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Iodine Status and Goitre Prevalence in Schools in Abomey in Benin

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Abstract

This study aims to analyze the iodine status and the prevalence of goiter among schoolchildren 06 to 12 years of Abomey from two indicators: volume ultrasound and urinary iodine.Selected by drawing go in a cluster of 09 schools on the basis of inclusion criteria children have benefited from the determination of urinary iodine, for the determination of iodine status and to cervical ultrasound examinations for the evaluation of thyroid volume. The prevalence of goiter was obtained, whichever is higher at the 97 percentile thyroid volumes for sex and body surface area in relation to the criteria of WHO and ICCIDD adapted by ZIMMERMANN. In total, 134 children were included. This group included 68 girls (50.70%) and 66 males (49.3%) with a sex ratio of 1.03. The median urinary iodine levels of 210µg / l and shows a lack of iodine deficiency in schoolchildren. The urinary iodine is between 100 ug / l and 300µg / L in 93.28% of children and between 300µg / l and 400 ug / l for others. The prevalence of goiter is estimated at 11.94%, which places the Abomey area according to WHO standards, in a slightly iodine deficient area. This result shows that the iodine status may change independently of the prevalence of goiters. We believe there are other goitrogenic factors to explore in the middle to identify the precursors of the observed prevalence.

Keywords*: iodine status, goiter prevalence, schoolchildren, Abomey, Benin.*

Introduction

Dietary iodine deficiency is a major problem that affects many countries worldwide. Africa is the third largest in the world with a percentage of 41.5% of the general population after Europe and the Eastern Mediterranean. [1] The Benin is not spared from this phenomenon whose main consequence is the occurrence of endemic goitre. The mountainous regions like central and northern West are most affected [2, 3]. When iodine deficiency is severe, the thyroid gland is unable to produce sufficient hormones iodine. In situations of decreased thyroid secretion, the pituitary gland causes a state of chronic excitement of thyroid glandular hyperplasia which then undergoes various pathological changes where the nodules and in the worst case, the tumor development the gland. In general, there is a socio-economic backwardness of the people concerned. [4]

In the case of endemic goitre, the perinatal mortality in particular is often higher [5]. UNICEF has estimated that each year 10 000 Beninese children born with mental retardation due to iodine deficiency. [6] The intellectual development of children is severely compromised.

Thus, the government and its partners initiated a policy of iodization and extension of the use of iodized salt in all households that fostered a sharp decline disorders due to iodine deficiency disorders (IDD) [7]. Consumption of iodized salt by households has been documented by various surveys at the national level (the EDSB-II 2001 INSAE and ORC Macro, 2002) [8] (the EDSB-III 2006 and INSAE . Macro Int Inc., 2007) [9] (the CFSVA 2008, GOB and al 2009). [10]. Surprisingly enough, the consumption of adequately iodized salt is more common in rural than urban areas. It is the lowest in the Atlantic (zone membership of the municipality of Abomey) and the Littoral, probably due to the existence of a production of natural non-iodized salt supplies these two departments (GOB et al 2009,. DANA / UNICEF, 2001) [11, 12]. A meta-analysis of 18 studies found that global populations deficient in iodine the Intelligence Quotient (IQ) was lower by 13.5 percentage points compared with that of non-iodine deficient [13] populations.

According to WHO, children of school age (06 to 12) are most vulnerable. In fact, iodine deficiency can cause mental retardation, affect the growth, learning abilities and work and productivity [14].

Unfortunately, at the town of Abomey, no attempt is made to assess the current state of protection of schoolchildren 06 to 12 years of this town against disorders related to iodine deficiency.

This study aims to determine the iodine status of schoolchildren in the area of Abomey and the prevalence of goiter for.

1. Study Subjects and Methods Framework

Our study is for children 06 to 12 years and took place in the town of Abomey, the area south of Benin, in the department of the Atlantic, a coastal area. It extends over an area of 539 km2 and is the largest town in the department.

The children were randomly selected at the primary schools in the locality. Thus, on the basis of inclusion and number assignment criteria, students were randomly go in each school every morning to reach its planned. Thereafter, each child was given a urine sample for the determination of urinary iodine and thyroid ultrasound determination of thyroid volume.

1.1. Data urinary iodine

The urinary iodine levels is an important parameter that reflects the level of consumption of iodine yesterday. For this reason, it remains an essential parameter for assessing iodine status of a population. The urine samples were collected between 8 and 9 hours for all students and the assay is performed according to the method developed by Sandell-Kolthoff and recommended by WHO for mass surveys. [15]

The urine samples were stored at 4 ° C in the refrigerator and the assays performed the next day at the Research Unit Ecotoxicology and Quality Study (UREQ) Professor Henri SOCLO the EPAC / UAC.

1.2. Thyroid ultrasound data

The thyroid ultrasound is performed on site in schools, with a portable brand SIEMENS with a 7.5 MHz linear probe. All examinations were performed on the appliance by one and only one specialist investigator thyroid ultrasound formed Polytechnic University of Abomey.

This investigation was to determine the dimensions (width (W), length (L) and thickness (e)) of each thyroid lobe and deduce the lobar volume (VL ml) according to the formula recommended by the WHO and published by NTAMBWE Kibambe T. and als, R. GUTEKUNST and als, als and BRUNN J, S and IVARSSON als.: VL = W x L x E x 0.479 [16, 17, 18, 19].

Finally, the thyroid volume (VT in mL) was obtained by the sum of the volume of both right lobes (VLD) and left (GBV): VT = VLD + VLG.

Goitre was assessed by holding the top 97 percentile in thyroid volume by sex and body surface area in relation to the criteria of WHO and ICCIDD [20] and adapted by ZIMMERMANN als in 2001. [21]

1.3. Statistical Methods

Our data were analyzed using Epi Info 3.5.3 French and Microsoft Excel 2007 [22, 23]. The size analysis was carried out with related statistics mean, median, standard deviation, maximum and minimum values and the 97 percentile.

2. Results and Discussion

2.1. Sample Characteristics

Age and sex: We identified a total of 136 children of which two (02) who had a nodular goiter have been eliminated. The sample finally included, 134 students including 68 girls (50.70%) against 66 boys (49.3%) with a sex ratio of 1.03. (Figure 1)

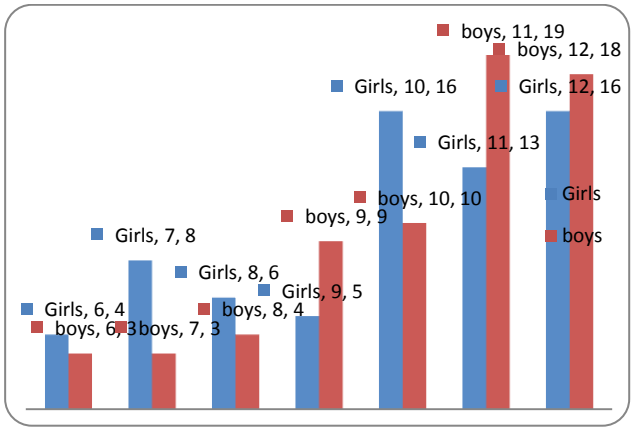

Fig.1: Distribution of students by age and sex

The predominance of girls is certainly related to the new policy of the Beninese state has encouraged massive enrollment of girls by enacting free enrollment in our elementary schools. Boys ages 11 and 12 and girls ages 10 and 12 were the most represented. The average age irrespective of gender is 10.04 ± 1.80 years. It is identical to that of children Algerians (10 ± 2.6 years) published in the works of S. Henjum als and [24] but is higher than that obtained by ZIMMERMANN et als. (9.3 ± 1.9 years) at the children some Africans and Europeans [25] countries and remains lower than that of Filipino children in the study of Kim et als [26].

This disparity is probably due to the fact that in some countries, children begin primary school early in infancy.

2.2. The data ioduria

The urinary iodine is a universally accepted parameter for assessing iodine status in a population. The severity of disorders due to iodine deficiency is assessed on the basis

of the median urinary iodine excretion. In our sample, the median rate of 210µg / l and shows that pupils in the locality respondent does not suffer from iodine deficiency. By cons, a staff of nine (09) students or (6.7%) had urinary iodine levels above 300µg / l and are in a state of excess consumption of iodine that exposes them to the effect Wolff-Chaikof can place in hypothyroidism or hyperthyroidism [27, 28] (Table 1).

Tables 1: Distribution of schoolchildren depending the urinary iodine rate

100 - 200	62	46,30
200 - 300	63	47,00
300 - 400	9	6,70
Total	134	100

In a study conducted in 2004 in Cotonou, NTAMBWEKIBAMBE et al. found an estimated 289.4 g / l median, while Tokoudagba-PADONOU et al. obtained in 2006, a median greater than 300 mg / l in the Collines Department. [29] Taken together, these results generally reflected the effectiveness of the policy of dietary iodine introduced in Benin since 1990.

2.3. Goitre prevalence in our sample

2.3.1. Thyroid ultrasound data

Tables 2: Thyroid ultrasound volumes (VET) of girls

Age	VMn	Average ± σ	p97	VMx
6	0,65	1,39 ± 0,64	1,99	2,01
7	1,52	2,11 ± 0,43	2,71	2,77
8	0,84	1,62 ± 0,51	2,06	2,06
9	1,22	1,79± 0,56	2,54	2,59
10	1,42	2,95 ± 1,00	4,70	5,12
11	1,84	3,05 ± 0,74	3,81	3,85
12	1,8	3,50 ± 0,97	5,22	5,3
Groupe	0,65	2,70 ± 1,05	5,11	5,30

VMn = minimal value, σ = écart- type , p50 = percentile 50 , p97 = percentile 97 ; V Mx = maximal value

Tables 3: Thyroid ultrasound volumes of boys

Age	VMn	Average ± σ	p50	p97	VMx
6	0,96	1,34 ± 0,47	1,21	1,8	1,8
7	1,42	1,86 ± 0,38	2,03	2,11	2,12
8	0,60	1,07 ± 0,51	1,08	2,19	1,53
9	1,00	2,01 ± 0,63	1,81	2,80	2,81
10	1,58	2,40 ± 0,62	2,57	3,06	3,09
11	1,77	2,91 ± 0,82	2,78	4,60	4,88
12	1,39	2,68 ± 0,94	2,67	3,90	4,01
Groupe	0,60	2,42 ± 0,92	2,41	4,03	4,88

Tables 2 and 3 show that the values in milliliters (ml) of the minimum and maximum ultrasound volumes are respectively 0.65 and 5.30 against 0.60 in girls and 4.88 in boys. The approximation of VET means shows that the thyroid volume is comparable to girls than boys (p = 0.095).

These results confirm those published in non-iodine deficient areas by R. GUTEKUNST and als, IVARSSON S.A. and als. [17, 19].

Table 4: Volume thyroid girls divided according to body surface area (BSA)

SC	Manpower	VMn	Average ± σ	p97	VMx
0,7	7	1,13	1,76 ± 0,42	2,04	2,05
0,8	7	0,65	2,15 ± 0,96	3,86	4,17
0,9	5	0,84	1,6 ± 0,59	2,05	2,08
1	13	1,42	2,31 ± 0,72	3,63	3,86
1,1	16	1,8	3,15 ± 0,87	4,7	5,12
1,2	10	2,14	3,4 ± 0,97	5,25	5,3
1,3	7	2,59	3,16 ± 0,69	3,88	3,94
1,4	3	3,75	4,08 ± 0,33	4,38	4,4

Table 5: Thyroid Volume boys divided according to body surface

SC	Manpower	VMn	Average ± σ	p97	VMx
0,6	1	-	1,21	-	-
0,7	1	-	1,86	-	-
0,8	7	0,6	1,3±0,56	1,19	2,03
0,9	14	0,96	2,05±0,58	2,89	2,94
1	14	1,53	2,37± 0,67	3,52	3,41
1,1	17	1,48	2,61±0,74	3,93	3,99
1,2	8	1,39	3,11±0,85	4,22	4,35
1,3	3	3,69	4,19±0,62	4,83	4,88
1,6	1		3,65	-	-

According to the 1997 WHO reference, the 97 percentile of VET varies from 4.8 to 11.9 ml for females and 4.7 to 10ml boys for body surface area ranging between 0.8 and 1.4 m2 [20]. According to the 2003 baseline, 50 and 97 percentiles respectively fluctuate between 1.46 to 3.66 ml and 2.56 to 6.4 ml in girls against 1.47 to 3.36 ml and 2.62 to 5.98 ml boys for body surface area ranging from 0.7 to 1.4 m2 [25]. If our values in Tables IV and V are similar to those obtained by the WHO in 2003, however they are much lower than in 1997.

In countries where the prevalence of stunting is high, the thyroid volume is directly related to body surface area [20].

In Benin 04 out of 10 children suffer from growth retardation [30] and our results show that the volume of the thyroid has the highest correlation with the body surface(r = 0.66).

Table 6: Distribution of pupils with a thyroid ultrasound volume (VET) higher than the 97 percentile based on body surface

SC	Girls	Boys	Total
0,7	1	0	**1**
0,8	1	4	**5**
0,9	1	1	**2**
1	1	0	**1**
1,1	1	1	**2**
1,2	1	1	**2**
1,3	1	1	**2**
1,4	1	-	**1**
Total	8	8	**16**

The closer to the body surface at the Table VI shows that sixteen (16) students or 11.94% of children have a VET upper limit of normal of 97 percentile. Homogeneous goiter prevalence is estimated at 11.94%.

According to WHO standards, the prevalence rate between 9 and 19.9%, makes our study framework, slightly iodine deficiency [15] area. This result is quite surprising since the average urinary iodine is relatively high. So we're trying to say that the iodine status evolves independently of the prevalence of goiters. Since iodine intake is adequate, we believe there are other disturbing factors thyroid function. The adjuvant role of goitrogenic foods in the disruption of the uptake of iodine is well known today [31, 32, 33], it is more appropriate to analyze the toxicity vis-à-vis the thyroid different foods consumed by our students.

Conclusion

This study focused on two (02) monitoring indicators (the urinary iodine levels and ultrasound volume) shows that school of Abomey do not suffer from iodine deficiency, however, the prevalence of goiter is estimated at 11 94%. This very surprising situation reflects the iodine status may change independently of the prevalence of goiters. We believe it is urgent to analyze the toxicity in relation to the thyroid of food consumed by our students. Overall results show that this study should be extended to other schools to protect children from 06 to 12 years against the risks of food iodine deficiency.

Reference

[1]. Zimmermann M. B., (2008), Iodine requirements and the risks and benefits of correcting iodine deficiency in population, *Journal of trace elements in medicine and biology*, **(22): 81-92**.

[2]. Tokoudagba-Padonou I., Akpona A.S., Aboudoulaye I., Gomina Assoumanou M, (2006), Consommations d'aliments goitrigènes et troubles dus à la carence en iode (TDCI) dans le département des collines en république du Bénin, *Journal de la Société de Biologie Clinique*, **(10): 17-20.**

[3]. Sezan A. , Gangbo F. , Senou M., Ahokpe M., Agossou E., Akpona S., (2008), Perturbations thyroïdiennes dans la région à risque de Tanguiéta. *Journal de la Société de Biologie Clinique*, **(13): 5-11.**

[4]. Yazipo D. , Ngaindiro L.F. , Barriere-Constantin L,(1995), Efficacité d'un système d'iodation de l'eau dans la lutte contre les troubles dus à la carence iodée en Afrique Centrale. *SANTE*., **(5) : 9-17.**

[5]. HetzelL B.S, (1983), Iodine Deficiency Disorders (IDD) and their eradication, *Lancet ii*,**1983:1126-1129.**

[6]. Banque Mondiale, Système éducatif béninois : Analyse sectorielle pour une politique éducative plus équilibrée et plus efficace. *Série :* Développement Humain en Afrique : **N°. 165.**

[7]. SNU BENIN, (**2002),** Bilan Commun de Pays. Système des Nations Unies au Bénin**.** (disponible à http://www.undg.org/archive_docs/5451-Benin_CCA.pd) Consulté le 28/04/12.

[8]. INSAE et ORC MACRO,(2002), Enquête Démographique et de Santé Bénin 2001 (EDSB-II). *Institut National de la Statistique et de l'Analyse Economique, Bénin et ORC Macro, Calverton, Maryland, USA*.

[9]. (Disponible,à :http://www.measuredhs.com/pubs/pub_details.cfm?ID=366&ctry_id=52&SrchTp = ctry&flag = sur&cn=Benin. Consulté le 28/04/12

[10]. INSAE ET MACRO INTERNATIONAL INC., (2007), Enquête Démographique et de Santé Bénin 2006 (EDSB-III) . *Institut National de la Statistique et de l'Analyse Economique, Bénin et Macro International Inc. Calverton, Maryland, USA***.**

[11]. Disponible,à :http://www.measuredhs.com/pubs/pub_details.cfm?ID=733&ctry_id=52&SrchTp=ctry&flag=sur&cn=Benin). Consulté le 28/04/12.

[12]. GDB, INSAE, PAM, UNICEF et FAO., (2009), Analyse Globale de la Vulnérabilité, de la Sécurité Alimentaire et de la Nutrition (AGVSAN)- République du Bénin (données de novembre et décembre 2008). Gouvernement du Bénin, Institut National de la Statistique et de l'Analyse Economique (Bénin), Programme Alimentaire Mondial, Fonds de Nations Unies pour l'Enfance et Organisation des Nations Unies pour l'alimentation et l'agriculture. **2009.**

[13]. Disponible,à :http://documents.wfp.org/stellent/groups/public/documents/ena/wfp203247.pdf. Consulté le 28/04/12

[14]. GDB , INSAE , PAM , UNICEF et FAO., (2009), Analyse Globale de la Vulnérabilité, de la Sécurité Alimentaire et de la Nutrition (AGVSAN)- République du Bénin (données de novembre et décembre 2008). Gouvernement du Bénin, Institut National de la Statistique et de l'Analyse Economique (Bénin), Programme Alimentaire Mondial, Fonds de Nations Unies pour l'Enfance et Organisation des Nations Unies pour l'alimentation et l'agriculture.

[15]. Disponible,à :http://documents.wfp.org/stellent/groups/public/documents/ena/wfp203247.pdf. Consulté le 02/04/12.

[16]. DANA/UNICEF,(2001), Enquête nationale sur la prévalence des troubles dus à la carence en iode en milieu scolaire primaire au Bénin – Restitution des résultats. Direction de l'Alimentation et de la Nutrition Appliquée, Ministère de l'Agriculture, de l'Elevage et de la Pêche, Porto Novo.

[17]. Aguayo V. M. , Bégin F., JurkoviC L., Solano A., Yusufali R, (2005) , Accélérer le progrès vers l'Iodation Universelle du Sel en Afrique de l'Ouest : Un moment critique. Rapport de la consultation Ouest Africaine sur l'Iodation Universelle du Sel 19-21 octobre 2004, Dakar, Sénégal. Publié pour Le

Réseau pour l'Elimination Durable de la Carence en Iode, par le Fonds des Nations-Unies pour l'Enfance (UNICEF) et l'Initiative pour les Micronutriments (MI).

[18]. Disponible à http://www.idpas.org/SCNReportSite/supplements/USI%20Report%20French.pdf).Consulté le 02/04/12.

[19]. SANTIAGO-FERNANDEZ P. , MUELA-MARTINEZ JA. , ROJO-MARTINEZ G. , GARCIA-FUENTES E. , GARRIGA M.J. , LEON A.G , SORIGUER F., (2004), Intelligence quotient and iodine intake: a cross-sectional study in children. *J Clin. Endocrinol. Metab*, **89 (8):3851-7.**

[20]. OMS. Serie Sur Les Micronutriments, (1994), Indicateurs d'évaluation des troubles dus à la carence en iode et de la lutte contre ces troubles par l'iodation du sel. Genève, *WHO/NUT*, **(94.6): 50p.**

[21]. Ntambwe Kibambe T.; Acakpo A.; Ouedraogo A.; Salami M., (2004), Evaluation rapide des troubles dus a la carence en iode : le projet ThyroMobil dans six pays d'Afrique de l'Ouest. *International Symposium Research in Applied Nutrition Developing Countries*, **51-62.**

[22]. Gutekunst R., Smolarek H., Scriba P.,(1988), Comparison of thyroid volumes of schoolchildren in Federal Republic of Germany and Sweden, Thyroid Disorders Associated with Iodine Deficiency and Excess, **(22): 37-38**.

[23]. Brunn J., Block U., Ruf G., Bos I., KunzE W. P., Scriba P. C., (1981), Volumetric analysis of thyroid lobes by real-time ultrasound, *Deutsche Medizinische Wochenschrift*, **(106-41): 1338–1340p**

[24]. Ivarsson, Persson P, Ericsson UB., (**1989),** Thyroid gland volume as measured by ultrasonography in healthy children and adolescents in non-iodine deficient area, *Acta Paediatrica Scandinavica*, **(78): 633- 634**

[25]. WHO , ICCIDD, (**1997),** Recommended normative values for thyroid volume in children aged 6- 15 years. *Bull. WHO*, **(75): 95-97**.

[26]. Zimmermann M.B, MolinarI L. , Spehl M. , Weidinger-TOTH J. , Podoba J., Hess S, , Delange F., (2001), Towards a consensus on reference values of thyroid volume in iodine replete schoolchildren results of workshop on interobserver and interequipment variation in sonographic measurement of thyroid volume, *Euro. J. Endo,* **(144): 213-20**.

[27]. Ancelle T.,(2006), Statistique épidémiologie, *2e édition, Paris : Maloine*, **300p**.

[28]. SCHWARTZ D., (1986), Statistique médicale et biologie. *5e édition, Paris : Flammarion* **125p**

[29]. Henjum S*., (2010)* Endemic goitre and excessive iodine in urine and drinking water among Saharawi refugee children, *Public Health Nutrition*, **6p**

[30]. Zimmermann M.B, Hess S.Y., Molinari L., (2004), New reference values for thyroid volume by ultrasound in iodine sufficient schoolchildren: a World Health Organization/Nutrition for Health and Development Iodine Deficiency Study Group Report*. Am J Clin Nutr*, **(79): 231 - 237**.

[31]. Kim B.K., Young Sik Choi Y. S., Oak C.H., Park Yo-H., Kim J.H., Park D.J. Determination of Thyroid Volume by Ultrasonography among Schoolchildren in Philippines. *International Journal of Endocrinology*, **(387971): 6p.**

[32]. Roti E., Degli Uberti E., (**2001),** Iodine excess and hyperthyroidism, *Thyroid*, **(11): 493–500**.

[33]. Georgop Markou K., Oulos N., Kyriazopoulou, Vagenakis A.G., (**2001),** Iodine-indue hypothyroidism, *Thyroid*, **(11): 501-510.**

[34]. Tokoudagba-Padonou I., Akpona A. S, AboudoulayE I, Gomina Assoumanou M., (**2006),** Consommation d'aliments goitrigènes et troubles dus a la carence en iode (TDCI) dans le département des collines en République du Bénin*. Journal de la Société de Biologie Clinique*, **(10) : 17-20**.

[35]. Ministere De La Prospective, Du Developpement, De L'evaluation Des Politiques Publiques Et De La Coordination De L'action Gouvernementale Republique,(**Octobre 2010),** Rapport spécial 2010 d'évaluation de la mise en œuvre des objectifs du millénaire pour le développement (OMD) au Bénin. *EDITION FRIDZEL, République du Bénin*.

[36]. Delange F, The role of goitrogenic factors distinct from iodine deficiency in etiology of goiter,(1988), *Ann. Endocrinol. (Paris)*., **49 (4-5): 302-5.**

[37]. Amar K., Sanjukta M., Dishari L., Swritiratan T., (**2004),** Goitrogenic content of Indian cyanogenic plant foods and their in vivo anti-thyroidal activity, *Indian J. Med. Res*. , **119:180-185**

[38]. Brauer V. F. H., Below H., Kramer A., (**2006),**The role of thiocyanate in the etiology of goiter in an industrial metropolitan area, *European Journal of Endocrinology,* **(154):229-235**.