WORLD SCIENCE RESEARCH JOURNALS

World Journal of Medicine and medical Science Research Vol. 4 (01), pp. 032-038, December 2016
Available online at http://wsrjournals.org/journal/wjmmsr
ISSN 2331-1851 ©2016 World Science Research Journals

Full Length Research

BIOCHEMICAL PATTERN OF THYROID DISORDERS IN MAIDUGURI, NORTHEASTERN NIGERIA

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Accepted 23 November, 2016

No previous study documented biochemical pattern of thyroid disorders in Maiduguri, north-eastern Nigeria. Therefore, the changing pattern which usually occurs after introduction of iodine supplementation cannot be observed. The study is therefore intended to create awareness of presence of thyroid disorders, document the first biochemical pattern of thyroid disorders forming a turning focal point for observations during iodine supplementation in this region. Thyroid function tests results analyzed within 5 years (January 2009 to December 2013) in Chemical Pathology Department, UMTH, and Maiduguri were reviewed. This included 871 results; each was interpreted individually using standard method. Results were then grouped according to the types (pattern) of thyroid dysfunctions. Age, gender and indication for each result were also sorted. Percentages of each category were determined. Results shows improper filling of request forms. Out of the 871 results only 2% request for Paediatric age group, 79% for adults while age was not known in 19%. Gender was not indicated for 5.3% of requests. Where gender was indicated it showed male: female ratio of 1:5.1. Although indications for 78.2% of request are for thyroid-related disorders (63.4% Goitre-related indications), only 32.8% results showed biochemical evidence of thyroid disorders and Hyperthyroidism/thyrotoxicosis is commoner (81.1%) among results with biochemical evidence of thyroid disorders compared to hypothyroidism (18.9%), forming 26.6 and 26.2% among all results analyzed, respectively. Primary disorders are commoner among both categories. Majority of results with biochemical evidence of thyroid dysfunctions belonged to patients with age between 20 and 50 years, the most productive age group. Thyroid disorder is common, predominantly in adults with female preponderance. Goitre-related indications are common yet results showing thyroid disorder is only 32.8% which may signify presence of iodine deficiency in this region. Hyperthyroidism/thyrotoxicosis is more compared to hypothyroidism and primary disorders predominate in each category.

Key words: Thyroid disorders, biochemical pattern, Maiduguri, Nigeria.

INTRODUCTION

Thyroid disorders are common worldwide (Vanderpump and Tunbridge 1996). However, it was once thought to be rare in Africans in the early 1960s (Famuyiwa 1987). Gross under-reporting might have been accounted for this scenario. Subsequently, the 1970s witnessed an upsurge in reported cases of thyroid disorders in Africans and dietary iodine deficiency was noted to be the major determinant of thyroid pathology (Hetzel 1983). Today thyroid dysfunctions are among the most common endocrine disorders second only to diabetes mellitus worldwide, including Africa. However, the situation of under- reporting of thyroid disorders has not changed significantly in Nigeria and in North eastern region in particular.

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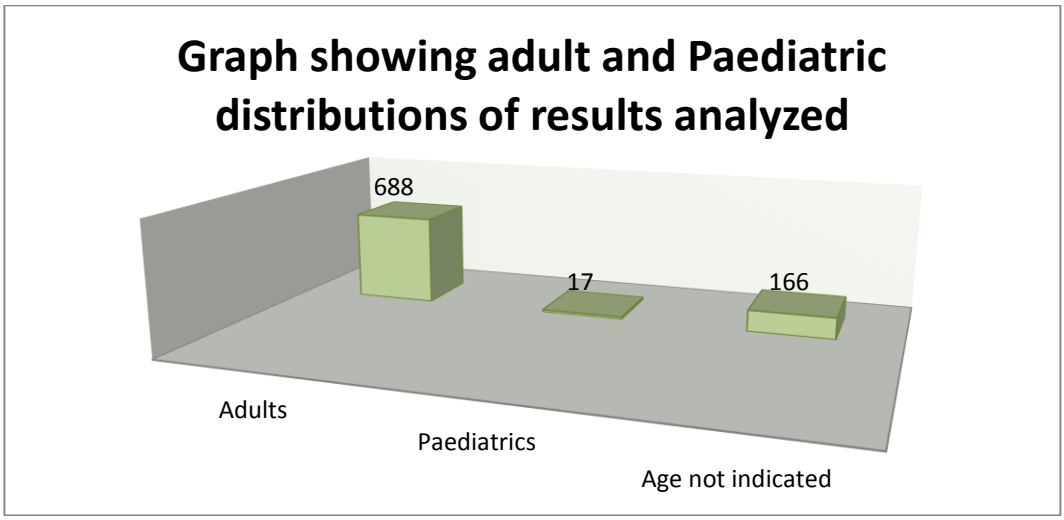

Figure 1: Distribution of results among Paediatric and adult age groups

Thyroid dysfunction is demonstrated not only to vary considerably from area to area but also changes even in the same area with iodine supplementation (Vanderpump 2009). Nigeria introduced iodine supplementation through salt iodization since 1995 to date. Yet no validation of the impact through improved levels of urinary iodine is available in this region. More so, there is a paucity of data in this part of Nigeria on thyroid disorder in general and biochemical pattern of thyroid dysfunction in particular before introduction of iodized salt and even now as a follow up since the pattern changes with availability of iodine. These are consequences of gross-under reporting.

The result of this study may be the first establishing biochemical pattern of thyroid dysfunction in this environment. This will allow comparison with other regions in Nigeria and may also be a starting point for future observations for changing pattern of thyroid dysfunctions during iodine supplementation period in the country. The result will also be relevant to the strategies for extending gains in iodine supplementation because the current civil conflict and fragile political structure going on in this region may jeopardise its efficiency. This study will also create awareness among health workers and patients alike that thyroid disorders are common in this environment.

This study therefore investigated biochemical pattern of thyroid disorders in this region of Nigeria using the outcome of requests for thyroid function tests in University of Maiduguri Teaching Hospital (UMTH), Maiduguri, North eastern Nigeria, and involving 871 tests results.

MATERIALS AND METHODS

The study covered a period of five (5) years (January 2009 to December 2013) involving samples from primary patients of UMTH and those from other Government and private hospitals in Maiduguri and her environments, brought to Chemical Pathology Laboratory, UMTH. Samples are usually spun at 3000 g/min for 5 min and serum collected and stored at -20 ^{o}C until analysis which is usually done fortnightly. Analyses of hormones (TSH, total T_4 and total T_3) were estimated using enzyme linked Immunosorbant Assay (ELISA), (Perfemed Group Inc. Website: www.perfemed.com. Building #E6, Beijing Yizhuang, Biomedical Park, No 88, Kiechuang Sixth Street, Yizhuang Beijing, 101111 China), a method with good sensitivity. In our Laboratory the limit of detection for TSH is 0.075 mIU/ml, 0.04 ng/ml for T_3, and 0.5 ug/dl for T_4, defined as 2STD in the measurement of zero doses.

The indication for each request, the gender, and age of each patient was determined and individual result was interpreted using standard method (Dayan 2001) to establish the biochemical pattern of thyroid disorder.

RESULTS

Figure 1 showed that the total number of results analyzed for the study was 871, out of this 17(2.0 %) were for patients in the paediatric age range and 688(79.0 %) were for adults, the age of 166(19.0 %) results was not indicated. There is adult preponderance out of the 871 results, 136(15.6 %) were for male patients while 689(79.1 %) were for female showing a male: female ratio 1:5.1 as indicated in Figure 2, and the gender for 46(5.3 %) results was not indicated.

Among the 871 results analyzed, the indications for 681(78.2 %) showed thyroid-related disorders, as noted in Figure 3, 163(18.7 %) for non-thyroid-related disorders (Figure 4), while there was no indications for 27(3.1 %) results. Although the indications may only

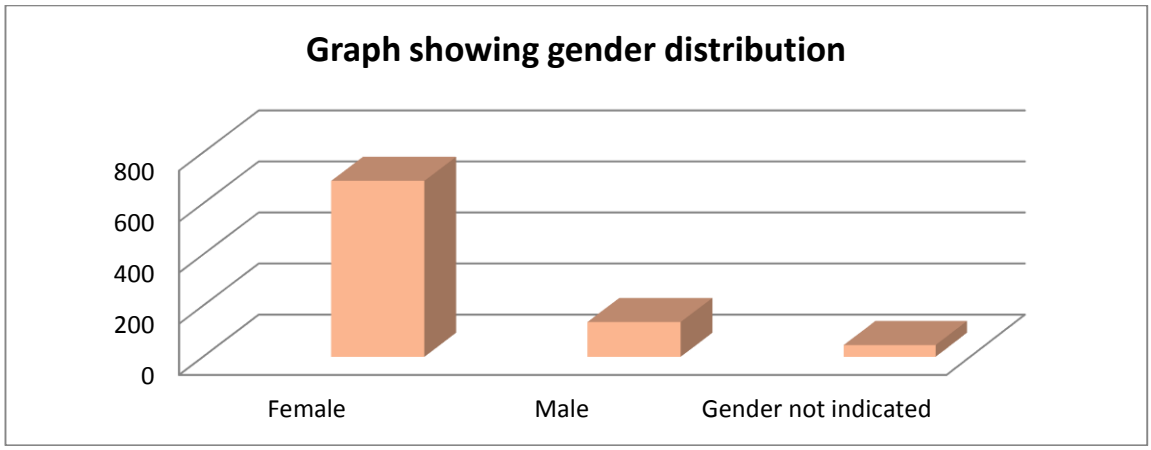

Figure 2: Distribution of results by gender

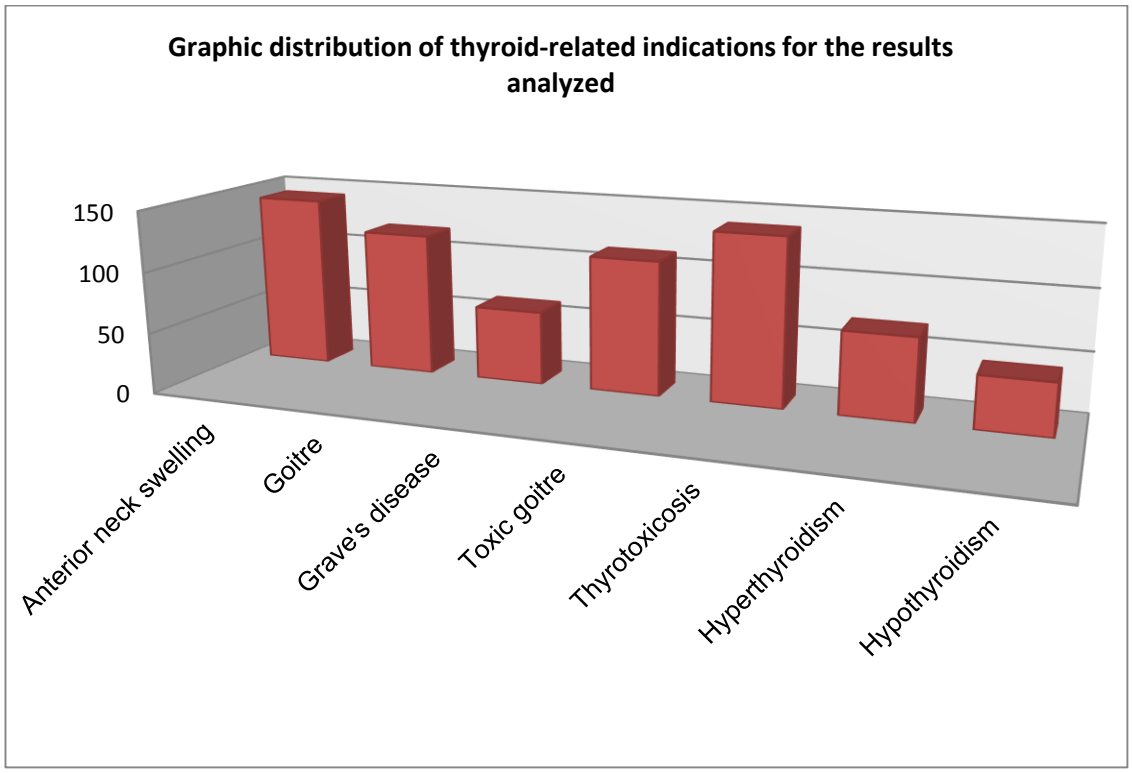

Figure 3: Distribution of thyroid-related indications

show the point perception of the requesting doctor and not a true reflection of the patient's problem, goitre-related indications forms the bulk (63.4 %) among thyroid-related requests for the tests Study demonstrated that thyroid function test is not only requested in patients with obvious thyroid disorders but also in other disorders as shown in Figure 4.

Out of the 871 results analyzed 286(32.8 %) showed biochemical evidence of thyroid disorders while 585(67.2 %) did not show (Euthyroidism). Of the results whose requests for the analysis were for thyroid-related disorders, indications for 432(63.4 %)showed presence of obvious goitre-related disorders, forming 49.6 % of the total results analyzed for the study, an evidence of high prevalence of goitre among patients seeking medical help where thyroid function tests was requested. The results with biochemical evidence of thyroid disorders showed Hyperthyroidism/thyrotoxicosis is comonn with 81.1 % compared to hypothyroidism which is 18.9 %. However,

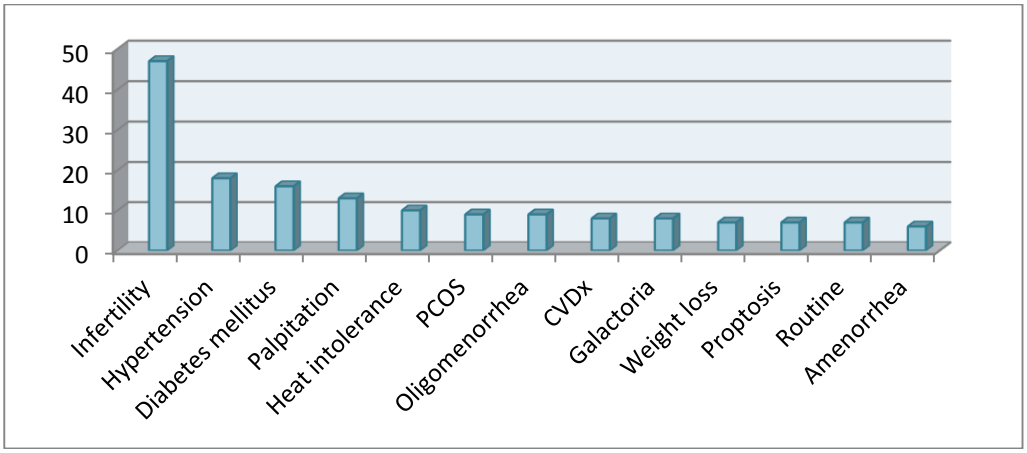

Figure 4: Indications for thyroid function tests in disorders other than thyroid

Table 1: Gender distributions among major thyroid dysfunctions

Result indicating biochemical thyroid disorder was 286(31.4% of total number of results analyzed)	
Hyperthyroidism/thyrotoxicosis , 232(81.1%) **Males=39** **Females=184** **No gender indicated=9** **M:F ratio=1:4.7**	Hypothyroidism, 54(18.9%) Males=7 Females=47 No gender indicated=0 M:F ratio=1:6.7

Table 2: Results showing biochemical evidence of types of thyroid disorders

Euthyroidism	**Hyperthyroidism/thyrotoxicosis**					**Hypothyroidism**			
	Primary	secondary	Sub pri	Sub sec	T_3 toxicosis	Pri	Sec	Sub Pri	Sub Sec
585 (67.2%)	192 (22.0%)	2 (0.2%)	29 (3.3%)	1 (0.1%)	8 (0.9%)	29 (3.3%)	8 (0.9%)	12 (1.4%)	5 (0.6%)

this was 26.6 and 6.2 %, respectively among all results analyzed. Distributions also showed female prepondrance in both hyperthyrodism/thyrotoxicosis and hypothyroidism with male:female ratios 1:4.7 and 1:6.7, respectively (see Table 1).

Although in this study, indications for thyroid function tests in patients with goitre-related disorders forms the bulk (63 %) of the requests, results showing biochemical evidence of hypothyroidism are less frequent compared to those with evidence of hyperthyroidism/thyrotoxicosis. This may reflect the pattern patients seek medical attention and not necessarily the pattern of thyroid dysfunctions in this environment. Primary thyroid disorders in both hyperfunctioning and hypofunctioning, constituted the largest among results with biochemical evidence of thyroid disorder, this is followed by subclinical disorders. T_3-toxicosis constituted about 0.9 % of all results analyzed, 2.8 % of results with evidence of biochemical thyroid disorders and 3.4 % of cases with hyperfunctioning results (see Table 2). Majority of patients presented with thyroid disorders in this environment were between 20 and 50 years, which is the most productive age group, however the age range

Table 3: Distribution of results with biochemical evidence of thyroid disorders among age ranges

Age range(yrs)	Hyperthyroidism /thyrotoxicosis	Hypothyroidism
<10	2	0
10-19	8	2
20-29	48	8
30-39	54	15
40-49	39	7
50-59	8	1
60-69	6	0
>70	2	2
No age indicated	65	19
Total	**232**	**54**

of all results was 3 years to 90 years, covering a wide range of ages (see Table 3).

DISCUSSION

Improper completion of request forms is noted in this study where no age was indicated for 166(19 %) requests, no gender was indicted for 46(5.3 %) of requests, and no indication for the request for 27(3.1 %) of results. Although auditing is not the primary intension of this study, it is a good medium to remind the audience that for accurate interpretation of thyroid function tests some major factors must be taken into considerations. These will enable a better result interpretation to suit the following purposes (a) to make a diagnosis, (b) exclude thyroid disorders as differentials, (c) monitor therapy, and (d) detect recurrence. Efficient management of patients requires accurate results from investigations. Therefore, in order for the laboratory to correctly interpret TFT results and provide accurate reports, relevant clinical history on the request forms is essential. The following points serve as a guide as to what should be included with TFT requests: Current diagnosis (in particular, indicate if patient is ill); purpose for which TFT was requested; previous TFT findings and when, and current or recent drug therapy (in particular, anti-epileptics, NSAIDS, aspirin, amiodarone and lithium). Other information required include any known thyroid abnormalities or pathologies; Antithyroid drug therapy (including when commenced or dose altered); Thyroxine therapy (including when commenced or dose altered); any other forms of treatment related to the thyroid dysfunction, and other endocrinological pathologies. Similarly it is important to note that every word(s) or phrase on the request form is for a purpose hence proper completion of the form is paramount.

The result of this study may not necessarily reflect current status of thyroid dysfunctions in the region but a representative only in those seeking (solution to their illness) medical advice. In the study it was found to be less common in paediatric age group (2.4 % of total results whose age was indicated) as indicated in Figure 1, common in females (79.1 %) compared to males (15.6%) with male: femaleratio1:5.1(Figure 2). This pattern concurs with studies in Lagos (Ogbera et al., 2007) and Shagamu (Amballi et al., 2002) in South-western Nigeria and in Denmark (Knudsen et al., 1999). A hospital based tissue (histological) in corroboration with biochemical study is recommended to determine the actual pattern of thyroid disorders in this environment.

Although the indications only showed the point perception of the requesting doctor and not a true reflection of the patient's clinical condition, goitre-related indications forms the bulk (63 %) of result reviewed among thyroid-related requests for the tests and forms 49.6 % all the results analyzed as indicated in Figure 3. The prevalence of hypothyroidism in the study is 6.2 % among all results analysed (Table 2), yet 67.2% of the results showed no biochemical evidence of thyroid disorders (Euthyroidism), signifying high prevalence of goitre among patients seeking medical help and thyroid function test were requested. It is important to note that enlargement of the thyroid gland is the best known sign of iodine deficiency and many patients in this study and those with goitre-related indications, in particular, might have euthyroid goitre (simple goitre) which is mainly a result of iodine deficiency.

The introduction of formal iodine deficiency prevention programmes in the 1990s (1995 in Nigeria) marked a turning point in the drive towards sustainable iodine sufficiency in Africa and between 1990 to 2007, global population coverage with iodised salt increased from about 20 to 70%, (World Health Organisation 2007). Despite these gains the International Council for

the Control of Iodine Deficiency Disorders (ICCIDD) estimated that nearly 2 billion individuals in 2011 continue to have insufficient iodine intake worldwide and iodine deficiency remains a public health problem in 32 countries including Nigeria (Andersen et al., 2012). Similarly, by WHO estimates in 2004, at least 350 million Africans are at risk of iodine deficiency (World Health Organization 2004), goitres are present in 28.3 % of the African population, and approximately 25 % of the global burden of iodine deficiency as measured by disability adjusted life years (DALYs) occurs in Africa (World Health Organization 2002). The demands of communicable disease, coupled with the challenges of poverty, civil conflicts and fragile political structure currently occurring in the region of study can frustrate efforts at eliminating iodine deficiency (Ekpechi 1987). The study therefore recommends determination of goitre prevalence as well as iodine status in this environment. This will be relevant to facilitate plan strategies for intervention and sustaining the past gains.

The Participatory Information Collection Study (1993), using thyroid hormone concentrations as indicators of iodine status reported an iodine deficiency prevalence of 41 to 65.6% in the regions of Nigeria and Universal salt iodization programme was introduced in 1995. However, several parts of Nigeria have been before now identified with goitre endemicity, including the region of present study, and hence labelled the goitre belt (Isichie et al., 1987, Nwokol and Ekpechi 1966, Olurin 1975, Ubom 1991). Hence the need to again reassess iodine status of the inhabitants in the area of study.

Thyroid function test was not requested only in patients with thyroid-related disorders but also in other disorders with evidence of thyroid hormone involvement such as infertility and related disorders (Krassas et al., 2010, Singh et al., 2011, Birador et al., 2012, and Emokpae 2011), diabetes mellitus (Paul et al., 2004), and dyslipidaemia (Bianco 2008).

This result showed that about 32.8 % proportion of the requests revealed thyroid dysfunction which concurs with a similar study in the Western Nigeria (34.0 %) (Amballi et al., 2002). Thyroid dysfunctions occurs more in females compared to males and that the age group 20-49 years are those most affect. Findings in a similar study carried out in Shagamu (Amballi et al., 2002), Nigeria, showed that the age group 36 to 45 years are mainly affected. Thyroid disorders therefore tend to affect the most productive segment of the population in this region with a large negative impact on the economy of the area. Hyperthyroidism/thyrotoxicosis is common (81.1 %) compared to hypothyroidism (18.9 %) among results with biochemical evidence of thyroid disorders. However, their respective prevalence is 26.6 and 6.2% among all results analyzed for the study and showed female preponderances in both cases. The result concurs with a similar study carried out by Amballi, et al., 2002, who found a prevalence of 25.5 and 8.4 % for hyperthyroidism and hypothyroidism, respectively.

The major disorders in this environment is due to primary hyperthyroidism, 22.0 % of all results analyzed but about 67.1 % of results with thyroid disorders while primary hypothyroidism constituted 3.3 % of all results analyzed and 10.1 % of results with biochemical evidence of thyroid dysfunctions. The major cause of primary hyperthyroidism is Graves' disease. Graves' disease was believed to be rare in Africa based on the early experience of physicians in the region (Gelfand 1962). However, it is now more frequently reported across the continent. In South Africa, a 60 % rise in its incidence was observed over an 11-year period (Kalk and Kalk 1989). This was most apparent in iodine sufficient urban dwellers, a significant proportion of who were recent migrants from iodine deficient areas. Graves' disease is the commonest cause of hyperthyroidism in iodine-replete parts of the world, and Egbuta et al., 2002, in their study concluded that their findings would suggest that Nigeria, in general terms, has achieved the goal of universal salt iodisation and should now focus its attention on constant monitoring in order to sustain this iodisation level. Could findings in this study of common occurrence of hyperthyroidism/thyrotoxicosis reflects the conclusions of Egbuta et al., 2002, though no previous report on biochemical pattern of thyroid disorders in this environment. It may also indicate that previously nodular or multinodular euthyroid goitres which are common in iodine deficient areas become autonomous during the iodised salt supplementation causing the hyperthyroidism/thyrotoxicosis. Pedersen et al., 2006, also in Denmark noted an increased incidence of hyperthyroidism after the environment became iodine-sufficient and were seen in young adults (20-39).

Similarly, in this study results with biochemical evidence of thyroid dysfunction involved mainly patients between 20 and 50 years old. A histological characterisation of thyroid disorders in this environment is recommended to observe whether it is more of autoimmune type which manifests in iodine-replete environment

Conclusion

Although the result of the study concurs with studies carried out in other parts of Nigeria, no previous report in this region to compare if there is any changing pattern following iodised salt supplementation. High prevalence of goitre among patient seeking medical advice and thyroid function tests was requested yet only 32.8 % showed thyroid dysfunction. This may signify still presence of iodine deficiency in this region.

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