DETERMINATION OF RELATIONSHIP BETWEEN THYROID GLAND VOLUME AND PARITY, SMOKING HABITS AND ALCOHOL CONSUMPTION.

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ABSTRACT

Objective: This study is aimed at investigating possible relationship between thyroid gland volume, parity, smoking and alcohol consumption.

Background: The thyroid gland is one of the largest endocrine glands in the body that produces thyroid hormones, principally thyroxine (T_4) and triiodothyronine (T_3). These hormones regulate the rate of metabolism and control the growth and rate of function of many other systems in the body. Any factor that affects thyroid gland volume, would affect production and function of thyroid hormones in the body.

Materials And Methods: LOGIC 5 ultrasound machine, 10MHZ linear transducer and ultrasound gel were used. Ultrasound of the neck in patients that fulfill recruitment criteriaand presenting to radiology department between 2011 and 2012, were evaluated for the study. Demographic data, indications and findings were evaluated.

Results: A total of 400subjects were involved in the study, with more female non-smokers(250) and non-alcoholics(231) than males. There was variation in size of thyroid gland in non-alcoholics (Mean thyroid volume = 5.58±2.60)compared to alcoholics(Mean thyroid volume = 6.14±2.74), indicating the goitrogenic effect of alcohol.There is an increase in thyroid volume with increase in smoking, though not significant. Parity does not have significant effect on thyroid volume in this study, with P-value of 0.128.

Conclusion: Cigarette smoking, alcohol and pregnancy are associated with increase in thyroid volume. This has been attributed to the goitrogenic effect of nicotine, alcohol and pregnancy hormones. The effects of nicotine and alcohol on thyroid gland, is seen in both males and females.
Although pregnancy is noted to cause increase thyroid volume, there was increase in volume with increase in parity in this study.

Key Word: Determination, Thyroid volume, Parity, Smoking and Alcohol consumption.

INTRODUCTION

Ultrasound (US) provides the best anatomical representation of the thyroid gland. Using high-resolution (10 MHz) transducer, modern machines provide excellent spatial resolution and allow nodules as small as 2-3mm to be detected. Laboratory values of T3, T4 and TSH may be **deranged and thyroid gland appears normal on ultrasound scan.** Ultrasound is simple, non-invasive, readily available, real-time, accurate, and cost effective appearing to be more suitable in tropical Africa for thyroid imaging where more sophisticated modern imaging techniques may not be readily available asdocumented by Ahidjo et.al[1].

Scans can be video-recorded, stored and reproduced whenever needed. They can also be repeated as many times as possible, with no hazards of ionizing radiation. No special preparation is required. It is well suited for most individuals. No contrast administration is required. Besides the quality of ultrasound images compare favorably to those of other imaging modalities as documented in a previous study by Martin P et.al[2]. The data generated by this study will provide the very much needed baseline in the diagnosis, treatment and prognosis of thyroid diseases in this environment. No known work was done for determination of thyroid volume using 10MHZ

transducer and analyzing the thyroid function (which was used as exclusion criteria) of the individuals in a highland part of Nigeria. This work was done on the above premise. Fatima et al[3] in a prospective study to investigate the influence of smoking on sonographically determined thyroid gland volume and echo-texture in a large randomly selected group of 500 healthy subjects of both sexes from a non-iodine deficient area, discovered that, in 257 non-smokers the mean value of the right thyroid lobe volume and the left thyroid lobe volume were 7.97 ± 5.27 ml and 6.94 ±4.82 ml respectively, whereas they were found to be 8.68 ± 5.97 ml and 7.03 ± 3.05 ml respectively in 243 smokers. Thyroid gland volume was higher in male and female smokers than in non-smokers ($p > 0.05$).They concluded that smoking does affect mean thyroid gland volume in smokers and has no influence on the echogenicity or echo-texture of the thyroid gland.

Alcohol consumption affects the size of thyroid gland.Valeix[4] et al noted that alcohol intake was associated with higher thyroid volume in males and females irrespective of iodine status.They observed an increase dose-response relationship between alcohol intake levels and thyroid enlargement in both males and females.Alcohol consumption was strongly associated with a higher risk in females.

Pregnancy acts as a goitrogen in women.The thyroid does not shrink to its former size after delivery.Mario[5] et al evaluated the effect of parity on 208 nongoitrous healthy women.The mean thyroid volume increased progressively with number of parity.The increment was statistically significant. They observed that the goitrogenic effect of parity in moderate iodine deficiency is not reversible.They are of the opinion that iodine supply during pregnancy should be increased in conditions with moderate iodine deficiency.

MATERIALS AND METHODS

STUDY AREA

Jos is the capital city of Plateau State.Plateau state has over 30 different ethnic groups. The 2006 Nigerian census put the population of Plateau State at 3,178,712.[6] Jos University Teaching Hospital(JUTH) is one of the three teaching hospitals in the North-Central Zone of Nigeria. It serves as a referral center for the neighbouring states of Bauchi, Gombe, Benue, **Kogi,** Nassarawa, Taraba, Adamawa and parts of Kaduna State.

STUDY POPULATION AND DESIGN

This was a hospital-based Cross-sectional study that was done in the Department of Radiology, Jos University Teaching Hospital (JUTH), and a tertiary health institution situated in the central part of Jos, for the period of twelve months (June 2011-June 2012).

INCLUSION CRITERIA

- Patients that consented to have the procedure (sonographic evaluation of thyroid gland volume and laboratory assessment of thyroid function)
- Patients referred for ultrasound examination, other than thyroid ultrasound scan.
- Patients 18 years and above
- Patients with normal laboratory values of T3(0.6-2ng/ml), T4(45-115ng/ml) and TSH(0.3-6.5ng/ml)

EXCLUSION CRITERIA

- Female during menstruation, pregnancy or who have delivered within the last twelve (12) months
- Subjects with anterior neck swelling or clinical evidence of thyroid/endocrine disorder
- Subjects with previous thyroid surgery.
- Subject with abnormal laboratory values of T3, T4 and TSH.
- Subjects who did not consent to participate in the study

SAMPLE SIZE DETERMINATION

The sample size was determined using Fisher's statistical[7] formula $n=z^2pq/ d^2$ for population greater than 10,000 and it was calculated to be 384 as shown below:

The formula $n=z^2pq/ d^2$

Where n = Desired sample size.

z = Standard deviation, using set at 1.96, which correspond to 95% confidence level.

p = Proportion in target population estimated to have a particular characteristic. If no reasonable estimate, 50% (0.5) is used.

$q = 1.0 – p$

d = degree of accuracy desired, usually set at 0.05

Therefore $n=1.96^2 x0.5x0.5/0.05^2=384$.

However a sample size of 400 was used.

TECHNIQUE

The procedure was explained to all participants, and informed consent was obtained. A data sheet (appendix I&II) was completed for the all participants in which the ages were obtained and weights and heights were obtained by the participants climbing a weighing scale and standing by a wall that was marked in meters The weight and height of each participant was then measured without shoes or heavy clothes before the scan was done. The body mass index (BMI) in Kilogram/meter square (Kg/m^2)[3] was then calculated from the weight and height[2].The participants were asked questions on history of previous thyroid disease or surgery as stated in the questionnaire. Questions on alcohol consumption, cigarette smoking and parity of women were asked as seen in the questionnaires.Patients were examined in supine position with a pillow placed under the shoulders to aid in the extension of the head. All examinations were performed using LOGIC 5, a real-time ultrasound machine fitted with a 10MHZ linear transducer. Ultrasound gel was applied over the anterior neck (thyroid area) and the transducer placed directly on the skin overthe thyroid area. Images of each lobe and the isthmus were obtained in transverse(Fig 4) and longitudinal planes (Fig 5 and 6). Longitudinal (length) as well as transverse (width) and depth (AP) were measured in centimeters (cm).The right and left thyroid volume data were obtained and analyzed separately. The isthmus was not included in the sum.The lobe volume (cm^3)was calculated from the equation of Brunn et al[8,9]using the ellipsoid model formula by multiplying length (L) by width (w) by depth (d) in cm by a correction factor 0.52 and the lobe volumes are summed. The isthmus volume was calculated from $V_{isthmus}$ (cm^3) equals $length_{isthmus}$ by $width_{isthmus}$ by $depth_{isthmus}$ all in cm multiplied by 0.479[31].Total Thyroid volume (cm^3) = total sum of lobe volumes (cm^3)

Isthmus volume (cm^3) = $length_{isthmus}$ x $width_{isthmus}$ x $depth_{isthmus}$ x 0.52

The body surface area was calculated using the formula of Dubois and Dubois[10]

Body surface area BSA (m^2) = $Weight^{0.425}$ x $Height^{0.725}$ x 71.84×10^{-4}

andBody mass index (BMI) ($Kg/m^{2)}$ was calculated from weight/$height^2$.

Blood samples were taken for thyroid function tests (T3, T4 and TSH) in which results that were not within normal range were not included.

RESULTS

Table 1 shows marginal increase in thyroid volume with smoking and alcohol intake, though not significant.

Risk Factors	Male N(%)	Mean Thyroid Vol	P	Female N(%)	Mean Thyroid Vol	P
Non Smoking	132(88.0)	6.05±2.41	0.939	250(100.0)	5.62±2.61	-
Smoking	18(12.0)	6.09±2.06		0(0.0)	-	
Non-Alcohol	115(76.7)	6.05±2.40	0.806	231(92.4)	5.58±2.60	0.378
Alcohol Intake	35(23.3)	6.32±2.28		19(7.6)	6.14±2.74	

Table 2 shows the relationship of the thyroid volume with PARITY

There was no increase in thyroid volume with increase parity.Thyroid volume does not correlate significantly with parity.Even though the thyroid volume is higher in nulliparous(5.99±2.37) than the multiparous(5.73±3.23)

Table 2: Relationship of mean Thyroid Volume with Parity

Parity	Nulliparous(0)		Parous(1-4)		Grand Multiparous(>4)		
	N(%)	MeanSD	N(%)	MeanSD	N(%)	MeanSD	
	227(56.8)	5.99±2.37	125(31.3)	5.42±2.47	48(12.0)	5.73±3.23	0.128

Discussion

There are factors that are known to affect thyroid volume in individuals.Some of the factors were evaluated in this study. They include cigarette smoking, alcohol consumption and parity of the woman.

Cigarette smoking affects thyroid volume. The effect of smoking is more with increased number of sticks smoked per day[3]. There was increase in thyroid volume with smoking. The difference in volume was not statistically significant (P=0.939). Fatima et.al[3] and Aydin et.al[11]noted that thyroid volumes were higher in smokers than non-smokers.It is thought that nicotine acts as a goitrogen.

There was increased thyroid volume with alcohol consumption, though it was not statistically significant with a P values of 0.806 and 0.378 for male and female subjects. Valeix et al[4] also found that thyroid volume increment was noted in both males and females that consumed alcohol.

Parity is known to affect the volume ofthyroid gland as seen in the study done by Mario et.al.[5]The pregnancy is said to act as goitrogen, in which the thyroid will never return to its previous size.There was however significant increase in volume with increase in parity in this study.

In conclusion, increase in thyroid volume was associated with increase in alcohol consumption, parity and cigarette smoking, though they were not significant statistically.

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