

The Effects of Induced Hypothyroidism on Plasma FSH and LH Concentrations in Female Wistar Rats

Mohammed Abdel Rahman Idris

M.A, Department of Biochemistry, Faculty of Medicine and Health Sciences, University of Dongola, Sudan

maidris71@gmail.com

ABSTRACT

Thyroxin and triiodothyroine are essential for normal organs growth development and function. These hormones regulate the basal metabolic rate (BMR) of all cells and play a critical role in the development of several organ systems such as reproductive. The experimental study was located at the University of Kwa Zulu-Natal (UKZN), Faculty of Science and Agriculture School of Biochemistry, Genetics and Microbiology, Westville campus South Africa, from October 2009 up to May 2010. Our objective is to investigate the effects of experimental induced hypothyroidism in females Wistar rats FSH and LH concentrations and answer specific question what was worse to have low thyroid hormones in female Wistar rats. Carbimazole compound was administered orally to experimental animals. The dose was 50 mg/kg body weight for three weeks to induce the hypothyroid, euthyroid rats were received 3ml of deionized water. The concentrations of thyroid hormones (TSH, T₃ and T₄) and gonadotrophins (FSH, LH) were determined by using enzyme immunoassay kits from TOSOH, Corporation Japan. Through Hitach 906 analyzer. The results of body weight showed significant $p \leq 0.05$ decreased in hypothyroid female rats group as compared to control group. TSH was showed significant $p \leq 0.05$ decreased in hypothyroid rats as compared to control rats group, but T₃ and T₄ were showed decreased without significant. LH and FSH were showed conflict result FSH was decrease, but LH was increase without significant in hypothyroid compared to control rats group.

Keywords: *Hypothyroidism, Carbimazole and reproductive system*

1. INTRODUCTION

Normal thyroid hormones blood levels are essential for growth and development of tissues and organs function [1]. Iodine deficiency and its associated clinical manifestations such as goitre, hypothyroidism and impaired mental and physical development present a major world problem [2]. In Africa, the dietary iodine deficiency is the major determine of thyroid pathology resulting in iodine deficiency disorders (IDD) including goitre and mental retardation [3]. In Sudan iodine deficiency is widespread and severe particularly in States of Darfour and Blue Nile, where goitre prevalence rate as high as 87% and 75% respectively. A prevalence of 22% goitre in Sudan, it leads to assumption that IDD in Sudan is severe [4]. Changes in thyroid hormones levels can adversely affect fertility, pregnancy outcome and postnatal development in humans and animals with major effects on growth, hearing mental acuity and development to reproductive system. Hypothyroidism has associated with increased risk of adverse pregnancy outcome in humans [1]. In female rats hypothyroidism is associated with blockade gonadotrophins induced first ovulation by increasing follicle stimulating hormone (FSH) and luteinizing hormone (LH) plasma concentrations [5]. In recent studies, it has become increasingly clear that adequate levels of circulating thyroid hormone (T₃) are primary importance for normal female reproductive function. In humans and animals, the changes in T₃ levels results in menstrual gonadotrophins secretion [6]. FSH is critical for ovarian folliculogenesis and female fertility and also play a key role in natural follicle development and in a combination with LH stimulate preovulatory follicular growth [7].

2. MATERIALS AND METHODS

Twenty four Female Wistar rats weight (250-300 gm) were used in the experimental and provided with standard laboratory rats chow food and water when they were put out of metabolic cage (E pol. Diet. 4700. Epol South Africa). They were housed in Biomedical Resource Unit (BRU) in UKZN. The animals were maintained under standard laboratory conditions of constant temperature ($22 \pm 20^\circ\text{C}$), CO₂ content of < 5000 ppm, relative humidity of $55 \pm 50\%$ and the noise level of > 65 decibels. All the procedures were performed from UKZN animal's ethic codes, and then it approved the UKZN animal ethics sub-committee reference (045/10/A) date: 11.12.2009.

2.1 Experimental Animals

The rats were initially acclimatized for three days acclimated period and then every third day rats were put in the metabolic cage for twenty four hours. The experimental model of hypothyroidism was induced by oral administered of Carbimazole tablets dissolved in distilled water. The dose was 50 mg/kg body weights for twenty one days at 9:00 am [8]. Rats were sacrificed after anesthetized by halothane on day twenty three. Blood was drawn directly from the right atrium of the heart. Separation of plasma was achieved by using the centrifugation.

2.2 Experimental Protocol

The rats were initially acclimatized for three days acclimated period and then every third day rats were put in the metabolic cage for twenty four hours. The experimental model of hypothyroidism was induced by oral administered of Carbimazole tablets dissolved in distilled water. The dose was 50 mg/kg body weights for

<http://www.ejournalofscience.org>

twenty one days at 9:00 am ^[8]. Rats were sacrificed after anesthetized by halothane on day twenty three. Blood was drawn directly from the right atrium of the heart. Separation of plasma was achieved by using the centrifugation.

2.3 Methods

Rat's body weight, food and water consumption were measured and recorded every third day of experimental period. Thyroid hormones concentrations were measured by using Enzyme Immunoassay kits from TOSOH Corporation Shiba-Koen First Bldg, 3-8-2, Shiba, Minato-Ku, Tokyo 105-8623, Japan, through Hitachi 906 analyzer ^[9]. Gonadotrophins hormones concentrations were measured by using Enzyme Immunoassay kits from TOSOH Corporation Shiba-Koen First Bldg, 3-8-2, Shiba, Minato-Ku, Tokyo 105-8623, Japan, through Hitachi 906 analyzer ^[10].

2.4 Statistics Analysis

All values were express as means \pm SD. The students-t test was used for the evaluation of differences between two groups. The differences were considered significant if a P value was less than 0.05.

3. RESULTS AND DISCUSSION

Table -1 indicate the mean value of body weight, food consumption and water consumption in hypothyroid rats group, they were significantly increased as compared to control rats group. The increased in body weight was associated with reduction in food and water consumption. These findings were showed that thyroxine depletion did induced gain in body weight. These results are agreement with previously studies in rats reported by ^[11]

The table - 2 illustrate that TSH and T₄ in hypothyroid female Wistar rats group was showed slight decrease, but not significant as compared to control rats group, T₃ was not changed between two groups. FSH and LH concentrations were very low and presented opposite results. The results have indicated that Carbimazole used in inducing hypothyroidism, it leads to create effects on reproductive hormones (FSH and LH initially). Similar results are due to thyroidectomy, but the suppression of thyroid function in female goats have been shown by ^[12]. Such results may be explained by possibilities that impaired thyroid function of pre-ovulatory luteinizing hormone surge and suppression of ovulation ^[13], also the finding are agreement with ^[5], Who reported that hypothyroidism in rats has be shown to reduced gonadotrophins levels.

Table 1: Mean values of rats body weight, consumption of food and water.

Hypothyroid	Control	Parameters
259.84 \pm 55.42 ^c	23351. \pm 21.51 ^d	Rats body weights g
19.67 \pm 4.65 ^d	19.30 \pm 5.85 ^c	Food consumption g
21.91 \pm 5.65 ^g	24.68 \pm 10.23 ^h	Water consumption ml

Values are means \pm SD. Means with rows not sharing common letter (s) are significantly different (P < 0.05).NS= non- significant.

Table 2: Means values of rats plasma

Hypothyroid	Control	Parameters
0.01 \pm 0.00 ^a	0.1 \pm 0.00 ^a	TSH μ IU/mL
0.39 \pm 0.10 ^{b NS}	0.38 \pm 0.09 ^{c NS}	T ₃ ng/mL
1.24 \pm 0.60 ^{d NS}	1.48 \pm 1.41 ^{e NS}	T ₄ μ g/dL
< 0.20 \pm 0.00 ^{f NS}	< 1.00 \pm 0.00 ^{g NS}	FSH mIU/mL
< 0.01 \pm 0.00 ⁱ	< 0.1 \pm 0.00 ^j	LH mIU/mL

Values are means \pm SD. Means with rows not sharing common letter (s) are significantly different (P < 0.05).

4. CONCLUSION

The experimental revealed that Carbimazole used for inducing rats hypothyroidism was effective and altered the levels of FSH and LH.

REFERENCES

- [1] Howdeshell K.L., Amodle of the development of the brain as construct of the thyroid system. Environ Health Percept 100. (Suppl, 3):337-348 (2001)
- [2] Delange F.M., Ermans A.M., Iodine deficiency In: Braver man LE, Utiger RD (Eds) Werner and Ingbar's, the thyroid, 7th ed. Philadelphia: Lippincott. Raven, 736-67(996)
- [3] Hetzel B.S, Wellby M.L., Iodine. In: O'Dell BL, Sunde RA(Eds); Handbook of nutritionally essential mineral elements, New York: Marcel, Deckker; 557-81(1996)
- [4] WHO, Promotion of iodized salt in the Eastern Mediterranean countries and North Africa countries meeting Report. WHO. EMRO Dubai, UAE (2001)
- [5] Mildred R.S., Christan H and Nancy A. Trento, Pure Appl. Chem. Vol.75. NO s. 11-12. pp. 2055(2003)
- [6] Webster R., Moenter S.M., Woodfull C.J.L. and F.J. Karsch F.J., Role of thyroid gland in seasonal reproduction thyroxine allows a season-specific suppression of gonadotropin secretion in sheep. Endocrinology. 129: (1) 176-183(1991)
- [7] Hillier S.G., Gonadotropin control of ovarian follicular growth and development (Molecular and cellular). Endocrinology. 179: 39-46 (2001)
- [8] Blovquit .M.F., Walens M., Bagayoko A.and Gripois D., Adrenal tyrosine hydroxylase activation in the developing rats influence of

<http://www.ejournalofscience.org>

- thyroid status. *Journal of develop. Physiol.* 14:325-329 (1990)
- [9] Taimela E., Tahtela R., Koskinen P., Nutila P., Forsstorm J. and Taimela S., Ability of two new thyrotrophic (TSH) assays to separate hyperthyroid patients from euthyroid patients with low TSH. *Clin. Chem.* 40, 101-105 (1994)
- [10] Boyar R.M., Katz J., Finkelstein J. W., Karen S., Weiner H., Weitzman E.D. and Helleman L., Anorexia Nervosa: Immaturity of the 24- hour luteinizing Hormones Secretary Pattern. *N. Engl. J. Med.* 291:861 (1976)
- [11] Wany J.L., Chinookoswong N., Yin S., Shin Z.Q., Calorigenic action of leptin are additive to, but not dependent on those of thyroid hormones. *Am J Physiol Endocrinol. Metab.* 279: E 1278-1285 (2000)
- [12] Reddy I.I., Varshney V. P., Sanwalt P.C., Agawal N, and Pande J. K., Peripheral plasma estradiol 17/3 and progesterone levels in female goats induced hypothyroidism. *Small Ruminant Research* 22, 149-154 (1990)
- [13] Anderson G.M and Barell G.K., Effects of thyroidectomy and thyroxine replacement on seasonal reproduction in the red deer hind. *Journal of reproduction and fertility* 113, 239-250 (1998)