ENDEMIC GOITRE IN DELHI

Goitre Unveiled in Walled City:
A Tale of Two Generations!

"SAPIENS QUI PROSPICIT"

(He is wise who looks ahead)

Dissertation submitted to the faculty of
Centre for Community Medicine of
All-India Institute of Medical Sciences

December, 1979 **C.S. PANDAV**

A C K N O W L E D G E M E N T S

It is a pleasure to thank the school children whose cheerful cooperation, enthusiastic participation and intelligent appreciation has been a constant source of encouragement to me in completing this project.

I would like to thank the Principals of the respective schools – Mr. Dan of Government Boys Higher Secondary School No.2, Kalkajee, Mrs. Mehta of Government Girls Higher Secondary School No.1, Kalkajee, Mrs. Sindhawani of Government Girls Higher Secondary School, Chandani Chowk and Mr. Aggarwal of Marwari Higher Secondary School, Chandani Chowk. Their interest and cooperation helped us complete the study in time.

To work under Prof. Nath has been stimulating experience. I owe much to him for his liberal guidance, helpful criticism and above all for his considerate attitude towards me. The colour slides and photographs taken by him have added élan to the dissertation. While working with him,

I am reminded of a poem :

Do not walk in front of me,
I ma not follow.
Do not walk behind.
I ma not lead.
Walk beside me.
And be my friend.

Dr. Kochupillai, is a rare combination of an astute clinician, scientist and philosopher who resolves the tangled webs of research with the same refinement with which the appreciates the finer nuances of music. He has not only given me a deep insight into the subject of this project but also, through his cosmic approach, taught me to have a holistic appreciation of a man and science. I am indebted to him not only for being a co-guide in this project but also for opening a much wider horizon for me.

My association with Dr. Karmarkar began on the sports field. Since then I have been making an attempt to imbibe his unique quality of taking victor and defeat alike with smiling equanimity. The laborious work of laboratory investigations was performed under his guidance. Of him, I can say that,

Not content merely to stay afar and guide.
But intent on walking ever arduous step b my side.

And carrying me along to match his giant stride.
This is an association I shall cherish with pleasure and pride.

In the field of research, it is only statistical validity which can sift the grain from the chaff.

Mr. Ramachandran has not only been illuminating in his exposition of the intricate art of statistical analysis but has verily lent the skeleton and substance to this work to sustain the clinical and epidemiological observations. His master over the numbers and razor sharp analysis rank him as a modern day Bhaskara. He was generous with his time and bore m demands on him with patience and good will. I thank him for all the help and guidance given to me.

It is not a mere coincidence that a man who deals with tiny but radioactive isotopes should compress enormous wisdom in the short but profound sentences with which he communicates with us. To Dr. Gopinath, “brevity is the soul of wit”. I thank him for his timely support and guidance in carrying out the radioactive iodine uptake studies.

Prof. Ramalingaswami, is peerless amongst the scientist-academicians in India today. His monumental work in unraveling the aetiopathogenetic mechanisms of thyroid disease in this country will forever serve as a beacon to any researcher in this field. While I could steal only a few precious moments from his bus schedule to seek his guidance on this project, the path that he has charted out as a pioneer in this field served as a inexhausitible source of inspiration. To this extent, I can claim to be an “Ekalavya” to this great master.

I am thankful to members of the faculty of Centre for Community Medicine: Dr. Bali, Dr. Bhatnagar, Dr. Gill, Dr. Kapoor, Dr. Reddiah, Dr. Lobo and my colleagues for their interest and support extended during this project. I would like to make a special mention of Dr. Surwade for his timely help.

I would like to express m sincere thanks to the front line workers Dr. Madan Godbole, Mr. Solanki and Mr. Romesh for their assistance in analysis of urine samples; Mr. Harbans Lal from the Department of Nuclear Medicine for the timely help in carrying out the iodine uptake studies. From the department of Biostatistics, I would like to thank Mr. Parmar for the preparation and coding of the proforma and Mr. Jain for sorting the data.

Illustrations in this dissertation are reflection of Mr. Ahuja’s meticulous and painstaking work. I would like to thank Mrs. Uma for the secretarial assistance.

Finally, I would like to thank Mr. Mittal for the layout and presentation of this work.

This project was financed by the research grant of the All-India Institute of Medical Sciences.

(C. S. PANDAV)

C O N T E N T S

1. INTRODUCTION

Endemic goitre is a problem of public health importance in India. The World's classic and most intense endemic belt runs along the southern slopes in the Himalayas extending from J & K in the West to Arunachal Pradesh, Nagaland and Manipur in the East. In addition, isolated pockets of endemicity exist in Chhota Nagpur Plateau, Arawali Range, Eastern and Western Ghats. About 40-45 million people are suffering from the disease[1]. According to a recent estimate made by the National Goitre Control Programme, Ministry of Health, Government of India, approximately 300 million people (50 percent of India's total population) are exposed to the risk of goitre throughout the country and over 60 million are goitrous[2]. Though, Delhi and its surrounding areas are located in close geographical proximity with the sub-Himalayan endemic goitre belt, as yet, there is no evidence in literature to suggest that goitre is prevalent in endemic proportions in these areas.

Physicians practicing the Delhi over the ears both within and outside the institutions have been struck b the frequency of goitre amongst patients seen by them. In fact, simple goitre is the most frequent thyroid disorder seen in the Endocrine Clinic of the All-India Institute of Medical Sciences (AIIMS), New Delhi. These patients come from Delhi and neighbourhood areas, and not from the Himalayan endemic goitre belt[11]. A substantial proportion of goitre patients seen at the AIIMS come from two areas of Delhi – Kalkaji and Chandani Chowk.

In view of this, it was decided to conduct a survey of goitre in these two areas. In planning this study the recommendation of the study-group on Endemic Goitre, convened b the World Health Organization in 1952 was taken note of. The suggested that the most convenient age-group for the study of prevalence of endemic goitre in a locality are the newborn, School-children and service recruits. A number of surveys have been made in different parts of the world on school-children to determine the prevalence of goitre[3].

In the light of the above well established accepted and practiced procedure, goitre survey in school children of Kalkaji and Chandani Chowk area of Delhi was carried out.

2. **DEFINITIONS OF SIMPLE AND ENDEMIC GOITRE**: **CRITERIA FOR ENDEMICITY**:

2.1 **Simple goitre**: Anatomical enlargement of the thyroid gland without an functional alterations is called euthyroid or simple goitre. B convention it is regarded as a compensator phenomenon which results when a single or a combination of factors interfere with the optimal formation of the hormones of the thyroid gland. Neoplastic growth is thus excluded from the purview of this definition[4]. In fact, the term "simple goitre" was used b Wane, Koutros and Alexander (1964) to denote those cases of non-toxic goitre where the could not find an evidence of factors like dyshormongenesis, autoimmune thyroiditis or ingestion of goitrogens[5].

2.2 **Endemic goitre**: The prevalence of enlargement of the thyroid gland occurring in a significant number of people living in any circumscribed area is called endemic goitre.

2.3 **Criteria for Endemicity**: Cases of enlargement of thyroid gland are found in all communities; even when there is an ample supply of iodine in the diet. Hence certain criteria have to be satisfied before designating on area as being endemic for goitre.

2.3.1 **Classification**: Man classifications have been suggested for field use in assessing the prevalence of thyroid enlargement.

In this school survey, the scheme adapted by Stanbury and his colleagues[6] from those suggested b Perez et al[7] was followed :

Grade 0a: Thyroid not palpable, or if palpable not larger than normal.

Grade 0b: Thyroid distinctly palpable but not visible with the head in a normal or raised portion considered to be definitely larger than normal, i.e. at least as large as the distal phalanx of the subject's thumb.

Grade I: Thyroid easily palpable and visible with the head in either a normal or a raised position. The presence of a discrete nodule qualifies a patient for inclusion in this grade.

Grade II: Thyroid easily visible with the head in a normal position.

Grade III: Goitre visible at a distance.

Grade IV: Monstrous goitres.

Thyroids of grade '0b" are abnormal b this classification, but are probably of no particular pathological significance except as indicators of thyroid abnormalities in the community.

2.3.2 **Epidemiological Criteria**: Endemic goitre would be considered to exist.

(a) When more than 5 per cent of an adolescent or pre-adolescent group have ‘grade I’ goitre or,

(b) When more than 30 per cent are assigned to ‘grade 0b’ or above.

This decision would be reinforced if it could be shown that in a fair sample of the population the mean daily excretion of iodine in the urine is :

(a) Less than 50 ug per 24 hours, or
(b) Less than 50 ug per gram of creatinine, in randomly obtained specimens.

3. PRESENT STATUS OF GOITRE AS A PUBLIC HEALTH PROBLEM IN INDIA.

Goitre has been an age-old health problem in the southern slopes of the Himalayas. Ancient Hindu accounts of medical literature likewise contain references to goitre. Incantations against goitre from the period around 2000 B.C. are found in Atharva-Veda. 'Galganda' was the name given b the earl Hindu physicians Susruta and Charaka (about 500 B.C.) to tumours of the neck. These tumours are generally considered to have been goitres, although Greenwald holds a different opinion in spite of the fact that the term 'galganda' is used to this day in India to denote goitre[8]. However, a systematic scientific effort to stud this problem was first made by Sir Robert McCarrison and his colleagues, however, could not lead to any definitive conclusions about the causation of the Himalayan endemic goitre but the concept of goitrogenic factors arose out of these studies. With the successful application of modern investigative techniques in the elucidation of the etiology of goitre in Mendoza, Argentina, By Stanbury and his colleagues[10], a new interest was triggered to study this problem afresh. In a series of field studies, Ramalingaswami and his colleagues at the All-India Institute of Medical Sciences (AIIMS) established the primary role of environmental iodine deficiency in the etiology of the Himalayan endemic goitre[11].

Establishment of iodine deficiency as the cause for Himalayan endemic goitre opened up prospects for its prevention by implementation of iodization programmes along the entire Himalayan endemic goitre belt. More and more countries of the South-East Asia region began investigations into the causation of endemic goitre within their respective countries. It soon became evident that an estimated 400 million people are exposed to the risk of iodine deficiency goitre in the south and south eastern regions of the Asian continent and that an estimated 80 million people are actually afflicted with goitre in this region. Thus a quarter or more of the 200 million people suffering from goitre throughout the world are inhabitants of this region. The countries mot affected b goitre include India, Pakistan, Bangladesh, Nepal, Burma, Thailand, Sri Lanka, Afghanistan, Indonesia, and Malaysia. Most of these countries have on-going goitre control programmes operating with varying degrees of success. Even after two decades of effort with the aid of International agencies such as UNICEF and the WHO, these countries still continue to have endemic goitre as a significant health problem.

3.1 PREVALENCE AND DISTRIBUTION:

Along the southern slopes, foothills and adjacent plains of the Himalayas, extending over 1500 miles from Kashmir in the West to the Naga hills in the east, involving the northern States of Jammu & Kashmir, Punjab, Himachal Pradesh, Uttar Pradesh, Bihar, West Bengal, Assam, Nagaland and Manipur, an estimated 50 million people are exposed to the risk of goitre[12]. The actual number of persons afflicted with goitre is estimated to the about 9 million[1]. According to a recent estimate made b the National goitre Control Programme, Ministry of

Health, Government of India, approximately 300 million people in India are exposed to the risk of goitre throughout the country and over 60 million are goitrous[2].

No comprehensive data about the locale to locale prevalence of goitre in this vast endemic belt are available. However, being a health problem that has attracted the attention of a series of investigators during the course of the last six decades, much information is available about the nature and severity of the problem from different areas of the goitre belt.

According to a survey made b the Goitre Control Programme launched by the Government of India, the average prevalence rate of goitre in the Himalayan and sub-Himalayan regions of the northern States is 29 per cent for the entire goitre belt[12]. This figure is based on extensive surveys carried out in the States of Himachal Pradesh, West Bengal, Bihar, Nagaland, parts of Jammu & Kashmir and Uttar Pradesh. There are innumerable pockets in this goitre belt where the prevalence of goitre amongst school going children varied from 55 to nearly 100 per cent. The state wise prevalence rate was as follows:

Jammu and Kashmir: 33 to 46%, Punjab: 40 to 53%; Himachal Pradesh (H.P.): 20 to 40%; U.P.: 10 to 42%; Bihar: 3 to 42%; West Bengal: 10 to 35%; Assam: 0.26 to 12%; Nagaland: 26 to 50%.

In addition to the well known Himalayan belt, there are more and more isolated pockets of endemic goitre being reported from different parts of the rest of India. Thus, goitre has been reported to be prevalent in endemic proportions along the hill tracts of central India[12]. Particularly along the Chhota Nagpur plateau, the Aravalli range in Rajasthan[13], Narmada Valley in Gujarat[14], Aurangabad district, Maharashtra[15,16], in Bombay city[17], Pune district[18] and also along the higher reaches of the Western ghats, in the tea estates of Kerala[19]. Recent addition to this list are Subvindha belt of Endemic goitre, Shahdol district of Madhya Pradesh[29] and banks of river Karjan and Narmada in Broach district of Gujarat[30].

A survey of goitre in Nandod Taluka of Broach district of Gujarat showed an average prevalence of 36.7%. Edibam et al. surveyed a total of 1374 persons in this region of Narmada Valle[14]. Krishnamachari's survey of 1238 people in 8 villages of Deccan plateau (Sillod Taluka, Aurangabad district, Maharashtra) showed average prevalence of 52 per cent[15], while Sathe and Dandare surveyed 1135 people in the same region, reported a prevalence of 48.2 per cent[16]. A recent study b our group in the same area revealed 30 per cent prevalence of goitre among school children[13]. Similar goitre prevalence rates have been reported among school children in Bombay by Shag et al[17]. A recent report from Ghodegaon Taluka (Pune district) of Maharashtra b Dudani and Natu, who surveyed 5829 people, has shown a prevalence of 16.5 per cent[18], while preliminary report of survey of prevalence of goitre in Tea estates of Munnar, Kerala b Basu et al. has shown a prevalence of 32.26 per cent[19]. Another report b Dwivedi has shown a prevalence of 55.75 per cent goitre in 13,609 people surveyed in Shahdol district of

Madhya Pradesh[29]. While Trivedi and co-workers, who carried the survey following the foot steps of the previous survey of Edibam et al. examined 6550 people along the bank of river Karjan and Narmada of Broach district in Gujarat and showed goitre prevalence of 22.89 per cent[30]. Table 2,3,4,5 present the prevalence of goitre in different parts of the country.

IT IS IMPORTANT TO NOTE HERE THAT THERE IS NO EVIDENCE IN LITERTURE SO FAR, TO SUGGEST THAT GOITRE IS PREVALENT IN ENDEMIC PROPORTION IN THE UNION TERRITOR OF DELHI.

Thus in summary a competent cartoonist with the task of brushing in goitre areas on a map of the Indian Penisula would heavily underline the entire length of the Himalayan “eyebrow”, lightly cover an irregular and fragmented area of secondary importance across the Central plateau from Pakistan to Bangladesh and merely to touch some minor grey-spots in the Deccan and extreme south.

TABLE – 1

IODINE METABOLISM AND IODINE CONTENT OF WATER IN DIFFERENT AREAS

Area of Study	I^{131} Thyroidal uptake or clearance rate (% 24 hours or -ml/mt)	Urinary Iodide	Ti or PBI (mean µgram%)	P.T.I. µgram%	Iodine in water µgram/lt.
Himalayan Endemic[11]					
a) Uttar Pradesh	68.7%±8.3 (M_SE)	30.2±2.82 µg/gram creatinine	3.87±0.31	0.096±0.21	0.298
b) Bihar	67.1%±12.3	-	3.0±0.11	0.088±0.017	0.205
Aurangabad[13]	53.42%±61%	39.6-41.62	4.12-4.63	-	-
Deccan Plateau[15]	78%	9-36µg/lt.	4.5	-	-
Delhi[21]	88.39ml/mt. ±13.1	20.0±1.85 µg/gram creatinine	T4-7.4±0.99	0.0695± 0.0075	9.0

TABLE - II

PREVALENCE OF GOITRE IN VARIOUS PARTS OF INDIA[9] (1945-1953)*

Sl. No.	Region	Prevalence of goitre(%)	No. of persons surveyed	Year of Survey	Authority
1.	Kashmir, Karakoram Mountains	90	-	1945	Allen-Mersh
2.	Uttar Pradesh, Dehradun	32	554	1945	Ramalingaswami
3	Uttar Pradesh Bareilly	26	133	1947	Lyall
4	East Punjab, Shivalik Hills	32	5042	1952	Ramalingaswami
5	East Punjab, Shivalik Hills	37	1337	1952	Ramalingaswami
6	Bihar, Purnea District	50	3 villages	1952	Ramalingaswami
7	Bihar, Ranchi District	70	563	1952	C. Thomas
8	West Bengal, Darjeeling	67	8204	1953	Sen Gupta & Swarup

*****Source: Kell, F.C. and Snedden, W.W., Prevalence and geographic distribution, Endemic goitre. WHO Monograph Series No.44, 1960 (9).

TABLE - III

PREVALENCE RATE OF GOITRE IN INDIA[10] (1958-66)*

Sl. No.	State	Population Examined in Lakhs	Preva-lence rate(%)	District	Range of Pre-valence Rate(%)
1.	Assam	2.58	2.5	Sibasagar Goalpara	1.5 7.7
2.	Bihar	0.86	27.1	Hazaribagh Muzaffarpur	3.6 41.7
3.	Himachal	0.21	-	Mandi Mahase	23.7 39.9
4.	J & K	0.07	31.6	Udhampur Anantnag	31.0 31.9
5.	Nagaland	0.11	32.4	Makokchang Tuensang	25.4 45.9
6.	Punjab (before 1.11.66)	0.21	-	Gurdaspur Kangra Hoshiarpur	32.3 32.2 40.3
7.	U.P.	0.67	31.5	Rampur Dehradun	10.7 39.7
8.	West Bengal	0.24	24.3	Malda Darjeeling	11.6 35.1
9.	Total population examined	8.00	10.6	-	-

*Source: Sengupta, S.K., Kapoor, P.N. and Roychoudhary, S.K.. Prevalence of Endemic goitre in the Sub-Himalayan Range of India. I.J.M.R. Vol. 56, (1968)[10].

TABLE - IV

PREVALENCE RATE OF GOITRE IN INDIA[10] (1966-1977)*

Sl. No.	State	District	Year	Prevalence rate (%)
1.	Assam	Sibasagar Lakhimpur Darang	1970 1970 1970	13.2 30.1 31,5
2.	Chandigarh	-	1977	45.9
3.	Gujarat	Bhanich	1977	31.7
4.	Haryana	Ambala Gurgaon	1972 1976	26.0 6.5
5.	Himachal Pradesh	Simla	1974	41.6
6.	Jammu & Kashmir	Baramulla Doda Jammu Kathua Srinagar Poonch-Rajouri	1971 1971 1971 1971 1971 1971	32.8 25.4 27.6 30.5 26.6 26.8
7.	Madha Pradesh	Shahdol	1976	55.6
8.	Maharashtra	Aurangabad	1973	35.0
9.	Manipur	-	1970	32.0
10.	Meghalaya	Garo Hills United Khasi & Jaintia Hills	1966 1966	2.3 7.0
11.	Mizoram	Mizo Hills Tripura	1966 1970	1.8 17.0
12.	Punjab	Ropar	1969	9.3
13.	Sikkim	Entire	1976	37.82
14.	Uttar Pradesh	Deoria Bareilly Rampur Shahjahanpur Pilibhit	1973 1974 1974 1974 1975	65.0 64.0 35.8 44.74 41.3

*Source: Pocket book of Health Statistics of India – 1978, Page 91.

TABLE - V

RECENT STUDIES ON GOITRE PREVALENCE IN INDIA

Sl. No.	Region	No. of persons surveyed	Preva-lence of goitre (%)	Year of survey	Reference
1.	Nandod Taluka Broach district, GUJARAT (Narmada Valley)	1374	36.7	1970	Edibam, H.H., Dave, B.T. and Niyogi, A.K. Indian J. Med. Sciences. 20: 36772, Ma, 1972.
2.	Sillod Taluka Aurangabad District MAHARASHTRA Primary School	673	71	1972	Dandare, M.P. and Sathe, P.V. Indian J. of Prev. Soc. Med. 4: 47, June 1973.
	Secondary School	2957	55.3		
3.	Sillod Taluka, Aurangabad District	1238	52.0	1974	Krishnamachari, K.V. Endemic goitre: A Public Health Problem in Maharashtra. Trop. Geog. Med. 26 (1974), 147.
4.	Sillod Taluka, Aurangabad District	1135	48.2	1972	Sathe, P.V. & Dandare, M.P. Indian J. of Public Health 19 (1975) 84.
5.	Choknad & Chanduvarai Tea Estates of Munnar, KERALA	747	32.26	1975	Basu, P.K., Narayan, R., Yusuf, S. & James, K.K. Preliminary repot of survey of prevalence of goitre in Tea Estates of Munnar – Paper presented at VI All-India Conference of Preventive & Social Medicine Bangalore (1976).
6.	Sub-Vindhya belt of endemic goitre,	13609	55.75	1976	Dwivedi, M.P. Survey: Sub-Vindhya

	Madhya Pradesh				belt of endemic goitre. Swasth Hind page 186, August 1978.
7.	Ghodegaon, District Pune MAHARASHTRA	5829	16.5	1974	Dudani, T.G. & Nahi, M.N. Epidemiology of goitre in Ghodegaon. IJMR Dec. 78/980.
8.	Banks of River Karjan and Narmada of Broach district GUJARAT.	6559	22.89	1972	Trivedi, D.H., Shah, D.N., Vyas, D.B. & Patel, Y.I. Endemic goitre in the village along the bank of river Karjan and Narmada of Broach District Gujarat. Indian Journal of Community Medicine. Vol.IV(1): 23, 1979.

3.2 **AETIOLOGY**:

Severe environmental iodine deficiency has been shown to be the cause of Himalayan endemic goitre[11]. The level of iodide in the drinking water is extremely low in the endemic zone, no value being higher than 3 microgrammes per litre and most values considerably below this figure. Marked elevation of thyroidal I^{131} uptake (24 hours) coupled with low urinary iodide excretion of less than 40 microgrammes, per gram of creatinine clearly demonstrate iodine deficiency state in the goitrous individuals (Table 1). The plasma inorganic iodide estimated b the isotope dilution technique was low while the BI^{131} at 48 hours was markedly elevated, thus demonstrating a rapid turn-over rate of intrathyroidal iodine pool of these goitrous individuals from the endemic zones. The glands at histology showed marked acinar proliferation with tall columnar epithelium and scanty colloid, thus substantiating histological the rapid turnover rate observed indirectly as the raised BI^{131}. The small intra-thyroidal iodine pool is turned over rapidly, in an effort to compensate for the environmental iodine deficiency, thus maintaining a euthyroid state despite the severe environmental iodine deficiency. Majority of the goitrous patients studied showed suppressibility of raised I^{131} uptake b extraneous triiodo-thyronine (T-3) thus demonstrating an intact pituitary thyroid interrelationship[22]. As majority of these goitres, on TSH stimulation did not show an further enhancement of I^{131} uptake, maximum endogenous stimulation b TSH is surmised. Studies designed to demonstrate iodine organification defects of partial or complete degrees did not yield an positive result[10]. Genetically determined abnormalities of iodine metabolism did not seem to be operative in the genesis of Himalayan endemic goitre.

A study carried out recently by our group in one of the severely endemic areas in Himalayas revealed significant functional maladaptation of the gland, despite the impressive adaptive mechanisms demonstrable in these glands[23]. Thus the mean basal TSH levels of 24 randomly selected goitrous individuals studied in a village in the Himalayas with a goitre prevalence rate of almost 100 per cent, was significantly more than the normal controls. More than 20 per cent of these goitrous individuals showed TSH levels which are diagnostic of hypothyroidism (mean TSH = 14.4mcg/ml). Studies on their pituitary TSH reverses b the TRH test showed markedly elevated TSH reserves indicating continuing pituitary TSH synthesis due to absence of adequate feedback inhibition. More significantly, an inverse correlation was demonstrable in these persons between circulating T4 and goitre size on the other. These findings show that severe environmental iodine deficiency is associated with functional failure of the thyroid even in the presence of formidable adaptive response. The public health implication of this finding is obvious.

Investigations into the etiology of goitre seen in other parts of India also indicate significant iodine deficiency as the causative factor (Refer Table 1). Goitrous persons studied from Aurangabad, Deccan Plateau and Delhi showed a uniform pattern of high radioactive iodine uptake with low urinary iodide excretion and low but normal protein bound iodine. Thus iodine deficiency goitre seems to be prevalent endemically in man areas of the country other than Himalayan goitre belt.

3.4 HEALTH CONSEQUENCES

Apart from the large disfiguring swelling in the neck, endemic goitre often undergoes nodular distortion with haemorrhagic and cystic changes causing respiratory distress requiring surgery. Retrosternal extension can also occur, causing pressure symptoms needing attention. However, the most serious health consequences of endemic goitre are the high incidence of endemic creatinism, deafmutism and varying degrees of feeble mindedness, seen among the populations living in endemic areas. The general impression has been that in areas where goitre prevalence rate is more than 50 per cent, such defective individuals constitute 4 percent or more of the population[12]. In the Gilgit area where McCarrison made his original observations, recent studies indicate that 2.4 per cent of the population were deafmutes[24]. In some of the villages in the Himalayan endemic in Uttar Pradesh, Stott in 1931, estimated that 4 per cent of the population were deafmutes[25]. In another area to the west of these foot-hills, 1 per cent of the population showed mild to extreme forms of mental and physical retardation[26]. In a study made in the township of Bettiah in Bihar, where goitre prevalence rate among school children was 100 per cent all the 20 deafmutes studied showed goitre and half of them showed nodular distortion of the gland[27]. Though all the deafmutes studied were mentally defective, none of them were clinically hypothyroid. There was no available family history of cretinism or deafmutism among them. The deafness observed was of the perceptive type and more than 60 per cent of them had total deafness audiometrically. The parameters of quantitative iodine metabolism observed in them were closely comparable to the observed values among goitrous individuals. Their serum BI values were low but

comparable to other endemic goitrous patients and the PBI I^{131} was high, showing rapid turnover of a small intrathyroidal iodine pool as a compensatory phenomenon. None of the deafmutes studied in the Himalayas showed difference in thyroidal adaptive response when compared to other endemic goitrous patients.

3.4 CONTROL MEASURES

Simple goitre is the easiest of all known diseases to prevent. It ma be excluded from the list of human diseases as soon as society determines to make this effort[31].

- David Marine.

In areas where this effort has been made, goitre prevalence has been reduced: in others, efforts are just beginning or have not begun at all.

- Richard Follis

Switzerland was the first country (1923) to introduce prophylactic measures of adding iodine to table salt. Later it was introduced in Michigan (USA) and New Zealand in 1924. Strikingly successful results are on record. In Switzerland and New Zealand, the prevalence of goitre in school children was reduced by 90 per cent in two or three decades; cretinism and deafmutism soon began to disappear[32].

Indian scene: In order to substantiate the evidence for iodine deficiency as a causative factor of endemic goitre in the Himalayan goitre belt, a prospective study was organized in 1954 in the Kangra Valle of Himachal Pradesh[26,28]. The study area was divided into 3 zones A, B and C. After base-line survey, the salt distributed to zones A and C was fortified with potassium iodide and iodate while zone B was supplied with unfortified salt. The iodine fortification was such as to supply approximately 200 microgrammes per capita per day. After 5 to 6 years of iodization, striking decrease in the prevalence of goitre was observable in zone A and C when compared to the uniodized zone B. 6 ears later, a systematic survey of goitre prevalence showed further reduction in the prevalence of goitre. In 1972, spot checks on goitre prevalence in the iodised areas b an independent group of physicians showed negligible prevalence of goitre among school children and 131_I uptake and urinary excretion of iodide became normal. Encouraged b the success of this prospective stud the Government of India prepared a scheme for iodization of salt at various convenient sites in India for the production and distribution of iodised salt in sufficient quantities to meet the needs of all the goitre affected areas of the country. The scheme was intended to cover an estimated 40 million people exposed to the risk of severe environmental iodine deficiency and its adverse health consequences. 12 plants were installed for iodating salt at three sites of salt production (Sambhar Lake in Rajasthan; Howrath – West Bengal and Kharagoda – Gujarat) between 1962 and 1965 for distribution to the entire Himalaya goitre belt. With this production capacity, demands of only 4.1 per cent of the total endemic goitre territories of the country can be covered. Plans are afoot to further enhance the iodisation capacity. When this is achieved, an estimated 10 per cent of the endemic areas of the country will be converted b iodisation programmes. Thus the majority of the endemic areas of the country still remain

uniodized. The main constraints in the widespread implementation of the programme have been paucity of funds, inadequate administrative machinery and poor acceptability.

The Indian approach to the problem of endemic goitre can be suitably summed up in the words of the 1st century poet Juvenal,

"Quis tumidum guttur miratur in Himalayas?"
(Who wonders at a swelling of the neck in the Himalayas)[45].

4. **OBJECTIVES**:

4.1 To estimate the prevalence of goitre in school children of Kalkaji and Chandani Chowk areas of Delhi.

4.2 To correlate the prevalence of goitre with some aspects of iodine metabolism.

5. MATERIALS AND METHODS:

5.1 Area Surveyed:

The Union Territory of Delhi consisting of one district only, is a narrow strip of Indo-Ganga plain lying between 28° 25' and 28° 53' North Latitude and 76° 50' and 77° 22' East Longitude. It is bounded on the North West and South by Haryana state, on the East by Uttar Pradesh. Yamuna River flows by the side of its Eastern border in North South direction. It has an area of 14.85 sq. km. only about 0.05 per cent of the total area of country.

Delhi's altitude ranges between 213 and 305 meters above sea-level. The river Yamuna flows in North-South direction along its eastern border. The famous Ridge - the worn and arid last spur of the Arravali is on its West. Physically, Delhi can be divided into three parts - the plain, the Ridge and the Yamuna flood plain.

The climate of Union Territory of Delhi is extreme, characterized by excessive dryness and hot summer starting from the middle of March to the end of June and a surprisingly cold winter from November to middle of February. The monsoon season that follows immediately the hot summer continues up to the end of September. The post monsoon period of October and November constitute the transition period from monsoon to winter conditions.

The average maximum and minimum temperature of Delhi during winter is 21°C and 11°C and during summer is 36°C and 25°C respectively. The average annual rainfall is 660 millimeters34.

According to mid-year estimate in 1972, Delhi had a population of 42.8 lakhs and was growing at rate of 4.2 per cent (i.e. 2 lakhs annually). Besides population explosion, there is also a large migration from neighbouring areas. While 70 per cent of Union Territory of Delhi is rural, only 9 per cent of total population lives there, the density of population being 1725 per sq. km. In urban areas, the mean density of population is 4790 per sq. km. The overall density of population is 2738 per sq. km.[33].

For administrative purposes, Union Territory of Delhi has been broadly divided into 5 areas, Delhi Tehsil, Mehrauli Tehsil, New Delhi Municipal Committee, Delhi Cantonment and Delhi Municipal Corporation (urban). Delhi Municipal Corporation has an area of 360.55 sq. km. with a total population of 32,87,883 (81 per cent of total population of Union Territory of Delhi). Chandani Chowk and Kalkaji-Govindpuri areas come under the jurisdiction of Delhi Municipal Corporation[34].

School chosen from Chandani Chowk area, one boys' and one girls; are located in the walled cit of Shahajahanabad. While schools chosen from Kalkaji area are located in one of the resettlement colonies of Delhi – Kalkaji and Govindpuri. The study was conducted in the spring of 1979.

5.2 School Surveyed:

The school children of Kalkaji and Chandani Chowk areas formed the clinical material for this stud. In each area, one boys' and one girls' school was chosen. Socio-economic status of the goitrous patients attending the clinic and the co-operation extended b the school authorities were considered while choosing the schools.

Name of the school chosen

Kalkaji area:

1. Government Boys Higher Secondary School No.2.
2. Government Girls Higher Secondary School No.2.

Chandani Chowk area:

1. Marwari Boys Higher Secondary School, Chandani Chowk.
2. Government Girls Higher Secondary School, Jama Masjid.

The purpose of our stud was explained to the school principal and staff members. They were briefed about presentation and prevalence of simple goitre, the consequences of the condition if left untreated and methods available for its prevention. This helped us in having their total participation for conducting the survey in the school children.

In consultation with them, a suitable date, time and place for examining the children was chosen. All the children attending the school on the day of survey were examined. Care was taken to choose a day on which the attendance in the school was maximum. Over 90 per cent of the students on the attendance register of each school were examined.

Information on the following characteristics was elicited from ever child who was examined and recorded on a printed proforma. (copy attached) (1) Age (2) Sex (3) Religion (4) Size of the family (5) Per capita Annual Income in Rupees (6) History of having lived in an known endemic areas, 5 years prior to stay in Delhi (7) Source of water supply.

5.3 Clinical Examination:

All the children were clinically examined in broad daylight in the sitting position. Classification of the goitre size was done according to the criteria adapted b Stanbury[6] and his co-workers from the first suggested b Perez et al[7].

Grading of thyroid gland is inherently subjective. Chart of the classification was prepared. A constant and continuous reference to the definitions out-lined in the chart

was made b the authors. Observer variability was controlled b preliminary testing and agreement between first and second authors.

5.4 Iodine estimation in urine:

Random casual samples of urine from children with different grades were collected and preserved with toluene, until analysed. Urinary inorganic iodide was estimated b the modified method of Barker[35]. Urinary creatinine was measured b the alkaline picrate method of King and Wooten[36]. The values obtained were expressed as microgrammes of iodine per gram of creatinine.

5.5 I^{131} uptake studies:

Systematic sampling of 1 out of ever 4 children whose urinary values were estimated were called for 24 hour I^{131} uptake. The oral dose administered was about 3 microcuries. The results were obtained in terms of percentage of radioactivity taken up b the thyroid out of the total dose administered. The normal range of 24 hour I^{131} uptake in our laboratory is 15% - 35%.

6. RESULTS

Grade-wise distribution of goitre in Kalkaji schools is given in Table I. A total of 2214 students were examined in these two schools. Of these 992 (44.8 per cent) had normal size thyroid (0a), the remaining were goitrous (55.2 per cent). In all 1240 boys and 974 girls were examined. There was no boy with Grade III goitre while 5 girls belonged to this grade. None of the boys and girls examined had Grade IV enlargement of thyroid. Table II gives the grade-wise prevalence of goitre in the schools surveyed in the Chandani Chowk area. A total of 986 students were examined. Of these 447 (45.3 per cent) had normal size thyroid (0a) while remaining were goitrous (54.7 per cent). In all, 558 boys and 428 girls were examined. None of the boys had grade III or grade IV goitre while 13 girls had grade III goitre and one girl had grade IV thyroid enlargement.

Age and sex-wise prevalence of goitre in Kalkaji and Chandani Chowk schools is given in Table III and IV respectively. In both the schools, overall prevalence rate was higher among girls viz. Kalkaji schools: girls 67per cent; boys 46 per cent. Chandani Chowk Schools: girls 72 per cent; boys 42 per cent. This difference of prevalence of goitre – between girls and boys is statistically more significant. This sex related difference of goitre prevalence has been observed in all the age groups.

Urinary iodide concentration expressed as microgrammes per gram creatinine, in these school children is given in Table IV. In all 525 samples were analysed. Of these 335 were from Kalkaji schools and the rest were from Chandani Chowk schools. In Kalkaji schools 60 per cent boys and 70 per cent girls had urinary iodide values less than 50µg per gram creatinine. Of the 190 samples analysed from Chandani Chowk, 55 boys (66 per cent) and 89 girls (83 per cent) had urinary iodide values less than 50µg per gram creatinine.

24 hour thyroid uptake studies were carried in a total of 121 students Table IV gives the distribution of students in normal range (15% - 35%) uptake) and those with uptake values above normal.

TABLE – I

GRADE-WISE DISTRIBUTION OF GOITRE IN KALKAJI SCHOOLS

Sex	Total		Grade 0a		Grade 0b		Grade I		Grade II		Grade III	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Boys	1240	100.0	669	53.9	417	33.6	151	12.2	4	0.3	-	-
Girls	974	100.0	324	33.3	337	34.6	259	26.6	49	5.0	5	0.5
Total	**2214**	**100.0**	**992**	**44.8**	**754**	**34.1**	**410**	**18.5**	**53**	**2.4**	**5**	**0.2**

TABLE – II

GRADE-WISE DISTRIBUTION OF GOITRE IN CHANDANI CHOWK SCHOOLS

Sex	Total		Grade 0a		Grade 0b		Grade I		Grade II		Grade III		Grade IV	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Boys	558	100.0	325	58.2	165	29.6	64	11.5	4	0.7	-	-	-	-
Girls	428	100.0	122	28.5	134	31.3	123	28.7	35	8.2	13	3.1	1	0.2
Total	**986**	**100.0**	**447**	**45.3**	**299**	**30.3**	**187**	**19.0**	**39**	**4.0**	**13**	**1.3**	**1**	**0.1**

TABLE – III

GRADE-WISE DISTRIBUTION OF GOITRE IN KALKAJI SCHOOLS

	Total			Boys			Girls		
Age in years	Examined	Positive	Per cent	Examined	Positive	Per cent	Examined	Positive	Per cent
10 – 11	220	105	47.7	148	66	44.6	72	39	54.2
12 – 13	531	296	55.7	265	116	43.8	266	180	67.7
14 – 15	742	412	55.5	386	167	43.3	356	245	68.8
16 – 17	581	331	57.0	346	177	51,2	235	154	65,5
18 – 19	132	70	53.0	93	44	47.3	39	26	66.7
20 – 21	8	8	100.0	2	2	100.0	6	6	100.0
Total	**2214**	**1222**	**55.2**	**1240**	**572**	**46.1**	**974**	**650**	**66.7**

TABLE – IV

GRADE-WISE DISTRIBUTION OF GOITRE IN CHANDANI CHOWK SCHOOLS

	Total			**Boys**			**Girls**		
Age in years	Examined	Positive	Per cent	Examined	Positive	Per cent	Examined	Positive	Per cent
10 – 11	81	41	50.6	68	31	45.6	13	10	76.9
12 – 13	252	134	53.2	168	77	45.8	84	57	67.9
14 – 15	343	192	56.0	192	81	42.2	151	111	73.5
16 – 17	261	141	54.0	114	38	33.3	147	103	70.1
18 – 19	46	28	60.9	16	6	37.5	30	22	73.3
20 – 21	3	3	100.0	-	-	-	3	3	100.0
Total	**986**	**539**	**54.7**	**558**	**233**	**41.8**	**428**	**306**	**71.5**

TABLE – V

URINARY CONCENTRATION OF I^{127} MICROGRAMS ER GRAM OF CREATININE IN SCHOOL CHILDREN OF DELHI

Name of the School	Total number examined	0-50µg I^{127}/gm creatinine		51µg I^{127}/gm creatinine	
		Number	Per cent	Number	Per cent
Kalkaji Boys	208	127	61.06	81	38.94
Kalkaji Girls	127	89	70.8	38	29.92
Total (K)	335	216	64.48	119	35.52
Chandani Chowk Boys	83	55	66.27	28	33.73
Chandani Chowk Girls	107	89	83.18	18	16.82
Total (Ch.)	190	144	75.79	46	24.12
Grand Total (K+Ch.)	**525**	**360**	**68,57**	**165**	**31.43**

TABLE – VI

24 HOUR I^{131} UPTAKE B THYROID IN SCHOOL CHILDREN OF DELHI

Name of the School	Total number examined	I^{131}/ uptake 15% - 35%		I^{131}/uptake > 35%	
		Number	Per cent	Number	Per cent
Kalkaji Boys	36	15	41.67	21	58.33
Kalkaji Girls	36	8	22.20	28	77.8
Total (K)	72	23	31.94	49	68.06
Chandani Chowk Boys	24	5	20.83	19	79.17
Chandani Chowk Girls	25	2	8.0	23	92.0
Total (Ch.)	49	7	14.29	42	85.71
Grand Total (K+Ch.)	**121**	**30**	**24.79**	**91**	**75.21**

In Kalkaji area 68 per cent of the students had iodine uptake values more than 35 per cent, the corresponding values for Chandani Chowk students were 75 per cent.

Ninety four per cent of the students surveyed in this study have been residing in their respective localities ever since birth. The remaining 5.7 per cent belonged to areas hitherto not recognized to be endemic for goitre. Only 10 students (0.3 per cent) of 3200 examined gave history of residing in known endemic areas sometime during the 5 ears immediately preceding the survey.

7. **DISCUSSION**:

There is no reported evidence to suggest the prevalence of endemic goitre in the Union Territory of Delhi. Stanbury et al[6] have defined the epidemiological criterion for the presence of endemic goitre in a community. According to them, endemic goitre can be said to exist in an area when

(a) more than 5 per cent of the adolescents or pre-adolescents of the area have grade I goitre; or

(b) more than 30 per cent of the same have at least grade 0b goitre.

It is evident from the data presented in Table I and II that goitre is prevalent in endemic proportions in the school children of Kalkaji and Chandani Chowk areas of Delhi. In Kalkaji schools, the overall prevalence of goitre with grade 0b and above is 55 per cent. Likewise, in Chandani Chowk area, the overall prevalence of goitre with grade 0b and above is 55 per cent. While grade I and above constitute 24 per cent. These findings clearly satisfy the criteria laid down by Stanbury.

Ninety four per cent of the students attending these schools are residents of respective localities i.e. Kalkaji and Chandani Chowk. The practice of conducting goitre surveys in school children of a locality, as recommended b the stud groups on Endemic goitre, convened b the World Health Organization in 1952[3] is now a well established and accepted method for estimating the prevalence of goitre in that locality. On the basis of these observations and our findings in school children, we can safely conclude that goitre is prevalent in endemic proportions in the Kalkaji and Chandani Chowk localities of Delhi.

As observed in other similar studies goitre was prevalent in higher proportions among girls in these two areas (Table I and II). In Kalkaji schools 68 per cent of girls as compared to 46 per cent of boys have goitre. While in Chandani Chowk Schools the trend is similar with 72 per cent of girls and 42 per cent of boys having goitre.

Girls not only had goitre in greater numbers but also had goitre with larger size. In Kalkaji school, 4 boys as compared to 49 girls had grade II goitre, and none of the boys as compared to 5 girls had grade III goitre. These findings are more pronounced in Chandani Chowk Schools. Here, only 4 boys had grade II goitre while 35 girls belonged to this category. None of the boys had grade III or IV goitre. On the other hand 13 girls had grade III goitre and one girl had grade IV goitre.

These findings of age and sex distribution and severity of goitre in girls are in confirmity with the observations of other authors[11,13,14,15,18,19,29,30]. Krishnamachari who examined 1238 persons in Sillod Tehsil of Aurangabad district in 1974 had reported a 52 per cent prevalence with significance sex difference, the prevalence being 42.5 per cent in males and 60.8 per cent in females[15]. Study carried out b Basu in Choknad and Chanduvarai Tea Estates of Munnar, Kerala have shown a prevalence of 32.2 per cent in

974 people examined. Females in the age group of 11-15 years had – prevalence of 39.06 per cent as compared to 12.5 per cent in boys, while in the age groups 16-20 females had prevalence rate of 82.99 per cent as compared to 39.93 per cent of males[19]. Dudani and Natu who examined 5829 people in Ghodegaon PHC of Pune district have reported on over all prevalence of 16.5 per cent. In females the prevalence rate was 24.1 per cent as compared to 6.8 per cent in males. Severity of goitre, as assessed by clinical examination in females in all age groups was consistently very high[18]. Trivedi et al. who surveyed 6550 people in villages along the bank of river Karjan and Narmada have reported the prevalence of 22.89 per cent. Age group 11-20 had the highest prevalence. While there was a significant increase of prevalence in the females (33.10 per cent) over males (17.17 per cent) in the age group 21 and above[30]. Dandare and Sathe examined (16.1) 2937 high school children in Sillod Taluka. Of them 1637 showed presence of goitre with 55.3 per cent prevalence rate. The maximum prevalence was noticed at 12 years of age. The prevalence in females was 69.8 per cent and in males 54 per cent. The higher prevalence in females was also significant in the age groups of 14-15 years and 16-17 ears.

Studies on the daily urinary iodine excretion under field conditions are not easy mainly because of the difficulties involved in the 24 hours urine specimens. Work done b Follis[37,38], Vought[39] and Jolin[40], have shown that iodine/creatinine ratios of casual urine samples ma be used in a valid way to obtain a fairly representative index of the daily urinary iodine excretion in school children under field conditions. The main objective in the collection of urinary iodide excretion data is to assess the iodine nutriture in a given area so that corrective measures ma be recommended if dietary intake is deemed insufficient. Follis[37] has set the figure of 50µg iodine per gram creatinine in casual urine samples as the lower limit of normals. As per the criterion laid by Stanbury, urinary iodide excretion of less than 50µg per gram creatinine, in a fair sample of population not only reinforces the clinical criteria of endemicity of goitre but also presents characteristic feature of endemic goitre due to iodine deficiency. Considering that urinary iodide excretion is the best criterion for assessing iodine intake, our findings based on the urinary iodide excretion pattern suggest that deficient iodine intake plays a major role in the pathogenesis of the endemic goitre in these school children. Sixty four per cent of children from Kalkaji School and 69 per cent of children from Chandani Chowk have values less than 50µg iodine per gram creatinine, in casual sample of urine.

The daily creatinine excretion in urine is a function of the muscular mass of an individual and in a given subject is remarkably constant from day to day. The muscular mass of average Indian boys and girls is considerably less than their Western counterparts. Hence the daily urinary excretion of creatinine would be less than one gram, the value that has been assumed in all the studies including this study. Applying the correction factor, for creatinine a larger number of students would have values of less than 50µg urinary iodide per gram creatinine.

Twenty four hour thyroid uptake studies were carried out in a representative group of 121 students. 68 per cent students from Kalkaji and 75 per cent students from Chandani Chowk area had uptake values greater than 35%; the upper limit of normal. The low ingestion of iodine is reflected in the increased avidity of the thyroid gland for

iodine. 24 hour thyroid uptakes greater than 35% of the administered dose of radio-iodine may be encountered either in hyperthyroidism or iodine deficiency cases. In our stud we did not come across a single case of hyperthyroidism. Hence the high uptake seen in these children is likely to be a reflection of deficient iodine intake. These findings further substantiate our observation on the urinary iodide values.

Studies by Ramalingaswami[41] and Stanbury[43] have shown that high I^{131} uptake in combination with low urinary iodide excretion per gram creatinine is a feature of endemic goitre due to deficient intake. The low urinary iodide excretion observed coupled with the high 24 hour thyroidal I^{131} uptake clearly points to an existing state of iodine deficiency in the majority of the present group of school children.

Classical studies b Ramalingaswami[41] and co-workers have estimated the I^{131} uptake values and iodine in urine in the two states of Indian goitre belt – Uttar Pradesh and Bihar. Here the prevalence rate of goitre in general population is as high as 90 per cent. The mean uptake of I^{131} in 24 hours was 68.7 per cent (70 subjects) in Uttar Pradesh and 67.1 per cent (43 subjects) in Bihar. While control values in Delhi were 42.4 per cent (15 subjects). In our present stud of school children the mean uptake of I^{131} in 24 hours was 43.4 per cent (121 subjects). The mean urinary excretion of iodide microgrammes per gram creatinine in Uttar Pradesh was 30.2 (46 subjects) while control subjects in Delhi had a value of 76.4 (10 subjects). In the school children of the present stud the mean value was 48.4 (525 subjects). It is important to note here that in the above study control subjects in Delhi were adults, while our values have been estimated in the school children an age group exposed to increased physiological iodine requirement. Comparison of these laboratory findings substantiate our clinical observation that prevalence and degree of goitre seen in school children of Delhi is less severe than the classical Himalayan endemic belt.

Kochupillai[42] et al have reported that simple goitre is the most frequent disorder seen in the Endocrine Clinic of the All India Institute of Medical Sciences. These patients come from Delhi and Neighbourhood areas which are far removed from the Himalayan endemic goitre. Females belonging to second and third decade constitute 75 per cent of the patients attending this clinic. Quantitative studies done on them have shown high thyroidal I^{131} clearance rate coupled with low PII and low urinary iodide excretion. These findings indicate that iodine deficiency is an important goitrogenic factor in these patients. These observations further substantiate our findings that iodine deficiency plays an important role in the endemic goitre seen in Delhi.

Thus, though Delhi was not included in the classical Himalayan endemic goitre belt described b Ramalingaswami et al[11], the present stud clearly points to the prevalence of endemic goitre in the Union Territory of Delhi and also bring out iodine deficiency as the important factor in its causation.

R E C O M M E D A T I O N S

Epidemiological study, by Sooch et al[44] carried out over 16 years, of the use of iodized salt for the control of endemic goitre in the valley of Himalayan foot hills have been successful for progressive decline and control in goitre prevalence. In the basis of this prospective stud, Government of India prepared a scheme for iodization of salt. We feel that iodisation of salt is the most desirable form of prophylaxis for endemic goitre. We, therefore, recommend that necessary steps be taken to institute the same in these two areas of Delhi – Kalkaji and Chandani Chowk. We suggest that more extensive studies be carried to establish the prevalence of goitre in other areas of Delhi.

8. SUMMARY AND CONCLUSIONS

A total of 3200 school children were surveyed for goitre prevalence in the two areas of Union Territory of Delhi namely Kalkaji and Chandani Chowk. The observed prevalence of goitre in 2214 school children of Kalkaji was 54 per cent while it was 55 per cent in Chandani Chowk school children. Goitre prevalence was significantly greater in girls, so also the severity of goitre among them.

Urinary iodide estimation carried among them in randomly collected casual samples was less than 50µg of iodine per gram creatinine in 64 per cent of Kalkaji children and 76 per cent of Chandani Chowk children. Thyroidal I^{131} uptake studies carried on a representative sample showed high uptake values in 68 per cent of Kalkaji children and 86 per cent in Chandani Chowk children.

These data clearly indicate that endemic goitre is prevalent in these two areas of Union Territory of Delhi, as per the criteria laid down b Stanbury. The low urinary iodine excretion and high I^{131} uptake on a majority of them point to iodine deficiency as an important causative factor in the genesis of this endemic goitre.

Thus, iodine deficiency goitre seems to be prevalent in endemic proportion in the two areas of Union Territory of Delhi, even though this area was not included in the classical Himalayan endemic goitre belt described by Ramalingaswami.

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