to identify iodine level in the soil and water in the study area.

District level

- Health education sessions can be conducted to about availability of iodized salt and other fortified foods and supplements with iodine.
- Intensified salt iodine surveillance can be done at different distribution levels at periodic intervals.

- School/ college health awareness sessions can be conducted to educate the students about importance of iodine.

State Level

- Regular monitoring of iodine level in salt at production (30 ppm) and distribution level (15 ppm) should be done.
- Use of mass media in local languages to sensitise public about the importance and effects of iodine deficiency should be done.
- Awareness about the existing NIDDCP (National Iodine Deficiency Disorder Control Programme) and its benefits should be done for public.

Medical colleges & Health Science Universities

- CME and teaching programmes for UG and PG students to be conducted regarding Iodized salt & IDDs.
- Quantitative and Qualitative studies can be conducted to encourage the use of iodized salt.
- Training of health care workers about IDDs and iodized salt.
- Laboratory facilities to be established to identify urine iodine concentration in primary care level.

National Level

- Strengthen and implement the existing policy on compulsory iodization of salt by all manufacturers and enforcement of ban of non-iodized salt.
- Periodic surveillance and monitoring of soil, water, food for iodine level.

STRENGTHS OF THE STUDY

- It was a community – based cross sectional study conducted among a sample size of 400 antenatal women from different rural field practice areas. Hence, the study results can be generalized.
- Titration method was used for estimation of iodine concentration in salt and urinary samples in the present study, according to the guidelines of NIDDCP, Govt of India.

LIMITATIONS OF THE STUDY

- Iodine level of soil and water samples of the study area were not assessed in the present study.
- No qualitative data was collected from the study participants about the purchase, storage & consumption of iodized salt.

SUMMARY

A community based cross – sectional study was conducted to assess iodine status among rural ante-natal women more than 12 weeks of gestation in the field practice area of Primary Health Centre, Kinaye under the Department of Community Medicine, Jawaharlal Nehru Medical College, KAHER, Belagavi, Karnataka. The study was conducted for one year three months from 1st January 2020 to 31st March 2021.

The mean age of the 400 study participants was 24.43±4.29 years. The age of the participants ranged from 18- 45 years. 51.2% had completed secondary level of education and 26 % had completed Pre – University College (PUC)/ diploma. 88.5 % of the participants were homemakers and more than half of the participants (55.5%) belonged to Class IV socio – economic status and 24.3% belonged to Class III socio – economic status as per modified B G Prasad scale.

51.3% participants were in third trimester, 49.8% were in second trimester. 22.2% of the study participants were aware of iodized salt. Mass media was the source of information for 78.6% of the participants, school teachers were their source of information for 7.8% of the participants, 7.8% by healthcare workers, 2.2% by friends, 2.2% by Neighbors and 1.1% by books/ news papers.

Only 2.3% had awareness about increased iodine requirement during pregnancy. Only 6.3% of the participants were aware of IDD. Awareness about iodine requirement was very poor. Mass media was the source of information for 76% participants about IDD, 12 % by health workers, 8% by teachers and 4% by friends. 49.3 % participants knew that good health is the benefit of intake of iodized salt,

11.9% had knowledge that ''intake of iodized salt will prevent Goitre & Cretinism'', 7.5% had knowledge that it will prevent Goitre & Cretinism and also provide good health.

40% of the participants chose salt based on packaging, 33% by price, 16.3% chose by brand and 10% chose based on iodization. 86.7% participants used powdered salt, 10.3% did not follow any fixed pattern and 3% of participants used crystal salt. 12.3% participants could read the information (Iodized salt was mentioned over the packet) to identify the iodized salt. 1.8% identified iodized salt by identifying the logo of iodized salt. 57.3% participants were consuming iodine rich food (egg). 77.25% were consuming iodine rich foods (milk and other dairy products).

88.5% participants stored salt in a container with lid, 10% participants stored salt in the same packet and 1.5% participants stored salt in a container without lid. 46.8% of the participants added salt in middle of cooking, 37.3% participants added salt in the beginning of cooking, 14.5% added salt towards the end of cooking and 1.5% added salt after cooking.

11.5% participants had grade-I goitre. Mean value of the salt iodine was 17.81 ± 12.21. Six out of ten salt samples were adequately iodized, three out of ten salt samples collected from household of the study participants were inadequately iodized and rest 5% samples were with no iodine content. Mean value of 100 urine samples for urinary excretion of iodine was 80.27 ± 25.32. 1% of the sample had adequate median urinary iodine concentration. 76% of the urine samples had moderate iodine deficiency, 13% had severe deficiency, 10% urine samples had mild iodine deficiency.

32.5% participants from Santibastwad had grade I goitre, 33.33% used inadequately iodized salt and 100% of the study participants had shown deficient iodine concentration in urine. In Mache-I, 4.8% participants had grade I goitre, 18.75% used inadequately iodized salt and 87.5% of the study participants had shown deficient iodine concentration in urine.

Goitre status was associated with different areas, which was statistically significant with p-0.004 (X^2-24.425). Goitre status was associated with socioeconomic status, which was statistically significance with p-0.038 (X^2-10.983). Salt iodine concentration was not associated goitre status, which was not statistically significant p-0.618, (X^2-0.618). Association was found between different study areas and difference in salt iodine concentration, which was statistically significant with p-0.031 (X^2-28.396). Association was found between age and salt iodine concentration, which was nearly significant p- 0.057 (X^2-9.061). There was no association between the groups those who had taken iodine rich foods and those who had not taken iodine rich foods.

Area was associated with urinary excretion of iodine, which was statistically significant with p- <0.001 (X^2- 87.029). There was no association between age and urinary excretion of iodine, which was not statistically significant (p- 0.719). There was no difference in median urinary excretion of iodine distribution between different trimester and urinary excretion of iodine p- 0.269 (Z-1.106). Association was found between salt iodine concentration and urinary excretion of iodine, which was statistically significant p-0.021 (X^2-8.068)

Urinary excretion of iodine was associated with goitre status, which was statistically significant p-0.010 (X^2-11.778). Karle participants were 0.10 (adjusted OR: 0.10, 95% CI: 0.01- 0.67) times likely to be in adequately iodized salt category, which was statistically significant (p-0.016). Participants who added the salt in the beginning of cooking were 87% (adjusted OR: 0.13, 95% CI: 0.03-0.52) less likely to be in adequately iodized salt group as compared to those people who added salt in the end of cooking, which was statistically significant (p-0.004). People who added the salt in the middle of cooking were 0.19 (adjusted OR: 0.19, 95% CI: 0.05-0.73) times likely to be in adequately iodized group as compared to those people who added salt in the end, which was statistically significant (p-0.014).

The expected average decrease in salt iodine concentration in an area (Karle) was found to be 9.93 ppm (p-0.001) (β: -9.93; 95% CI: -15.93, -3.92) as compared to the reference area. Kinaye was found to be 8.63 ppm (p-0.006) (β: -8.63; 95% CI: -14.66, -2.61) decrease in salt iodine concentration as compared to the reference area. Kinaye, Karle, Waghwade areas were found to be significant predictor of salt iodine concentration.

Expected average decrease in urinary excretion of iodine in one area (Mache-II) as compared to the reference was 17.88μg/l with (p-0.047) (β: -17.88; 95% CI: -35.24). In Peeranwadi expected average decrease in urinary excretion of iodine was 44.79μg/l (p-<0.001) (β: -44.79; 95% CI: -62.17, -27.42) as to the reference area. On an average, the urinary excretion of iodine concentration in women with elementary education was expected to increase by 51.24μg/l with (p-0.006) (β: 51.24; 95% CI: 16.01, 86.47) as compared to illiterate women. Similarly, on average, the urinary iodine in women with high school education was expected to increase by 22.28μg/l

with (p-0.030) (β: 22.28; 95% CI: 2.56, 42.01) as compared to illiterate women. With each unit increase in attitude score, there was 3.96 times increase in urinary excretion of iodine with (p-0.036) (β: 3.96; 95% CI: 0.33, 7.59) keeping other variables constant. Area, Education and Attitude score were the statistically significant predictors for urinary excretion of iodine. Socioeconomic status (p-0.328) and age (p-0.396) were not statistically significant.

Mean knowledge score was 1.30 ± 2.47, there was high positive correlation, between knowledge and attitude, which was statistically significant ($p<0.01$). Mean attitude score was 2.40 ± 1.70, there was moderate positive correlation between knowledge and practice, which was statistically significant ($p<0.01$). Mean practice score was 6.86 ± 1.31, there was statistically slight positive correlation between attitude and practice, which was statistically significant ($p<0.01$).

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ANNEXURE I – ETHICAL CLEARANCE LETTER

K.L.E. ACADEMY OF HIGHER EDUCATION AND RESEARCH
(Deemed-to-be-University)
Accredited 'A' Grade by NAAC (2nd Cycle) Placed in Category 'A' by MHRD (GoI)
JAWAHARLAL NEHRU MEDICAL COLLEGE,
NEHRU NAGAR, BELAGAVI-590010 (KARNATAKA-INDIA)
Website: http://www.jnmc.edu
E-Mail : dome@jnmc.edu
Phone: (+91-(0)831 Office : 2472550
Principal: 2471391
Fax No. +91 (0)831 - 2470759

Ref: MDC/DOME/ 169. **Date: 24/12/2019**

To,
(REG. NO. BD0119005)
PG student in Community Medicine,
J.N.Medical College,
BELAGAVI.

Sub: Institutional Ethical Clearance for the study.

With reference to the above, we wish to inform you that your proposed research project titled **"COMMUNITY – BASED ASSESSMENT OF IODINE STATUS AMONG RURAL ANTE-NATAL WOMEN – A CROSS SECTIONAL STUDY"**, is ethical and justifiable. The proposed research project has been cleared by the JNMC Institutional Ethics Committee on Human Subjects Research.

(Dr. Anita Dalal)
Member Secretary
JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belagavi.

(Dr. Roopa M Bellad)
Chairman,
JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belagavi.

3

ANNEXURE II- ICMR GRANT LETTER

icmr

INDIAN COUNCIL OF MEDICAL RESEARCH

Indian Council of Medical Research

Department of Health Research, Ministry of Health and Family Welfare, Government of India

No.3/2/Dec-2019/PG-Thesis-HRD (33) Dated: 23.03.2020

(REG. NO. BD0119005)

Room No-412, New PG Girls Hostel, Nehru Nagar, [illegible], Belagavi -590010 Karnataka
Registration No. [illegible]
[illegible]@gmail.com

Subject: Award of ICMR Financial Support for the MD/MS/DM/MCh/MDS dissertation/thesis for the December 2019 batch- reg

Dear Dr. [illegible],

This is in reference to your application seeking financial assistance from the ICMR for MD/MS/DM/MCh/MDS dissertation/thesis entitled "Community-Based Assessment of Iodine Status among Rural Antenatal Women- A Cross-Sectional Study"

I am glad to inform you that, based on the recommendation of Expert Committee, Director General, ICMR, has approved your application for the financial support of Rs. 50,000/- (Fifty thousand only) for the thesis as stated above, which will be disbursed in two/three installments. Initial amount of Rs. 30,000/- will be released after receipt of the Undertaking as per the guidelines and remaining amount of Rs. 20,000/- on receipt of the electronic copy and summary of work done of your dissertation / thesis duly approved by the University/ Institute along with one publication in an indexed Journal. Mandatory requirement to avail this opportunity is to provide us with an Undertaking duly forwarded through the Guide, to the undersigned, enabling us to release the grant.

The amount will be released after submission of the UNDERTAKING, GUIDE DETAILS as well as the MANDATE FORM (available on ICMR website) along with a photocopy of a Cancelled Cheque (Please ignore, if already submitted) LATEST BY 15th April, 2020 for receiving e-payment for purpose of verification of the concerned bank account where money is to be remitted.

Yours faithfully,

[illegible]
Administrative Officer
(For Director General)

Copy to:

1. Guide: Dr. Deepti M. Kadeangadi, Associate Professor, Dept. of Community Medicine, J.N. Medical College, KAHER, Belagavi, Karnataka-590010

[illegible]
V. Ramalingaswami Bhawan, P.O. Box No. 4911, Ansari Nagar, New Delhi - 110 029, India

ANNEXURE III – INFORMED CONSENT

``Community based assessment of iodine status among rural antenatal women - A Cross-sectional study''

Guide: ______________________

Co-Guide: ___________________

Investigator: __________________

Introduction:

Iodine deficiency is a major public health problem and it is one of the causes for preventable brain damage and mental retardation. Globally around 1.5 million people are at risk of iodine deficiency. In India the risk of iodine deficiency is around 200 million. Antenatal women, lactating mothers, neonates, 6-12 years old children are high risk groups. Iodine deficiency in Antenatal mothers causes neonatal hypothyroidism, congenital abnormalities, cretinism, growth retardation, etc. WHO recommends Goitre Examination, Salt iodine Survey, Urinary Excretion of Iodine level to identify iodine deficiency. This one-year study will assess the Iodine status, and their knowledge about iodine nutrition and also identifies any iodine deficient disorders.

Objectives / Purpose of the study:

You are being invited to participate in the present study to asses the dietary iodine status, and also investigate for Goitre, household Salt and Urinary Excretion of Iodine. This study will be carried out in the rural field practice area of Kinaye at Belagavi.

Explanation of procedure:

In this study, you will have to answer a few pre-designed questions about your socio-demography details and about your dietary practices, and you will be examined for Goitre. Household Salt and Urine samples will be collected for investigation. The entire procedure may take 20-30 minutes. If you agree to participate, the required information will be collected**.**

Possible Benefits:

You will not be benefited individually during this study, but you will come to know about iodine status of the community. No risks are involved in the study.

Incentives:

You will not be eligible for any kind of monetary benefits. However, you will be referred to KLE Dr. Prabhakar Kore charitable hospital, Belagavi, If necessary, for further treatment of Goitre/IDD.

Possible risks:

There are no risks involved in this study.

Cost of participation:

You will not bear any costs attached to your participation. All the cost of the study will be borne by the investigator.

Legal rights:

By signing this consent form, you are not waiving off any of your legal rights.

Confidentiality:

All the data collected will remain confidential and only aggregated data will be presented & published in national and international conference and journals. Your personal identity will not be revealed.

Withdrawal:

Your participation in this study is purely voluntary. You may decide to participate or not. Even though you decide not to participate, you will not be deprived of the benefits of this study.

Authorization to present/publish the result:

The investigator may use the information gathered from this study for presentation in conferences or publication in scientific journals. However, your personal identity will not be revealed.

Questions:

If you have any questions about rights as a research participant you can contact Dr.(Mrs). Roopa Bellad, Chairperson, Institutional Ethical Committee on Human Subjects Research, JNMC, KAHER, Belagavi-590010 and Dr. (Mrs.) N.S. Mahantashetti, Principal, JNMC, KAHER, Belagavi-590010 on phone no :0831-2471350.

CONSENT STATEMENT

``I have been explained all the contents of this consent form in my local language and have understood and clarified all my queries about the study to the best of my knowledge.

Furthermore, I recognize that I have the complete right to withdraw this consent at any point during the study. I understand that the information given by me will be confidential and will be used for research purpose only, further I am aware that the result of this research will be presented/published without disclosing any personal identification of the participants.

I hereby give my voluntary consent for participation in the study. I do sign the informed consent form in front of an eyewitness whom I recognize''

Name and Signature / left thumb impression of the participant: _______________

Name and signature / left thumb impression of the witness: __________________

Name and signature of the interviewer: ___________________

PLACE:

DATE:

ANNEXURE IV – RESEARCH QUESTIONNAIRE

I.Personal identifiers

1.1. Patient ID. No. --

1.2. Name of the pregnant women ----------------------------------Age-------------------

1.3. Husband's name--

1.4. Address--

1.5. Contact no.---

II.Socio-demographic characteristics & Clinical examination form

ID.No. -----------------------

2.1. Name of the head of the household--

2.2. How many members are there in your household? -------------------------------

2.3. Age of the participant (in years) ---

2.4. Educational qualification

Illiterate/ 1-5 std/ 6-10 std/ 11-12 std or ITI Diploma/ Graduation

2.5. Occupation

Home maker/ Govt Employee/ Pvt Employee/ Agriculture/ Labourer

2.6. Socio-economic status

SES Class I/ II/ III/ IV/ V (as per modified BGP classification)

Total income in Rs/ month ---

III.Obstetric History:

3.1. Last Menstrual Period---------------------------------------

3.2. Expected Date of Delivery--

3.3. Did you have any miscarriage/abortion in the past? --------------------------------

3.4. How many living children you have? ---

3.5. When did you had last childbirth? ---

3.6. Where you have delivered your last child? (home/hospital). -----------------------

3.7. What was the mode of last delivery? (Caesarion/normal) -------------------------

3.8. What was the birth weight of your last child?

IV. Your understanding about dietary iodine:

4.1. In your opinion, do pregnancy women need:

Less dietary iodine than women who are not pregnant

About the same dietary iodine as women who are not pregnant

More dietary iodine than women who are not pregnant

I don't know

4.2. Do you agree or disagree with the following statements?

4.2.1. Iodine deficiency is an important public health problem worldwide.

Strongly agree/ Agree/No opinion/Disagree/Strongly disagree

4.2.2. Iodine deficiency is an important public health problem in the United States.

Strongly agree/ Agree/No opinion/Disagree/Strongly disagree

4.2.3. Iodine content should be listed on food packaging in India.

Strongly agree/ Agree/No opinion/Disagree/Strongly disagree

4.2.4. It is not healthy to add salt to food.

Strongly agree/ Agree/No opinion/Disagree/Strongly disagree

4.2.5. Lack of iodine can cause goitre (enlarged goitre).

Strongly agree/ Agree/No opinion/Disagree/Strongly disagree

4.2.6. Lack of iodine can cause mental retardation in children.

Strongly agree/ Agree/No opinion/Disagree/Strongly disagree

V. Sources of iodine in your diet:

5.1. Has any health care provider ever discussed how much iodine you have in your diet?

Yes/ No

5.2.a. Do you ever buy table salt?

Yes/ No

5.2.b. If yes: Which factors do you consider when choosing salt?

Price/ Brand/Packaging/ Iodized or Non-Iodized/ Other

5.3.a. In the last 24 hours, have you added table salt to your food?

Yes/ No

5.3.b. If yes: What kind of salt?

Iodized/ Non-Iodized/ Don't know

5.4. In the last 24 hours, have you eaten any seaweed ?

Yes? (number of servings ________)/ No

5.5a. In the last 24 hours, have you taken a multivitamin?

Yes/ No

5.5.b. If yes: Was the multivitamin:

Regular/ pre-natal

5.5c. If yes: Was the multivitamin:

Prescription/ non-prescription (over the counter)

5.5d. If yes: What brand was the multivitamin? ______________________

5.5e. If yes: Did the multivitamin contain iodine?

Yes/ No/ Don't know

5.6. In the last 24 hours, have you taken any other dietary supplements (including vitamins, minerals, herbal preparations, or amino acids)?

Yes/ No

5.6a. If yes: Please list below:

Supplement type: ___________________________

Brand: _____________________________________

Amount in last 24 hours: ____________________

5.7. In the last 24 hours, have you had any of the following dietary products to eat or drink?

a. Cow's milk No /Yes? (number of glasses ____)

b. Cheese No/ Yes? (number of 2 oz. servings ____)

c. curd No/Yes? (number of containers ____)

d. Ice cream No/Yes? (number of scoops ____)

5.8. In the last 24 hours, have you eaten any egg

No/ Yes? (number of eggs ____)

5.9. In the last 24 hours, have you eaten any bread that was not home-made?

Yes/ No

5.9a. If yes: please list below:

Type (white, wheat, etc) ______________________________

Brand ____

Number of slices in the last 24 hours __________________

VI.Household salt survey sample

6.1. What quantity of salt do you usually buy at a time?

<200 grams/ 200-500 gram/ >500 gram-1 Kg / 1Kg- 5Kg/ 5-10Kg/ >10 Kg

6.2. Do you buy salt in packets or loose?

Packet-Branded/ Packet- Unbranded/ Loose/ No fixed pattern/ Other (specify)

6.3. Where do you purchase salt?

Street vendor / Public distribution system/Retail shop/ Wholesale shop/ Mall/Others

6.4. How will you identify iodised salt?

Cleaner (More white)/Purer (no impurities) /By smiling sun logo/Other (specify)/Don't know

6.5. What type of salt are you using right now?

Crystal/ Powdered/ Refined/ No fixed pattern/Others (specify)

6.6. What type of salt were you using before?

Crystal/ Powdered/ Refined/ No fixed pattern/Others (specify)

6.7.1f you changed the salt, why did you change it? ----------------------------------

6.8. How do you store the salt?

In the same packet/ In the container with a lid

In the container without a lid / Others (specify)

6.9. Usually, when you cook, when do you usually add salt while cooking?

In the beginning

Halfway through cooking/ Towards the end/ After cooking

6.10. Do you think we should take iodised salt?

Yes/ No/ Don't know/Not sure

6.11.1f yes, why do you think that we should take iodised salt?

1 = Prevent goiter------------------------

2= Prevent cretinism-------------------

3= Good health------------------------

4= Better Intelligence/mental/cognitive function---------------------

5=School performance-------------------

6= Prevent death-------------------------

7= Others (specify) ---------------------

8= don't know/don't remember--------------------

6.12.1f no, why?

Not available/ Costly / Any other (specify)

6.13. Have you ever heard message on iodine deficiency and iodised salt?

Yes/ No

6.14.1f yes, what was the source of information? Source(s)

Magazine/newspaper-------------------

Radio-----------------------

Television-----------------------

Friends/Neighbor-----------------------

Others (specify) ---------------------

Don't know/don't remember-------------

VII. medical history:

7.1. Have you ever been diagnosed with any of the following conditions:

a. Goitre (enlarged thyroid) Yes/ No/ Don’t know

b. Hyperthyroidism (overactive thyroid) Yes/ No/ Don’t know

c. Hypothyroidism (underactive thyroid) Yes/ No/ Don’t know

d. Thyroid nodule Yes/No/Don’t know

e. Thyroid cancer Yes/No/Don’t know

7.2. Has any family member (your grandparent, parent, sibling, or child) ever been diagnosed with any of the following conditions:

a. Goitre (enlarged thyroid) Yes/No/ Don't know

b. Hyperthyroidism (overactive thyroid) Yes/ No/ Don't know

c. Hypothyroidism (underactive thyroid) Yes/ No/ Don't know

d. Thyroid nodule Yes/ No/ Don't know

e. Thyroid cancer Yes/ No/ Don't know

7.3. In the last 3 months, have you taken thyroid hormone pills (L-thyroxine, Synthroid, Levoxyl, Unithroid,) - Yes/No

7.4. In the last 2 years, have you taken amiodarone? - Yes/No

7.5. In the last 3 months, have you had any X-rays (for example, a CT scan) in which contrast dye was injected into your veins? - Yes/No

7.6. In the last week, have you used any iodine-containing (brown-colored) antiseptic skin cleaner? - Yes/No

7.7. For women, in the last week, have you used any iodine-containing vaginal douche - Yes/No

VIII. Clinical examination of Thyroid status

8.1 Goitre grade (as per WHO classification)

Grade o/ grade 1/ grade 2

ANNEXURE V - KEY TO MASTER CHART

PERSONAL DETAILS

A-AREA OF RESIDENCE

a. Desur -1
b. Karle-2
c. Kinyae-3
d. Khardarshidi-4
e. Machee I-5
f. Machee II -6
g. Peeranwadi-7
h. Santibastwad-8
i. Waghwade -9

B-AGE of the pregnant women

a.16-24 yrs -1
b. >25 yrs -2

EDUCATIONAL DETAILS

a. Illeterate -1
b. Elementary-2
c. Highschool- 3
d. Higher secondary/diploma -4
e. Graduate - 5

C-OCCUPATIONAL STATUS OF WOMEN

a. Homemaker-1
b. Govt employee-2
c. Pvt employee-3
d. Farmer- 4
e. Labourer- 5

D-SOCIOECONOMIC STATUS OF THE FAMILY

a. Grade 1- 1
b. Grade 2 - 2
c. Grade 3 - 3
d. Grade 4- 4
e. Grade 5 - 5

E-HOUSE HOLD MEMBERS

a. <4 - 1
b. 5-6 - 2
c. 7-8 - 3
d. >=9 - 4

OBSTERTIC H/O

F-TRIMESTER

a. 2nd - 1 b. 3rd - 2

G- H/O MISSCARRIAGE

a. Yes- 1 b. No- 2

H-NO OF LIVING CHILDREN

a. 1 -1 c. 3 – 3 e. >=7 – 5

b. 2 -2 d. 4-6 - 4 f. N/A- 99

I-LAST CHILD BIRTH

a. <1yr - 1 d. >3 yrs - 4

b. 1-2 yrs - 2 e. N/A- 99

c. >2 - 3 yrs - 3

J-PLACE OF BIRTH

a. Hospital -1
b. Home -2
c. N/A - 99

K-MODE OF DELIVERY

a. Normal - 1
b. LSCS - 2
c. N/A - 99

L-BIRTH WEIGHT OF CHILD

a. <1.5 kg- 1 e. Don’t know - 5

b. 1.5- 2.4 - 2 f. N/A- 99

c. 2.5- 3.5 - 3

d. >3.5 - 4

N -HOW MUCH IODINE NEED

a. Don't know - 1 c. More- 3

b. Same - 2 d. less- 4

O-IODINE DEFICIENCY PUBLIC HEALTH PROBLEM IN WORLD

a. Agree- 1
b. No opinion - 2
c. Disagree - 3

P- IODINE DEFICIENCY PUBLIC HEALTH PROBLEM IN INDIA

a. Agree- 1
b. Disagree-2
c. No opinion -3

Q- LIST ON FOOD PACKAGE

a. Agree- 1
b. No opinion -2
c. Disagree- 3

R- NOT HEALTHY TO ADD SALT

a. Agree- 1
b. No opinion -2
c. Disagree- 3

S- LACK OF IODINE CAUSE GOITRE

a. Agree -1
b. No opinion -2
c. Disagree-3

T- LACK OF IODINE CAUSE MENTAL RETARTDATION

a. Agree- 1

b. No opinion -2

c. Disagree -3

U- HEALTH CARE PROVIDER DISCUSSED THE MATTER

a. Yes- 1 b. No- 9

V- CRITERIA FOR CHOOSING SALT

a. Price - 1 d. Iodized/Non - 4

b. Brand - 2 e. Others - 5

c. Packing - 3

W- **WHAT KIND OF SALT**

a. Iodized - 1

b. Non iodised - 2

c. Don't know - 3

X - MULTIVITAMIN

a. Regular -1

b. Pre natal - 2

c. Antenatal - 3

Y -MULTIVITAMIN

a. Prescription - 1 b. Non prescription - 2

Z- Brand

a. Folic Acid - 1 b. Vit d3 - 2 c. FA & Vit D3- 3

AA- MULTIVITAMIN CONTAINING IODINE

a. Yes- 1 b. No - 9 c. Don't now - 2

AB- INTAKE OF MINERAL SUPPLEMENTS

a. Yes - 1 b. No -9

AC- SUPPLEMENTS

a. Fe- 1 b. Ca -2 c. Fe & Ca- 3 d. Fe, Ca, Zn, Mg(OTHERS)- 4

AD- DIETARY SUPPLEMENTS

- Cows milk- 1
-Cheese -2
-Curds- 3
-All three- 4
-Milk & Curd- 5
- Milk & Cheese - 6
-Cheese & Curd - 7
- None -9

AE- EGG

a. Yes- 1 b. No- 9

AF-EATEN BREAD

a. Yes -1 b. No-9

AG- BREAD TYPE

a. White- 1
b. Brown- 2
c. N/A- 99

AH- QUANTITY OF SALT

a.<200 gm- 1
b. 200-500 - 2
c.>500-1kg - 3
d.1- 5 kg- 4

AI- SALT PACKETS

a. Packet Branded - 1
b. Packet Unbranded - 2
c. Loose - 3
d. No fixed pattern - 4
e. Packet Packing - 5

AJ-PURCHASE OF SALT

a. Street vendor -1
b. Public distrubution - 2
c. Retail shop - 3
d. Wholesale - 4
e. Mall/Others - 5

AK- IDENTIFICATION OF SALTS

a. Clean- 1
b. Pure- 2
c. logo - 3
d. Written/Mentioned -4
e. Don't know -5

AL- TYPE OF SALT

a. Crystal -1
b. Powdered - 2
c. Refined -3
d. No fixed pattern -4

AM- STORAGE OF SALT

a. Same Packet - 1
b. Container with lid -2
c. Container without lid - 3

AN- ADDING SALT IN COOKING

a. In the Beginning - 1
b. Halfway through- 2
c. Towards end- 3
d. After cooking - 4

AO- SHOULD WE TAKE IODISED SALTS

a. Yes -1
b. Don't know - 2
c. Not sure - 3
d. No- 9

AP- INTAKE OF IODIZED SALT IS TO PREVENT ?

a. Goitre -1
b. Cretinism- 2
c. Good health - 3
i. Good health & School performance - 11
j. Goitre+Cretinism+Good health - 12
k. Goitre+Cretinism+Good health+Intelligence-13

d. Intelligence - 4 l.Good health + Intelligence - 14

e. School performance -5 m. No effect -15

f. Goitre & Cretinism - 6 n.Goodhealth+School performance+intelligence-16

g. Don't know -7 o. Don't remember - 17

h. Goitre & Good health - 8

AQ- MESSAGE ON IODINE DEFICIENCY

a. Yes-1 b. No- 9

AR- SOURCE ON IODINE DEFICIENCY

AS-MESSAGE ON IODIZED SALT

a. Yes- 1 b. No- 9

AT-

a. Media -1 e. Don't know – 5

b. Friends -2 f. Don't remember - 6

c. Neighbour -3 g. Book - 7

d. Teachers- 4 h. Health Worker - 8

i. N/A- 99

PERSONAL DIAGNOSIS

AU- Goitre - Yes -1 - No - 9 -Don't know - 2

AV- Hyperthyroidism - Yes -1 -No- 9 -Don't Know - 2

AW- Hypothyroidism - Yes -1 - No- 9 -Don't know -2

AX- Thyroid nodule -Yes -1 - No - 9 -Don't know -2

AY- Thyroid ca - Yes -1 - No- 9 -Don't know - 2

FAMILY DIAGNOSIS

AZ – Goitre - Yes -1 - No - 9 -Don't know - 2

BA - Hyperthyroidism - Yes -1 -No- 9 -Don't Know - 2

BB - Hypothyroidism - Yes -1 - No- 9 -Don't know -2

BC - Thyroid nodule -Yes -1 - No - 9 -Don't know -2

BD - **Thyroid ca** - Yes -1 - No- 9 -Don't know - 2

BE- THYROID PILL

a. Yes -1 b. No- 9

BF- AMIODARONE

a. Yes-1 b. No - 9

BG- X-RAY

a. Yes- 1 b. No- 9

BH- IODINE CONTAINING ANTESEPTIC SKIN CLEANER

a. Yes -1 b. No-9 c. Don't know -2

BI- IODINE CONTAINING VAGINAL DOUCHE

a. Yes- 1 b. No- 9

BJ- GOITRE GRADE

a. Grade 0 -1 b. Grade 1- 2 c. Grade 2 -3

ANNEXURE VI – IEC MATERIAL

Patients with Goitre were identified and referred to PHC for further investigations.

Participants with iodine deficiency were identified, awareness regarding iodized salt, iodine deficiency disorders and iodine rich foods was given.

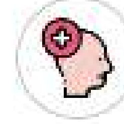
Health education about iodine and iodine deficiency disorders was given by using following IEC Materials.

IODINE RICH FOODS

IMPACT OF IODINE DEFICIENCY ON PREGNANT WOMEN

Can cause stillbirth, spontaneous abortion

Can lead to congenital abnormalities such as cretinism



Cause irreversible form of mental retardation in children

A daily dose of IODINE Keeps you fit and fine

Physical growth and development

Optimum mental developement

Regulation of body metabolism

Heat generation & maintenance of body temperature

Iodized salt is the best means to prevent

* Abortion
* Still birth
* Birth defects
* Incomplete foetal brain development or damage
* Retarded mental and physical growth
* Goitre (swelling in the neck)
* Low I.Q.levels
* Poor learning abilities

MAKE SURE THAT YOU BUY ONLY IODIZED SALT

HOW TO PREVENT
IODINE DEFICIENCY
Eat foods rich in iodine
Take an iodine supplement
Have iodized salt in small amounts

ANNEXURE -Master Chart

Sl no	Area	Age	Education	Occupation	SES	Household members	Trimester	Miscarriage	Living children	Last childbirth	Place of delivery	Mode of delivery	Child's weight	How much iodine needed	IDD public health problem worldwide	IDD in India	Iodine list on food pacakage	Not healthy to add salt	LOI cause Goiter	LOI cause MR	Healthcare provider discuss IDD	Criteria for choosing salt	What kind of salt	Multivitamin	MVT prescription	Brand	MVT contains iodine	Minerals	Type of supplements	Dietary supplements	Egg	Bread	White/ brown bread	Quantity of salt	Salt packets	Purchase of salt	How to identify	Type of salt	Storage of salt	Adding of salt	Should we take iodised salt	To prevent	Message on IDD	Source	Message on iodized salt	Source	Goiter	Hyperthyroidism	Hypothyroidism	Thyroid nodule	Thyroid cancer	Goiter-parents	Hyperthyroidism	Hypothyroidism	Thyroid Nodule	Thyroid ca	Thyroid pill	Amiodarone	X-ray	Antiseptic skin cleaner	Vaginal douche	Goiter grade	salt iodine level	urinary excretion of iodine
1	1	21	4	1	2	1	1	9	1	2	1	2	4	1	2	2	2	3	2	2	9	1	3	3	1	3	2	1	3	9	1	9	99	3	5	4	5	2	2	2	2	7	9	99	9	99	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	2	21.17	96.41
2	1	28	3	1	5	4	1	9	1	2	1	1	3	1	2	2	2	2	2	2	9	1	3	3	1	3	2	1	3	1	9	9	99	3	5	1	5	2	2	3	2	7	9	99	9	99	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	1	27.94	85.59
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Introduction

Aim and Objectives

Review of Literature

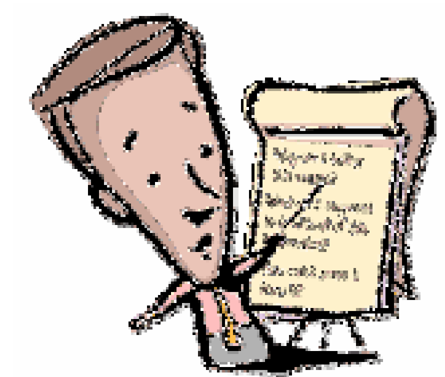
Methodology

Results

Discussion

Conclusion

Recommendations



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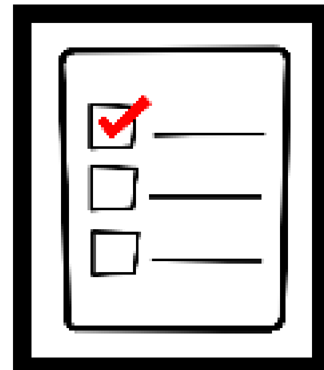

Limitations

Summary

Bibliography

Annexures