Research Base for Planning Control of Iodine-Deficiency Diseases in India
Is There a Bottom Line?

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While technologies are crucial and necessary for public health, scientific rigour cannot be compromised to promote unproven technologies. The search for evidence has to retain the essence of the scientific method if it is to meaningfully contribute to determining priorities and assessing the impact of interventions. In this connection, the on-going debate on the extent of iodine deficiency disease (IDD), in the context of a national strategy for its control, offers a good example of why we need objectivity in the practice of science. The National Institute of Nutrition (NIN) recently conducted a survey with the support of Director General Of Health Services (DGHS) and World Health Organisation (WHO) to set the record right. The report supports further efforts at iodisation, especially of the crystalline salt, and assumes that its findings provide evidence for the effectiveness of the National Goitre Control Programme (NGCP). This is premature as well as confounding in the light of the stated objectives, the choice of design, and the analysis that NIN offers. This note examines each of the following with the help of NIN's own and some additional data (Tables I- V), with reference to some of the major conclusions of the study: The regional nature of the study; degree of change in TGR; the assumed linear causality for the prevalence of IDD and, therefore, the impact of the NGCP; the extent of iodisation and its implication; the specific objective of assessing clinical manifestations of IDD, and finally, the methodological handicaps.

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The increasing global emphasis on technological solutions to problems in public health has done two things. Firstly, it has subordinated the role of socio-economic factors in health and disease among populations and, secondly, it has led to a shift in prioritisation of public health problems. As a result, only those diseases for which technological interventions are available (even though imperfect), find a place in Third World planning priorities today. This trend has serious implications for public health, not only because it leaves out many of the public health problems that are crying for attention but also because, technology-oriented professionals create misconceptions about the nature of the problems, without examining the evidence. Prevention is thus assumed to be a technological challenge or at best of health education, and social sector inputs outside the scope of medical intervention are ignored. This techno-imperialism continues in the tradition of the colonial search for clean technologies in the 19th Century, without addressing the complexity of public health problems [Qadeer 2005].

While technologies are crucial and necessary for public health, scientific rigour cannot be compromised to promote unproven technologies. The search for evidence has to retain

the essence of the scientific method if it is to meaningfully contribute to determining priorities and assessing the impact of interventions. In this connection, the on-going debate on the extent of iodine deficiency disease (IDD), in the context of a national strategy for its control, offers a good example of why we need objectivity in the practice of science.

The National Goitre Control Programme (NGCP) was started in 1962 with a focus on the goitre belt in the country. However, the programme of universal iodisation was introduced only in 1984, when all edible salt in the market was required to offer 30 ppm (parts per million) iodine at the production level. This was legalized through the PFA (Prevention of Food Adulteration) Act of 1988 that also banned the availability of crystalline salt (iodised) as an edible product. Objections to this were raised on several counts, especially that a generalised ban on edible non-iodised salt is uncalled for because iodisation is required in specific iodine-deficient areas, and also violates the constitutional right of freedom to choose treatment. It was argued that iodised salt actually harms those suffering from hypothyroidism and on thyroxin treatment. It was also argued that local production and subsidised sales of iodised salt would make it affordable and accessible to sections. Research has already shown that they need the iodised salt the most [Pandav et al 1986; Dodd et al 1993]. The Central Government agreed with this line of argument and lifted the ban on the sale of non-iodised salt in September 2000. But the states chose to retain or revoke the ban depending upon their own assessment.

This has upset a section of scientists who believe that iodine deficiency causes unacceptable levels of goitre and mental retardation and is a major public health problem. They also argue that if around hundred countries can universalise salt iodisation to deal with this problem [WHO, UNICEF, ICCIDD 1999], we should do it too (irrespective of their results). They have, therefore, advised the government to reintroduce the ban and universalise the salt iodisation programme. This urgency on their part however, ignores the fact that the evidence regarding the extent of iodine deficiency and the efficacy of universal iodisation is feeble.

The National Institute of Nutrition (NIN) recently conducted a survey with the support of Director General Of Health Services (DGHS) and World Health Organisation (WHO) to set the record right [NIN 2003]. The stated general objective of the study was to assess the current status of IDD in the selected districts of different regions of the country. The specific objectives however were: (i) to assess prevalence of clinical forms of IDD in 6-12 years of age in selected districts of different regions; (ii) to estimate random UIE (Urinary Iodine Excretion) in a sub-sample of the children covered; (iii) to assess the extent of use of iodised salt by the household through spot test and salt analysis by titration method; (iv) study women's awareness regarding iodised salt and sales by retail shops. Forty districts, with the highest levels of TGR (Total Goitre Rate) provided by the Director General Health Service (DGHS) surveys (Government of India 2001) over the past 2-44 years, were selected (1-2 from each state) from 25 states. It should be noted that the full details of these surveys and their methodologies have never been put out in the public domain for scrutiny. The 30-cluster technique recommended by WHO for

monitoring and quick assessments of prevalence of IDD and levels of iodisation of salt [ICCIDD, UNICEF, WHO 2001], has been used by NIN which is known for its limitations for other purposes.

The study offers the following conclusions and recommendations:

a. Significant reduction in TGR levels has taken place **probably** due to the NGCP. The evidence for this is that the Northeast districts show the maximum decline, higher levels of awareness about iodised salt, near complete iodisation of salt, and the greatest extent of its consumption, as compared to districts in other **regions**.
b. In the context that the selected districts had the highest levels of TGR in their States and show drastic declines now, the situation in the other districts of the region **can be expected** to be much better.
c. The median UIE was satisfactory in 31 out of 40 districts (77.7 per cent), with 100μg/l or more UIE levels, but it need not match prevalence of goitre, as that is the **cumulative effect of chronic iodine deficiency, and not current iodine status** (dependent upon iodisation of consumed salt).
d. In 14 districts UIE is under 50μg/l in over 20 per cent of the children, indicating severe iodine deficiency in 35 per cent of the study districts.
e. Iodine deficiency is endemic in 92.5 per cent of the study districts when the international cut off point of TGR of 5 per cent is taken and 50 per cent when the Indian standard of 10 per cent TGR is taken.
f. The awareness levels about iodisation were low except in northeast districts.
g. In 25 per cent of the districts the majority of the shops were selling un-iodised salt, while in 54 per cent districts mostly iodised salt was being used. In all districts zero to 58 per cent shops were selling both salts.

The report supports further efforts at iodisation, especially of the crystalline salt, and assumes that its findings provide evidence for the effectiveness of the NGCP. This is premature as well as confounding in the light of the stated objectives, the choice of design, and the analysis that NIN offers. We therefore, examine each of the following with the help of NIN's own and some additional data (Tables I- V), with reference to some of the major conclusions of the study: the regional nature of the study; degree of change in TGR; the assumed linear causality for the prevalence of IDD and, therefore, the impact of the NGCP; the extent of iodisation and its implication; the specific objective of assessing clinical manifestations of IDD; and finally, the methodological handicaps.

Is it a regional prevalence study?

Simply clumping states together and taking 1-2 districts from a state without any attempt to account for the size of the region, using proportionate population samples or through random selection, precludes the possibility of this being **a regional study**, which would require a three stage sampling procedure. The survey actually takes only **a purposive sample** of districts with highest TGR in the past. It is obvious then that the prevalence it provides is only for the districts that were most affected in the past and not for the states as a whole or the regions. Without knowing the pattern of prevalence in the states generalization from the study districts are not possible. Without saying so the study gears itself to compare prevalence over time, assess declines and then explain it on the

basis of programmatic success without actually looking at the data analytically, linking one set of data to another or assessing the NGCP activities over time. Thus claiming to assess prevalences it ends up doing an impact study rather unconvincingly.

Within its limited scope, it shows lowest range of TGR in the Northeast districts followed by Southern and Central districts. The highest prevalence is in the Eastern and the Northern cluster of districts, but adequate UIE levels in the sampled population are less than 50 per cent for only 1 out of 8 districts in the Eastern districts and 3 out of 8 in the Northern ones. Thus, the extent of prevalence is not linked to iodine insufficiency. The researchers argue that these two must not be linked as UIE reflects current status while goitre is a result of cumulative effect of iodine deficiency. We will comment on this assumption later.

Is the study designed to measure change?

The discussion and conclusion constantly (even if with riders) draw causal linkages between the declines in TGR and the NGCP, although the survey is not designed to study change. It is not insignificant that an impact analysis has never been mentioned as the objective! The inadequacy of design to measure change is evident from the fact that: a) the time intervals between the two surveys varied from 2 to 44 years; b) while the first survey was done among the general population the second was among 6-12 year old children and the age groups were, therefore, not matched; c) no details of the sampling designs were presented for the previous DGHS studies to establish that such a comparison is statistically feasible and valid.

To grasp the extent of discrepancy that these elements of design introduce, we examine the data presented by the study. The Northeast districts, with maximum average TGR declines, are presented as evidence of the impact of salt iodisation. Yet, a significant outlier, the district of Mon, is not explained. Here, declines in TGR (41.5 percentage points over 31 years) were despite a very poor household utilisation of adequately iodised salt (only 20 per cent household salt samples tested by the more reliable titration method had Iodine content of 15ppm or more). Is it that a better iodisation programme in this district hides an independent decline? Unfortunately, Mon is not an exception. In the Northern districts, Shahjahanpur (27.5 percentage point decline over 25 years) has a shockingly low level of iodised salt consumption (only 3.4 per cent household salt sample showing adequate iodisation). Saharanpur too has a 31 percentage point decline over12 years with only 26 per cent households consuming adequately iodised salt. The Central districts are no exception, where Shahdol and Surat districts, with very low levels of households consuming iodised salt (26.8 and 27.4 per cent), show high levels of decline - 45.4 and 40.6 percentage points over 24 and 11 years respectively. In the Southern districts, East Godavari and Tiruchirapalli are stark examples of similar discrepancies.

The Eastern districts, where TGRs are the highest, question the proposition in the opposite way. Here four districts out of eight have 51 per cent or more households taking adequately iodised salt, but only West Champaran shows a 24 percentage point decline over 21 years, while the other three districts (Darjeeling, East Gangtok, and North Mangum) show just about half of this decline over 24 years. In the Northern districts,

Sonepat with 7 years of iodisation programme and 80.9 per cent households having adequate intakes of iodine, shows a decline of only 5.2 points. Among the Central and Southern districts, only Sindhudurg and Wayanad have adequate iodized salt consumption in over 50 per cent households, but the declines in both are much lower compared to other districts in the two groups, with much lower level of adequate salt iodisation coverage. This points to a possible district level variation in causal factors that are not being considered or investigated.

Is goitre prevalence related to iodine insufficiency?

The fact that one district in the Northern and three in the Eastern states actually show an increase in prevalence, questions the very thesis of a linear relationship between supply of iodised salt and decline in Goitre prevalence. While the reader is cautioned by the authors not to attempt to see a correlation between UIE and TGR (a chronic remnant from the past), the fact that the universal iodisation programme started in 1984, while the children are only 6-12 years old, has been ignored. Thus, the presence of physiological goitre is as probable as chronic remnant goitre. The lowest TGR in the Northeast (4.5-8.6 per cent), and the absence of Grade II goitre there, indicates that about 5 per cent of Grade I goitre could be physiological. Reducing Grade I goitre by 5 per cent brings down TGR levels drastically except in Eastern districts (in the Northern district it is halved). This could have been tested by locating Grade I goitre in categories of children with varying levels of UIE and salt iodisation, but has not been attempted. Also, by not doing a general population survey the prevalence has been reduced by choice, even when the researchers knew that the base line used was a survey of general population! A general population survey would have improved comparison as well as provided a base line of 6-12 year olds for future monitoring.

The report mentions that 14 districts have more than 20 per cent population having UIE levels under 50μg/L, but the link between UIE and salt iodisation adequacy has not been scrutinised. A consistent relation between these two is a validation of at least the cause of the present iodine deficiency levels. Three interesting patterns are observed when we compare the proportion of population covered with adequately iodised salt with those with adequate UIE levels (100 μg/L). There are districts where these proportions match with a difference of about 10-12 per cent; and there are those districts where the proportion of salt adequacy is high but UIE is comparatively low (94.8 and 75.2 per cent respectively in Bishnupur, 70.0 and 33.0 per cent in North Mangum, and 91.5and 78.8 per cent in Chandel). In contrast, Dubri, Mon, Kupwara, Shahjahanpur, Palamu, Jalpaiguri, Sundargarh, Cuttack, Sarguja, Kota, Surat, Bikaner, and 7 districts of the Southern group show a reversal with relative lowering of proportions of population that gets adequately iodised salt compared to the population proportion that has adequate UIE levels. Does this indicate the presence of goitrogens in food that interfere with Iodine metabolism in the former set of districts, and sources of Iodine other than iodised salt in the latter set, making iodisation irrelevant?

The time gap between the two points of comparison shows very little correlation with declines. This should have been visible if the assumption that present levels of population coverage with adequately iodised salt reflects an effective programme and is the sole

cause of decline. This absence of consistency could either be due to other causal factors or due to inadequacies of the programme itself. The problems highlighted above also point out that the requirements of an impact study are very different from that of a prevalence study.

What are the levels of salt iodisation?

To assess the working of the programme we examine these very 14 districts. It is said that most of the powdered salt is iodised and crystal salt is non-iodised. The household data tells us only which of these forms the family consumes. When we look at the detailed analysis of salts sold we find that in these districts a significant proportion of shops are selling either un-iodised or both kinds of salts. This would be consistent with low levels of UIE. However, the unacceptable UIE levels in Nainital, North Mangum, Surat, and Kota are despite consumption of powdered salt. This is indicative of the fact that though iodised salt may be sold regularly, the actual consumption levels of the un-iodised salt, both crystal and powdered, are higher as these are cheaper (Table VI). Economic impediments to the existing programme are therefore far more critical than appreciated and should not be ignored. In absence of data on the ten indicators, eight out of which indicate a well managed programme [WHO 2001], or any other data for assessing the working of the programmes in the past, the assumption of a direct correlation between the programme and declines in TGR levels is unscientific and uncalled for.

Does the survey assess the prevalence of clinical forms of IDD?

One reason for taking a high-level TGR district could be to get a better picture of clinical manifestations of IDD. However, if the relationship between the symptoms and IDD had to be actually demonstrated, then it was necessary to have a sample that would be adequate to capture the prevalence of all the symptoms considered. The problem with these symptoms is that, except for the two types of cretinism, these are not specific to IDD, hence their presence alone means very little unless we know their prevalence in the unaffected population. Secondly, to establish a relationship with IDD, a much larger sample would be required taking their prevalence into account and not that of TGR. The levels of reported cretinism in the survey itself is insignificant, as are the other symptoms. Mental retardation, for example, does not get reported in 14 out of 40 districts. These levels barely establish IDD as a serious public health problem. The only way in which a causal linkage could be established would be to classify children according to clustering of symptom and match the level of UIE. This has not been done to strengthen the possibility of a wide range of clinical manifestation of IDD.

Is the problem distorted to suit a methodology?

The crux of the inconsistencies of this survey lies in the very definition of the problem it addresses and the methodology it uses. The problem is compounded by the fact that the researchers are a set of competent professionals who choose to state the problem in an ambiguous language to fit it into the simplistic methodology, but not suited to the requirements of the challenge. A 30-cluster sample is a method used to economise the monitoring of programmes of immunization or IDD control. The precision is compromised because surveys are repeated over time and constant errors do not affect the broad objectives. However, when used for complicated objectives of causal linkages and

impact analysis, this is not the best choice. Its use reflects the biased faith in preconceived notions that are never put to test, only reiterated through inadequate evidence. There is no other explanation for this biased production of "evidence" based on a design that increases the size of clusters, but not the number of clusters to improve representation of the population (Hoshaw et al 2001), assumes a uniform prevalence of 10 per cent by ignoring regional differences, while not even performing a preliminary exploratory household survey for TGR to justify the assumed prevalence

. A design effect (DE) of 3 is assumed for goitre prevalence without any actual exploratory assessment. It was therefore, necessary to check, at the end of the survey, if the ratio of the actual sample size to the effective sample size (DE) was uniformly 3 (given the very low levels of type II Goitre, and also present measures of variability of prevalence between clusters that determines the DE [www.mori.com/pubinfo/aiz/cluster-sampling] . Despite clear recommendations of the WHO to take at least 30 samples each of urine and salt from households, the DE for urinalysis is taken as 2 with a relative precision of 20 per cent, and a sub-sample of the clusters is taken (every 50th child surveyed)! The design also ignores the within-cluster factors of caste and class, so critical in the Indian context.

Can we draw conclusions about programme impact and causality of IDD from such a study and make recommendations of national significance? The NIN must not lend credibility to unsubstantiated claims. With all the expertise it has and the international support it enjoys, it should provide guidance and leadership in economical but substantive nutritional epidemiology. Ill-conceived surveys that provide quick, but undependable, evidence are costly both for the institution as well as the nation.

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Notes on Appendix Tables

The tables are constructed primarily from the data presented by the NIN. For including the year of ban on un-iodized salt sale by the state and the supply of iodised salt to the districts respectively, the following sources were used:

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Appendix Table 1a: Status of IDD in Eastern Region

Year of the first Survey (NIN 2003)	1964	1976	1976	1976	1976	1979	1987	1998
Prevalence in the first survey	20.9	35.2	33.2	37.8	37.8	64.3	30.3	21.6
Districts surveyed (NIN 2003)	Palamu	Darjeeling	Jalpaiguri	East Gantok	North Mangam	West Champ	Sundargar	Cuttack
Year of the state Ban on un-iodised salt *	1988	1998	1998	1985	1985	1988	1995	1995
Year of Iodised salt supply in Districts **			1986			1964		
Total Prevalence (%) of Goitre (NIN 2003)	21.9	22.9	23.1	26.7	23.7	40.1	39.6	21.8
Goitre G-I	19.6	20.9	21.8	24.7	20.1	35.3	36.8	20.5
Grade II	2.3	2	1.3	2	3.6	4.8	2.8	1.3
Difference in Prevalence (%) of the two surveys	-1	12.3	10.1	11.1	14.1	24.2	-9.3	-0.2
Time gap between surveys	36	24	24	24	24	21	13	2
Iodine Salt in hh~ Sample (%) by Titr. Method	22.4	51	45	69.5	70	51	22.4	22.9
Adequate UIE in population (%) > 100 µg/L	56.5	56.3	64.4	65.2	33	56.3	51	58.1
Inadequate UIE in population+A15 (%) <50 µg/L	23	11.2	19.2	19.1	39	11.2	25	22.4
Shops selling Iodized salt	35.3	52.7	31.7	97.6	93.3	20.7	74.4	27.9
Shops selling non-Iodized salt	36.1	25.6	21.1	1.6	4.2	46.5	18.8	67.2
Shops Selling both	28.6	21.7	47.2	0.8	2.5	32.8	6	4.9
Household distribution of salt Crystal (%)	75.9	51.6	55.3	18	26.1	80.8	62.7	80.4
Household distribution of Powder (%)	24.1	48	44.6	81.7	73.8	18.8	37	18.8

See notes for: * , **

All data from row 13 onwards is from NIN 2003

Appendix Table 1b: Status of IDD in Central Region

Year of the first Survey (NIN 2003)	1976	1981	1983	1987	1989	1990	1992	1993
Prevalence in the first survey	55.6	41.8	36.6	13.7	44	22	40.9	35
Districts surveyed (NIN 2003)	Shahdol	Sarguja	Valsad	Kota	Surat	Bikaner	Sindudurg	Kolhapur
Year of the state Ban on un-iodised salt *	1990	1990	2001	1992	2001	1992	1982-92	1982-92
Year of Iodised salt supply in Districts **								
Total Prevalence (%) of Goitre (NIN 2003)	10.2	16.2	14.5	9.9	3.4	9.2	14.5	8.2
Goitre G-I	10.1	14.8	13.9	9.8	3.3	9.3	12.9	7.2
Grade II	0.1	1.4	0.6	0.1	0.1	0	1.6	0.1
Difference in Prevalence (%) of the two surveys	45.4	25.6	22.1	3.8	40.6	12.8	26.4	27.7
Time gap between surveys	24	19	17	13	11	10	8	7
Iodine Salt in hh~ Sample (%) by Titr. Method	26.8	31.4	30.6	24.1	27.4	12.8	52.9	41.1
Adequate UIE in population (%) > 100 µg/L	30.2	58.1	36.5	60.2	45.4	58.6	59.5	32.8
Inadequate UIE in population (%) < 50 µg/L	48.8	20	38.4	23.9	28	17.8	17.6	36.5
Shops selling Iodized salt	46.5	26.6	20.1	83.3	18.8	59	14.3	38.9
Shops selling non-Iodized salt	9.9	69.5	76.6	16.7	73.2	36.1	83.9	55.7
Shops Selling both	43.6	3.9	5.3	0	8	4.9	1.8	5.4
Household distribution of salt Crystal (%)	65.5	49.7	51.9	6	36	61.9	77.9	41.6
Household distribution of Powder (%)	34.5	29.5	48.1	94	69	37	22.1	68.4

See notes for: * , **

All data from row 13 onwards is from NIN 2003

Appendix Table 1c: Status of IDD in Northern Region

Year of the first Survey (NIN 2003)	**1956**	**1961**	**1964**	**1971**	**1974**	**1975**	**1988**	**1993**
Prevalence in the first survey	41.2	52.3	30	27.4	41.6	44.7	45.7	24.5
Districts surveyed (NIN 2003)	Kullu	Gurudaspur	Nanital	Kupwara	Shimla	Shahjhanpur	Saharanpur	Sonepat
Year of the state ban on un-iodised salt *	1976	1986	1987	NA	1976	1987	1987	1987
Year of Iodised salt supply in Districts **	1966	NA	NA		1986	1987	NA	
Total Prevalence (%) of Goitre (NIN 2003)	9.6	20.6	6.9	8.5	10.4	17.2	14.4	19.3
Goitre G-I	10. 0	20. 0	6.8	8.3	10 .	17 .0	14	18 .0
Grade II	0.1	0.5	0.1	0.2	0.1	0.3	0.3	0.9
Difference in Prevalence (%) of the two surveys	31.6	31.7	23.1	18.9	31.2	27.5	31.3	5.2
Time gap between surveys	44	39	36	29	26	25	12	7
Iodine Salt in hh~ Sample (%) by Titr. Method	75.5	43.7	44.8	70.2	65.8	3.4	26.3	80.9
Adequate UIE in population (%) > 100 µg/L	82.9	39.1	54.6	92.2	68.8	35.7	36.3	72.5
Inadequate UIE in population (%) < 50 µg/L	8.8	32.7	33.3	1	7.1	16.4	28.1	8.7
Shops selling Iodized salt	71.4	66.6	35.1	NA	41.7	2	6.1	86.5
Shops selling non-Iodized salt	7.1	9.3	24.3	NA	0	56.9	72.2	6.3
Shops Selling both	21.4	24.1	40.5	NA	58.3	41.1	21.7	7.1
Distribution of household using Crystal salt (%)	9.9	8.4	44.9	11.2	3.1	90.8	66.4	13
Distribution of household using Powdered salt (%)	87.7	91.6	55	88.8	92.7	8.8	33.5	86.8

See notes for: * , **

All data from row 13 onwards is from NIN 2003

Appendix Table 1d: Status of IDD in North Eastern Region

Year of the first Survey (NIN 2003)	1959	1969	1978	1978	1982	1986	1986	1986
Prevalence in the first survey	40.2	50.2	68.6	68.6	26.5	65.8	25.9	25.9
Districts surveyed (NIN 2003)	Dubri	Mon	Aizawal	Chhintuipu	iChanglong	Dibrugarh	Bishnupur	Chandel
Year of the state Ban on un-iodised salt *	1989	1975	1986	1986	1976	1989	1975	1975
Year of Iodised salt supply in Districts **								
Total Prevalence (%) of Goitre (NIN 2003)	4.6	8.6	4.8	5.2	8.4	5.4	5	6.5
Goitre G-I	4.5	8.6	4.8	5.2	8.4	5.4	5 .0	6.5
Grade II	0.1	0.02	0	0	0	0	0.02	0
Difference in Prevalence (%) of the two surveys	35.6	41.6	63.8	63.4	19.4	60.4	20.9	19.4
Time gap between surveys	41	31	30	30	18	14	14	14
Iodine Salt in hh~ Sample (%) by Titr. Method	65.7	20.5	87.6	66.2	50.2	81.5	94.8	91.5
Adequate UIE in population (%) > 100 µg/L	79	56	80	77.6	57.5	75.7	75.2	78.8
Inadequate UIE in population (%) < 50 µg/L	6.7	20.3	4.3	6.2	18.2	11.9	8.6	9
Shops selling Iodized salt (%)	84.4	100	100	100	96.4	50	100	96.9
Shops selling non-Iodized salt (%)	0	0	0	0	1.8	50	0	0
Shops Selling both (%)	15.6	0	0	0	1.8	0	0	2.1
Household distribution of salt Crystal (%)	84.1	91.8	83.1	68.1	81.2	47.2	78.4	85.1
Household distribution of Powder (%)	16.9	8.2	16.9	31.9	18.8	52.7	21.6	14.9

See notes for: * , **

All data from row 13 onwards is from NIN 2003

Appendix Table 1e: Status of IDD in Southern Region

Year of the first Survey (NIN 2003)	1984	1985	1985	1986	1990	1992	1994	1994
Prevalence in the first survey	44.4	54	64.4	41.1	32.9	32.1	21	28
Districts surveyed (NIN 2003)	Ernakulam	Adilabad	East Godavari	Chikmagalur	Thiruchirapalli	Bangalore	Wayanad	Dindigul
Year of the state Ban on un-iodised salt *	No ban	1995	1995	1996	1995	1996	No ban	1995
Year of Iodised salt supply in Districts **					1990			
Total Prevalence (%) of Goitre (NIN 2003)	11.2	12.4	11.5	7.2	9.5	7.7	12.8	9.3
Goitre G-I	10.1	11.1	10.7	6.4	8.7	7.1	11.5	8.2
Grade II	1.1	1.3	0.8	0.8	0.8	0.6	1.3	1.1
Difference in Prevalence (%) of the two surveys	33.2	41.6	52.9	33.9	23.4	24.4	8.2	18.7
Time gap between surveys	16	15	15	14	10	8	6	6
Iodine Salt in hh~ Sample (%) by Titr. Method	33.8	26.2	9.5	23.8	10	36.7	57.1	16.7
Adequate UIE in population (%) > 100 µg/L	62.9	66.2	58.1	64.8	93.3	68.9	48.6	71.3
Inadequate UIE in population (%) < 50 µg/L	13.6	13.9	17.6	12.9	0	10.5	39	11.5
Shops selling Iodized salt	62.2	86.4	84.6	65	48	62.3	54.1	39
Shops selling non-Iodized salt	24.4	11.9	15.4	28	38.2	26.7	31.7	60
Shops Selling both	13.4	1.7	0	7	13.8	11	14.2	1
Household distribution of salt Crystal (%)	82	41.3	96	82.2	87.3	91.2	82.3	87.8
Household distribution of Powder (%)	18	58.7	4	17.8	12.7	8.8	17.7	12.2

See notes for: * , **

All data from row 13 onwards is from NIN 2003