Review Article

Epidemiology of thyroid diseases in Africa

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ABSTRACT

Background: Thyroid disorders are common endocrine disorders encountered in the African continent. Environmental and nutritional factors are often implicated in the occurrence of some thyroid disorders that occur in this part of the world. This is a narrative review that seeks to document the pattern, prevalence, and management of thyroid disorders in the continent. **Materials and Methods:** The search engine used for this review were PubMed and Google scholar. All available articles on thyroid disorders from the sub-African continent, published until May 2011, were included. **Results:** Iodine deficiency disorders (IDD) which top the list of thyroid disorders and remain the commonest cause of thyroid disorders in the continent is often affected not only by the iodine status in the region but sometimes also by selenium deficiency and thiocyanate toxicity. The reported prevalence rates of endemic goiter range from 1% to 90% depending on the area of study with myxedematous cretinism still a prominent feature of IDD in only a few regions of the continent. The extent of autoimmune thyroid disorders remains unknown because of underdiagnosis and underreporting but the few available studies note a prevalence rate of 1.2% to 9.9% of which Graves diseases is the commonest of these groups of disorders. Rarer causes of thyroid dysfunction such as thyroid tuberculosis and amiodarone related causes are also documented in this review. The onset of new thyroid diseases following amiodarone usage was documented in 27.6% of persons treated for arrhythmia. Reports on thyroid malignancies (CA) in Africa abound and differentiated thyroid malignancies are noted to occur more commonly than the other forms of thyroid CA. The documented prevalence rates of thyroid CA in the African continent are as follows (papillary: 6.7–72.1%, follicular: 4.9–68%, anaplastic: 5–21.4%, and medullary: 2.6%–13.8%). For the differentiated thyroid CA, there is a changing trend toward the more frequent occurrence of papillary CA compared to follicular CA and this may be attributable to widespread iodization programs. Our review shows that diagnosis and evaluation of thyroid disorders are reliant in most regions of the continent on clinical acumen and suboptimal diagnostic facilities and expertise are what obtain in many practices. The frequently employed management options of thyroid disorders in the continent are pharmacological and surgical treatment modalities. **Conclusion:** Diagnosis and management of thyroid disorders in the African continent remain suboptimal. Thyroid registries may be helpful to determine the scope of the burden of thyroid disorders since this knowledge may help change policies on the approach to the management of these disorders.

Key words: Africa, epidemiology, thyroid

Introduction

Thyroid diseases refer to benign or malignant disorders that affect the structure and function of the thyroid gland.

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The scope of thyroid diseases that are frequently noted in Africa include hypothyroidism, thyrotoxicosis (which could be from hyperthyroidism or nonthyroid causes), thyroid malignancies, and iodine deficiency disorders.

Materials and Methods

The search engines used included Googles scholar and Pubmed. The MeSH terms used included "Africa" thyroid, goiter, iodine deficiency disorders, hyperthyroidism, hypothyroidism, autoimmune thyroid disorders, and thyroid cancer.

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Results and Discussion

Iodine deficiency disorders

Iodine deficiency is a major public health problem throughout Africa and is the commonest cause of thyroid disorders in this continent.[1] Iodine deficiency is defined as a median urinary iodine concentration less than 50 μg/L in a population.[2] Internationally, 2.2 billion people worldwide are at risk for iodine deficiency disorder. Of these persons, 30–70% have goiter and 1–10% have cretinism.[3] The UNICEF estimates state that 8% of newborns from sub-Saharan Africa are unprotected from learning disabilities resulting from iodine deficiency related disorders.[3] In children and adolescents, the range of iodine deficiency disorders include goiter, sublinical hypothyroidism, impaired mental function, retarded physical development, and increased susceptibility of the thyroid gland to nuclear radiation. In adults, IDD include goiter with its complications, hypothyroidism, impaired mental function, spontaneous hyperthyroidism in the elderly, iodine-induced hyperthyroidism, and increased susceptibility of the thyroid gland to nuclear radiation

Endemic goiter, characterized by enlargement of the thyroid gland in a significantly large fraction of a population group (in a population when >5% of 6–12-year-old children have enlarged thyroid glands) is a notable feature of iodine deficiency. It is pertinent to note that although there is a demonstrable association between iodine deficiency and endemic goiter, goitrogens (substances that suppress the function of the thyroid gland by interfering with iodine uptake) may also play a role in the development of endemic goiter. In Africa, goitrogens of note include thiocyanates that are often found in poorly detoxified cassava, a staple food that is commonly eaten as a source of carbohydrate. Selenium deficiency has also been reported to be a contributory factor in the occurrence of endemic goiter in Africa or persistence of endemic goiter in iodine deficient areas even after correcting for iodine deficiency.[4-5] In a Cameroun report,[6] the prevalence of thiocyanate overload and iodine deficiency was 20% and 21%, respectively . Endemic goiters are seen in both mountainous (New Guinea) and nonmountainous regions of Africa (Cameroun, Northern Zaire, Central Africa Republic, Uganda, and Rwanda).[3] The prevalence rates of endemic goiters in Africa range from 1% to 90% and the distribution is shown in Table 1.

Other manifestations of iodine deficiency that include endemic cretinism and development of hyperthyroidism in multinodular goiter are not as widely studied as the endemic goiters in the African continent. Endemic cretinism occurs in areas of severe iodine deficiency and is manifested by two major clinical patterns- the myxedematous form which is the commonly occurring form of cretinism in Africa and the neurological form.[19] The prevalence rates of endemic cretinism range from 1.2% to 6% with Central Africa recording the highest rate.[18,20,21] It is interesting to note that there are hardly reports on endemic cretinism in the twenty-first century Africa and this may be largely due to widespread iodization programs in the continent. Although there is no objective evidence to conclude that endemic cretinism has been totally eradicated in the continent, it is safe to postulate that this IDD may not be as prevalent as it use to be in this part of the world.

Table 1: The prevalence of endemic goiter in some African countries

Country	Year	*N	Endemic goiter (%)	Age	Reference
Cameroun	2002–2003	120	21	3–19	6
Tanzania	1982	560	25–90	6–19	7
Tanzania	2004	140,758	6.9	6–12	8
Uganda	1999	2,880	60.2	6–12	9
Ethiopia	2005	10,965	39.9	6–12	10
Egypt		99	25		11
Lesotho			4.9	8–12	12
Ivory Coast			29	5–14	13
Burkina Faso		210	5.2	≤45	14
Nigeria		3 476	1–23		15
Sudan	2006	6 083	38.8	6–12	16
South A		300	74.2		17
Zaire			65–85		18

*Number of people studied

Autoimmune diseases of the thyroid gland

Autoimmune thyroid disease (AITD) is the most common organ-specific autoimmune disorder resulting in dysfunction (hyperfunction, hypofunction or both) of the thyroid gland. The classification of AITD is as follows: Graves disease which is expressed as thyroid hypertrophy and hyperthyroidism, atrophic thyroiditis, or primary hypothyroidism expressed as thyroid atrophy and hypothyroidism, painless thyroiditis (postpartum or spontaneous), expressed as small goiter, thyrotoxicosis and or hypothyroidism and Chronic autoimmune thyroiditis or Hashimotos expressed as goiter due to lymphocytic infiltration and or hypothyroidism.

Of the autoimmune diseases of the thyroid, Graves disease is the predominantly documented in Africa.[22] The overall incidence of AITD in Tunisia is 9.9% and this was noted to have occurred in conjunction with 6.3% of other autoimmune disease.[23] In Ethiopia, the prevalence of autoimmune thyroid disease is reported to be 1.2%[24] and reports from Libya indicate a prevalence rate of disease

3.7%.[25] Thyrotoxicosis is the predominant presenting features of Graves disease and in this region, the presenting features of thyrotoxicosis are sometimes dramatic and characterized by the complications of the disease condition. This scenario may be explained by late presentation, financial constraints and missed diagnoses from ignorance on the part of general practitioners who these patients usually present to initially. In a South African report, atypical features and complications of thyrotoxicosis such as cardiac complications myopathy and infiltrative eye diseases were noted more in black South Africans than the whites.[26] It is instructive to note that thyrotoxicosis is a notable cause of cardiac morbidity in this part of the world. In a report from Togo, cardiac complications were documented in 46.6% of patients with thyrotoxicosis.[27] Ogbera *et al.*,[28] had noted the occurrence of heart failure in 42% of subjects with thyrotoxicosis in Lagos Nigeria and in a Congolese report a smaller frequency rate of 12.6% was documented for thyrotoxic heart disease.[29]

The prevalence rates of thyrotoxicosis and Graves disease of some African countries are shown in Table 2.

Other autoimmune diseases of the thyroid gland are largely underdiagnosed and underreported. Chabchoub *et al.*,[24] report the prevalence rates of atrophic thyroiditis and Hashimotos disease to be 32.2% and 22.8%, respectively.

The scope of antibody profiles in cases of suspected AITD in Africa is not known given the availability of only few studies on this entity from the continent. Most countries in Africa can be described as "resource poor" and the focus of management of AITD is treating clinical manifestations, and not carrying out in-depth investigations.

Although thyroid peroxidase antibodies (TPOAb) and/or thyroglobulin (TgAb) are frequently present in the sera of patients with AITD, some patients occasionally have negative thyroid autoantibody test results. Thyroid receptors antibodies (TRAb) are present in most patients with a history of or who currently have Graves' disease.

Table 2: Prevalence of thyrotoxicosis and Graves disease in some African countries

Country	TD (n)	Toxicosis (%)	Graves disease (%)	Reference
Tunisia	1079		45	24
Ethiopia	373	43.7	41.1	22
Kenya	222	13	47	30
Togo	82	36	83.3	27
South Africa	688	66	34	31
Nigeria	170	75		7
Brazaville	567	20.8	60.8	32

TD: Thyroid diseases

The clinical significance of these antibodies in the African context is grossly understudied and their usefulness may lie in their being highly suggestive of autoimmune diseases.[33] Some of the results on studies on thyroid antibodies in some African countries are shown in Table 3.

The studies on thyroid antibody profile show TPO antibody to be the commonly detected antibody in autoimmune thyroid diseases. Our findings also show the high specificity of TSH receptor antibodies in the detection of Graves disease. Further evaluation on antibody profiling in Africans with thyroid diseases is required.

Other causes of thyroid dysfunction

Drug induced thyroid dysfunction: amiodarone is a potent antiarryhtmic agent that is associated with new onset thyroid dysfunction. A South Africa study[41] recorded a high incidence of new onset thyroid dysfunction (TD) in a subset of 163 patients after a median duration of 369 days of treatment with amiodarone for cardiac arrhythmias. The percentage of the patients that developed new onset TD was 27.6% of which subclinical hypothyroidism and subclinical hyperthyroidism were the commonly documented TD.

Tuberculosis

Thyroid dysfunction have been described in association with tuberculosis in the African context. In a study of 50 patients with active tuberculosis, 90% were found to have the sick euthyroid syndrome.[42] A Somali case report documented the occurrence of thyroid tuberculosis in a young man who was euthyroid but presenting with a thyroid mass.[43]

Iatrogenic causes

In a Cotonou series on hypothyroidism, thyroidectomy

Table 3: Prevalence of antibodies in thyroid disease in some African countries

Country	Disease	TPOAb %	TgAb %	TRAb %	Reference
Kenya	Primary thyroid disorder	51.4	36.1		34
	Thyrotoxicosis	50.8	33		
	Hypothyroidism	53.3	46.7		
Nigeria	Graves disease	76.8	11.6		35
	Simple non toxic goiter	14.29	9.25		
	Toxic nodular goiter	12.5	25		
Zimbabwe	Thyrotoxicosis	39	39		36
South Africa	Graves disease	37.4	4.2	95	37
Tunisia	Hypothyroidism	78.6	42		38
Cameroun	Thyrotoxicosis	44			39
South Africa	Graves	54	17	83	40

TPOAb: Although thyroid peroxidase antibodies, TgAb: Thyroglobulin, TRAb: Thyroid receptors antibodies

was reported to be the leading cause of hypothyroidism and this was noted in 70% of the cases.[44] This finding is in contradistinction from a Senegalese report that documented thyroidectomies as accounting for 30% of cases of hypothyroidism.[45] It is pertinent to note here that there were marked differences in the manifestations of hypothyroidism in these series. The Cotonou report had weight gain and paraesthesia as commonly presenting features of hypothyroidism but the Senegal report had constipation and bradycardia as the commonly presenting features of hypothyroidism.

Hypothyroidism has been reported following the use of radioactive iodine in the treatment of thyroid disorders. In an earlier review by the author on the use of RAI in the treatment of thyroid disorders with emphasis on the African continent, hypothyroidism was noted to be the commonly documented and almost inevitable complication of this treatment modality.[46] A Nigerian report noted the incidence of hypothyroidism one year following therapeutic administration of RAI to be 50%.[47] In a South African report of hyperthyroidism relapse following thyroidectomy, the incidence of hypothyroidism one year following RAI administration was observed to be 23%.[48]

Thyroid cancer, though a relatively rare form of malignancy worldwide, is noted to be the commonest occurring endocrine malignancy.[49] The majority (90%) of thyroid cancers (TC) occurring worldwide are differentiated TC and these include follicular and papillary cancers.[50] The differentiated cancers arise from the follicular cells of the thyroid gland and follicular cancer represents an increased portion of thyroid cancers in regions where dietary intake of iodine is low.[51] In a review of trends of differentiated CA from some West Africa tertiary centers, the results indicated that in the 1980s, there was a predominance of follicular CA over papillary CA (35.8% *vs* 27.3%).[52] However, in the same report from the 1990 to 2004, there was a documented predominance of papillary CA over the follicular type (35.7% *vs* 24.8%). This scenario may be reflective of the changing iodine status of the continent as a result of widespread iodization programs. Thyroid cancers are fairly well studied in the African continent and results of review of biopsy specimens indicate that follicular cancers are sometimes the commonly encountered thyroid neoplasms in some geographical locations. This distribution of follicular CA may be largely dependent on the iodine status of the area of study. Anaplastic thyroid cancers (ATC) are a histologically heterogeneous group of extremely aggressive undifferentiated tumors arising from the follicular epithelium which accounts for 2–5% of all thyroid cancers.[53] ATC cells do not retain any of the biological features of the original follicular cells such as uptake of iodine and synthesis of thyroglobulin.[53] The prevalence of anaplastic thyroid neoplasms as shown on Table 4 ranges from 4% to 21.4%. It is instructive to note that high prevalence rates of anaplastic cancers occurred in same regions with high prevalence rates of follicular cancers. Medullary carcinoma of the thyroid (MTC), a distinct thyroid carcinoma originating in the parafollicular C cells of the thyroid gland was the least documented malignancy.

The distribution of thyroid CA from some African countries based on biopsy results are shown in Table 4.

Management and outcome of thyroid diseases

Robust diagnostic facilities for thyroid disorders are lacking in most countries in Africa and the commonly employed diagnostic techniques include immunoassays, serology, ultrasonography cytology, and histopathological techniques for the evaluation of thyroid nodules.

Computed tomographic scans and magnetic resonance imaging facilities are also not widely available but when available are often inaccessible for most patients because of the system of health care provision which is often that of "out of pocket" payment.

Fine needle aspiration cytology (FNAC) is commonly employed in the evaluation of thyroid nodules in the African continent and in the Nigerian context, usually

Table 4: Thyroid cancer in some African countries

Country	Number	Papillary %	Medullary %	Anaplastic %	Follicular %	Reference
Nigeria	444	34.5	13.8		48.3	54
Ethiopia	114	72				55
South Africa	71	42.3	4.2	7	40.9	56
Nigeria	137	45.3	5		44.5	57
Sudan	112	22.3		21.4	42	58
Zimbabwe		70		14	14	59
South Africa	100	16	2.6	13	68	60
Libya	60	46.6	3.3	5	45	25
Kenya	222	6.7			4.9	30

patients presenting with nontoxic goiters are made to undergo FNAC. A Tunisian report[61] noted that the interpretability rate of FNAC in the evaluation of thyroid nodules was 7.52%, sensitivity as compared with that of histopathology was 70% and a specificity of 97.43%. In a Nigerian series, the diagnostic accuracy of FNAC for malignancy was reported to be 80.6% with a sensitivity and specificity 83% and 80%, respectively.[62]

On review of the literature, many of the available reports on the use of nuclear medicine in diagnosis of thyroid disorders were from the South Africa region. The indication for nuclear scans in the South African report was in the evaluation of thyroid nodules and TC99m MIBI scintigraphy was found in association with FNAC to be useful in the preoperative evaluation of thyroid carcinoma.[63] In another South African report on the evaluation of thyroid nodules, the specificity of MIBI, pertechnetate, and FNAC is 77%, 40%, and 90%, respectively.[64] An Ethiopian report noted that the primary role of scintigraphy was in the investigation of the solitary nodule, ectopic thyroid tissue and the retrosternal goiter.[65] Radioactive iodine--a major tool in the diagnosis and management of benign and malignant thyroid disorders is underutilized in the African. Radioactive uptake test/scan were employed in a Liberian report to facilitate the diagnosis and management of hyperthyroidism.[66]

RAI was first used in Nigeria in 1991 and the indications were diverse including as a first-line treatment for Graves' disease, thyrotoxic heart disease, recurrent thyrotoxicosis, and failed antithyroid drug therapy[67] and at present as part of the management modalities of thyroid CA usually following thyroidectomy. The documented rate of RAI usage in Nigeria in the treatment of thyroid disorders is 7% and doses are often administered empirically.[68] This diagnostic modality is not usually offered for diagnostic purposes in the Nigerian context.

The treatment modalities that are commonly employed in the management of thyrotoxicosis are pharmacotherapy (thionamides) and surgery. In a follow up of patients treated with thionamides in Nigeria, the remission rate was noted to be 61% and this was associated with small-sized goiters and shorter duration of illness.[69] Surgery is also commonly used for treating thyroid disorders in Nigeria. In Kano, a northern state of Nigeria 75 patients with thyroid disorders that included simple goiters, toxic goiters, thyroid CA, and follicular adenoma all had thyroid surgery done.[70] In a Senegal report, of a total of 105 patients who had varying forms of thyroid disorders, 41.6% of these patients had total or subtotal thyroidectomy.

There is hardly information on the outcome of thyroid disorders in Africa and this is largely attributable to the virtual absence of thyroid registries in the continent. In a report by Gondos *et al.*,[71] it was observed that excess mortality from thyroid cancer is a notable feature of this disease in most parts of Africa. In Ugandan patients with thyroid cancer, the reported relative survival after 5 years of diagnosis was 12.5%. This is in contradistinction from what obtains in the United States of America where the cure rates for thyroid cancer is very high.[71]

Conclusion

Thyroid disorders are relatively common in the African continent. Iodine deficiency although still the commonly documented cause of thyroid disorders in Africa, is not as rampant as it used to be. Nuclear medicine in the diagnosis and treatment of thyroid disorders remains highly underutilized and surgery is still a commonly used management modality for benign and malignant thyroid lesions. There is a compelling need to set up thyroid disorder registries in order to determine not only the scope of the burden of these disorders, but also to document changing trends if any especially given the background of widespread iodization programs which presently obtain in the continent.

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