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Trend in Iodine Deficiency Disorders in Karnataka, India

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Dr Girish N Rao	Dr Krishnamurthy U.
Additional Professor, Department of Epidemiology National Institute of Mental Health and Neuro Sciences Bangalore 560029	Associate professor, Department of Biochemistry, M S Ramaiah medical college, Bangalore : 560054

ABSTRACT *The key objective of the study was to find the trend in iodine deficiency disorders in south Indian state, Karnataka from past to present through the review of litreture. This study used electronic database and manual search to identify the studies. Search revealed 5 journal publications and 4 reports. The various epidemiological studies have used different epidemiological indicators for iodine deficiency. Salt samplings, total goiter prevalence and urinary iodine excretion were the indicators used. On asesssing the trend, two districts showed improvement, 2 persisted to be iodine insufficient and there were 5 districts which were not endemic by total goiter prevalence, but were showing iodine insufficiency by Urinary iodine excretion. Also, it was evident from most of the studies that less percentage of salts were adequately iodized. Many other factors like limitations of the indicators, intervening factors in disease pathphysiology like goitrogens and fluroide were revealed.*

INTRODUCTION:
Iodine an essential micromineral is used for the synthesis of thyroid hormones from thyroid gland, which are involved in regulating metabolism, development and tissue differentiation. Iodine is primarily obtained through the diet, deficiency of which results in a spectrum of disorders categorised as iodine deficiency disorders (IDDs) (Table 1). (1) Recognizing the magnitude of the problem, Government of India launched National Goiter Control Programme (NGCP) in 1962. Subsequent studies showed that the problem was more ubiquitous than estimates. Hence, with a larger scope of activity the NGCP was re-designed as National Iodine Deficiency Disorders Control Programme (NIDDCP) in 1992. The revised Policy Guidelines on NIDDCP was released in 2006. This document not only contains the guidelines for the IDD survey, estmation of iodide content in salt and urinary iodine estimation but also the achievements of the program with respect to salt iodisation. (2) The document reveals the scenario at the national level and was the inspiration to this study to find the scenario of the home state, Karnataka, a state in South West India consisting of thirty districts.

Following a World Health Organization (WHO) sponsored workshop in 1984, an action plan was drawn up by Government of Karnataka to enquire about the goiter cases being reported in different hospitals. Sharadha Dhanvantri hospital in Chickmagalur district reported a large number of goiter cases. A quick goiter survey by the district health administration found the prevalence to be 5 – 10%. Following this, in 1986 with technical assistance from Government of India a detailed goiter survey was undertaken in Chickkamagalur district. The survey revealed the prevalence of goiter as high as 41%. This led to the launch of NGCP in Chikkamagalur district and a Goiter Cell was established in the Bureau of Nutrition, Directorate of Health and Family Welfare Services. An interim study conducted between 1988 and 1991 for the first time estimated the magnitude of the problem across Karnataka. (3) Since then, several efforts have been undertaken to monitor and evaluate the implementation of the programme. In the absence of a comprehensive overview at the state level, this study reviewed the different epidemiological studies and other related reports regarding IDD in Karnataka. The key objective of the study was to study the problem trend in post iodization era.

MATERIAL AND METHODS:
Epidemiological studies in Karnataka with respect to IDD were identified by searching the electronic database. A general search was first performed using the keywords 'iodine', 'iodine deficiency disorders', and 'Karnataka' on the Google and PubMed. Furthermore, a manual search was conducted from the bibliographic references quoted in the selected publications. Results from 'The National Family Health Surveys' (NFHS-2 and NFHS-3) pertaining to IDD in Karnataka were also considered. Studies were compared to find the trend from past to the present.

RESULTS:
Search revealed a total of 10 documents of which 6 were journal publications (4-9) and 4 (3, 10-12) were reports. The details and the findings are shown in Table 2 and Table 3. The population chosen and sampling methodology varied between the studies. School based methods were commonly used. The studies looked at total goiter prevalence (TGP), proportions using adequately iodised salt {>15ppm) and Urinary iodine excretion (UIE). One study performed a pre and post iodinisation survey. Findings of the NHFS surveys are shown in Table 3. Further, the two publications (4, 6) which had the data of most of the districts and spanned between the two decades were compared and shown in Table 4.

Table 4 shows that the districts Chickkamagalur and Uttara Kannada (UK) which had >10% prevalence of goiter in 1988 had become iodine sufficient (>100 μg/L) by 2001. Kodagu and Dakshina Kannada (DK) which had >10% prevalence of goiter persist to be iodine deficient. Shimoga, Gulbarga, Kolar, Bijapur and Bellary which had <10% TGP are showing <100 μg/L UIE.

Table 4 also shows that Raichur and Tumkur, though only 2% of the households are consuming adequately iodized salt (>15ppm) the median UIE is >100μg/L; contrastingly Kodagu, where 17.3% households are consuming adequately iodized salt but median UIE is just 30μg/L.

DISCUSSION:
The pioneer Kangra Valley Study (1956 – 1972) in Himachal Pradesh (13-15) paved the way for establishing the NIDDCP. Considered a major watershed mark in public health nutrition, it leveraged technology and laid the platform for Universal iodinisation of salt across the country. Over the period since implementation of the programme there have been several changes, particularly in the methodology of estima-

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tion of prevalence of IDD i.e. from TGP to UIE. In this background, the present study attempted to provide an overview of the situation of IDD in the state of Karnataka.

TGP and UIE are the two epidemiological tools used to estimate the prevalence of IDD. When TGP exceeds 10% in a defined population, then the goiter is said to be endemic and if the TGP exceeds 10% among school children, then it is considered as a public health significant problem. (16) A main limitation of assessing the IDD burden using TGP is that, in endemic areas it may not return to normal even months or years after correction of iodine deficiency. Hence, TGP reflects population's past iodine nutrition status of the population and not the present. (17) UIE is used to characterize iodine utilization and accurately predict the level of salt iodination required to maintain proper physiological functions. Hence, median UIE is considered as a sensitive indicator and is recommended. If the Median UIE is <100 µg/L in school children who are aged between 8-10 years then the iodine deficiency is considered as a significant public health problem in that population. (18) Since, the two studies chosen to compare have used two dfifferent tools and also differ in survey methodology. Since, this is a handicap for a mathematical comparision this review is an effort to understand the trend rather than aseesssing the progress in terms of digital figures.

In a significant finding Kodagu and DK persisted to be iodine deficient in the post salt iodization era. In Kodagu and DK the percentage of households consuming adequately iodised salt were 17.3 % and 12% respectively. Thus, indicating the need for active intervention measures to promote the consumption of iodised salt.

In Raichur and Tumkur, though only 2% of the households are consuming adequately iodized salt (>15ppm) the median UIE is >100µg/L but in Kodagu, where 17.3% households are consuming adequately iodized salt but median UIE is just 30µg/L. This is a complex situation where probably the geographical features are playing the role and need to be explored.

In another significant finding, Bellary, Bijapur, Gulbarga, Kolar and Shimoga which had <10% TGP in 1988 are showing <100 µg/L UIE in 2001. The percentage of households consuming adequately iodised salt in these districts are 2.6%, 8.4%, 0.0%, 5.1% and 23.6% respectively. The reasons may be that UIE being a sensitive tool has identified these districts which were probably prevailing in the subclinical status. Another reason can be that some of the geographical factors might have protected these districts from the development of goiter and this can be a topic for research.

Belgaum which had TGP of 2.5% in 1988 has showed 16.6% in 2009.Marwaha RK et al (19) studying the reasons for residual goitre among school children in the post salt iodinisation phase suspected the existence of additional factors like thyroid inhibitors in goitrogenesis. Interestingly, animal experiments have revealed mutually interacting effects of the two halogens, Iodine and fluorine on both goiter and fluorosis. (20) In this context, it is worthwhile noting that Chikmagalur, Mysore, Mangalore, Shimoga, Gulbarga, Kolar, Belgaum, Raichur, Bijapur, Chitradurga, Tumkur, Mandya, Bangalore-rural, are endemic for fluorosis in Karnataka. (21) More in-depth studies which probe the pathophysiology of development of goiter in such contexts are needed.

In conclusion, with a wide spectrum of adverse consequencee of IDD, the very low proportion of population use adequately iodised salt in Karnataka is a matter of serious concern. Also, emergence of districts with iodine insufficiency is a matter of concern in post salt iodisation era. IDD and its prevalence have a wide scope for research in terms of geographical suseptibility, dietary factors and interaction of iodine with other micro-nutrients.

Table 1: The Spectrum of Iodine Deficiency Disorders (1)

Fetus	Abortions, Stillbirths, Congenital Anomalies, Increased Perinatal Mortality, Increased Infant Mortality, Neurological Cretinism (Mental deficiency, Deaf-mutism, Spastic diplegia, Squint), Myxedematous Cretinism, Mental deficiency, Dwarfism, Psychomotor Defects
Neonate	Neonatal goiter, Neonatal hypothyroidism
Child and Adolescent	Goiter, Juvenile hypothyroidism, Impaired mental function, Retarded physical development
Adult	Goiter with complications, Hypothyroidism, Impaired mental function

Table-2: Journal publications relating to IDD in Karnataka

Sl No	Author(s) & year of study	Methodology & Population	Results
1	Jalaja S et al (1988 -91) (4)	TGP; Village and school children in all the districts of the state	Overall TGP: 4.9% 4 districts had >10% TGP
2	Pereira P et al (1992-93) (5)	Pre iodine Phase: TGP & UIE 700 of general population in a village of Dakshina Kannada district	TGP - 53.80% UIE - 82.69% had <89mg/g creatinine
		Post iodine Phase: TGP 926 of general population	TGP - 50.91% No UIE findings
3	Umesh Kapil et al (2001) (6)	UIE in School children & salt iodization in all the districts of the state	15.8% cosumed adequately iodised salt. 8 districts showed <100 µg/L of Median UIE
4	Rao et al (2002) (7)	TGP & UIE 722 school children in coastal Karnataka by PPS method.	TGP - 30% 48.3 % of salt samples had >15ppm of Iodine
5	Avinash KR et al (2002) (8)	Iodine content of 100 salt samples sold in Mangalore	39% of salt samples had >15ppm of Iodine
6	R Kamath et al (9)	house-to-house survey in rural community of Belgaum district	TGP of 16.6%; 50% of samples had ≥15ppm of Iodine

UIE: urinary iodine estimation, TGP: total goiter prevalence, PPS: Population Proportionate to Size

Table – 3 Reports relating to IDD in Karnataka

Sl no	Author(s)	Findings of the report
1	Jalaja Sundaram et al (3)	TGP in 1988 showed 4.9%
2	Tiwari BK et al (10)	6 out of 17 districts surveyed were endemic to iodine deficiency with goitre prevalence rates in the range of 10.67 – 41.11%.
3	NFHS 2 (11)	43% of households consuming >15ppm iodised salt
4	NFHS 3 (12)	43.5% of households consuming >15ppm iodised salt

Table – 4: District vise comparison of the findings of the two studies (4, 6)

Sl No	Districts	TGP % (1988-89) (4)	Median UIE, µg/L (2001) (6)	% of population consuming >15ppm of Iodized salt (2001) (6)
1	Bangalore (Rural)	1.79	100	28.9
2	Bangalore (Urban)	1.73	185	31.5
3	Belgaum	2.53	100	15.5
4	Bellary	1.00	65#	2.6
5	Bidar	5.37	-	28.0

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6	Bijapur	1.86	85#	8.4
7	Chickkamagalur	41.11*	150	32.7
8	Chitradurga	0.99	>200	34.6
9	Davangere	-	52#	3.2
10	Dharwad	1.57	100	34
11	Dhakshina Kannada	14.18*	70#	12.0
12	Gulbarga	4.85	70#	0.0
13	Hassan	2.04	-	3.9
14	Haveri	-	100	6.7
15	Kodagu	23.12*	30#	17.3
16	Kolar	2.97	95#	5.1
17	Koppal	-	100	3.9
18	Mandya	1.2	120	21.4
19	Mysore	1.62	-	26.3
20	Raichur	1.94	120	2.0
21	Shimoga	6.9	30#	23.6
22	Tumkur	2.23	100	2.0
23	Udupi	-	>200	15.4
24	Uttara Kannada	10.67*	100	10.0

*districts with more than 10% TGP

#districts with <100 μg/L of Median UIE

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