ORIGINAL ARTICLE

The Effect of Testosterone Hormone Levels in the Blood and Urine of Obese Women

ASMAA HASHIM SHAKER
Department of Chemistry, College of Education for Women, University of Tikrit, Tikrit, Iraq.
Correspondence to Dr. Asmaa Hashim Shaker, E-mail: dr.asmaa@tu.edu.iq

ABSTRACT

Obesity is an unhealthy phenomenon during which an abnormal increase in the size and weight of body weight occurs and leads to many metabolic, physiological, and hormonal disorders. Sex hormones are directly influenced by the obesity, especially the testosterone hormone that is highly affected by the excessive obesity. Thus, the level of testosterone hormone in the blood and urine of women, aged between20-45 years, was studied. The study included 50 blood samples from obese women as well as 60 blood samples from healthy women. The results showed a direct relation between the obesity and high testosterone levels. The statistics suggest a P-value in the obese women of ($P < 0.005$) compared to the healthy women group. The level of testosterone hormone in the blood of obese women is (1.122 ±0.119) ng/ml compared to (0.2011 ± 0.119) ng/ml in the healthy group. Further, the levels of testosterone hormone in 50 and 60 urine samples of obese and healthy women, respectively, were investigated. The results showed a decrease in the level of the hormone of obese women at the level of ($P<0.005$), whereas the level of testosterone in the urine of obese women is (2.105 ± 0.224)ng/mg in comparison with(± 0.519 2.75) ng/ml in the urine of the healthy women group. The samples were also classified based on the ages and body weight, whereas a P-values of ($P < 0.005$) were observed in the obese woman group compared to the healthy group.

Keywords: Obesity, testosterone hormone, neurotransmitters dopamine, androgen group

INTRODUCTION

Testosterone is a male steroidal hormone from the androgen group and is derived from cholesterol and produced by the testis. Its molecular formula is ($C19H28O2$) and the molecular weight is288.431 $g.mol{-}1$[1]. It is related with the blood proteins with97-99.5% of (SHBG sex hormone- bending globulin and Albumin)[2]. The half-life of the testosterone is 2-4 hours. It is disposed 90% by the urine and 6% through feces [3] andis mainly reduced in the liver[4]. In addition to its characteristics of sexual growth, it promotes the growth of bones, muscles and hair, especially in males, and the decrease in its levels results in abnormalities in bone growth and dissociates in full sexual development of men[5-9]. Further, the decrease in the hormone levels affects the immune system, whereas it causes a metabolic syndrome, heart disease and blood vessels that cause chronic infections, where hormone levels in blood plasma are inversely associated with the number of white blood cells and thyroid levels[10,11]. In addition to its importance as a hormone, it has been used to in the treatment of breast cancer in women[12].

It has been recently observed an increase in the hormone disorders in obese women, thus the relationship of testosterone levels with obesity, which is a phenomenon that resulting from the increase in accumulated fat, has been studied[13-15]. It has been shown to be more likely to grow fatty mass in women than men associated with sex hormone changes in both sexes[16]. Fat represent a source of androgen build-up in women that forms a close relationship in changes in levels of sex hormones and disorders in the pituitary gland in the part responsible for sex hormones[17] unlike males who have positive changes with changing androgen levels[18]. Thus, there is a clear connection of the changing women's body weight to hormonal disorders[19].

Obesity is also associated with many other diseases such as depression, as it is associated with sex hormones where it interacts with neurotransmitters dopamine, noradrenaline, choline and sertonine[20,21], as well as problems of reproduction, menopause and infertility[22-24].

MATERIALS AND METHODS

Samples Preparation: The samples are collected from obese women in Kirkuk Teaching Hospital and outpatient clinics after their diagnosis by specialist doctors. We collected 50 blood samples and 50 urine samples from obese married and unmarried women in addition to 60 blood samples and 60 urine samples of healthy woman as a control group. The samples were collected from woman aged between 20-45 years and the samples are directly measured without any storge.

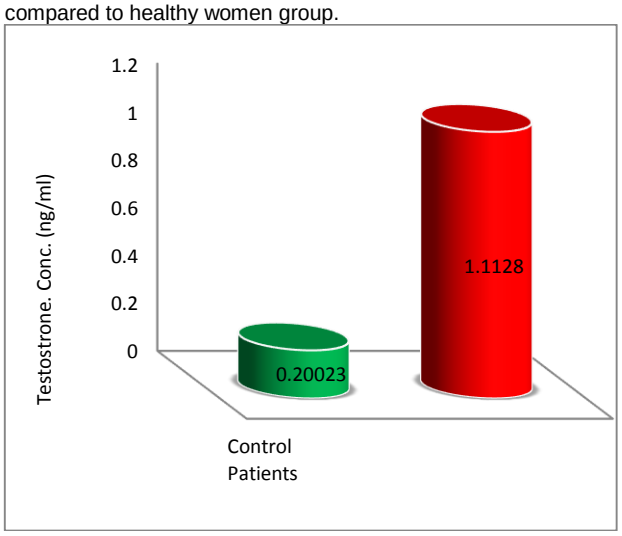
Estimation of testosterone levels: The level of testosterone was measured using (LIAISON-ANALYZER) technique by following the steps impeded in the manual of (DIASORIN-USA) instrument. The basic principle of this technique is based on the direct and competitive association with chemiluminescence, whereas the testosterone determinants are connected to magnetic bodies (solid phase) and the testosterone is connected to Isoluminol. During the incubation period, testosterone is being separated from the related proteins and compete with the hormone on the connection site of the determinant. After incubation, the non-unconnected substances are removed during the washing process. After that, the prefix is added and the chemiluminescence and reaction begin. The light signal is measured by a photo multiplier as relative lighting units (RLU) and inversely proportional to the concentration of testosterone found in standard calibration devices or samples.

RESULTS AND DISCUSSION

Obesity is associated with many diseases, including cysts, infertility, menstrual disorders, heart disease and depression [25].In addition to the use of certain medications, genetic and economic factors and mental disorders play a role in weight gain and excessive obesity [26-28]. Testosterone hormone has a major role in obesity, where its high levels in women results in obesity that leads to many disorders. Its levels were studied in obese women with 50 blood samples and 50 urine samples and compared to 60 blood samples and 60 urine samples of non-obese women control group, whom age ranges between 20 and 45 years.

Testosterone levels in obese women's blood: The results of this study showed that the average testosterone concentration in the blood of obese women is (1.11282± 0.1402) ng/ml while in the control group is (0.20023± 0.0837)ng/ml as shown in figure 1 below:

Figure 1: The level of testosterone in the blood of obese women compared to healthy women group.



From the above results, a significant increase of($p<0.05$)is observed in the blood of obese women compared to healthy women group which can be attributed to the relation of the testosterone level the metabolism and this is consistent with Renato study[29].

The influence of average body weight: The samples were divided into two groups according to the weight value, whereas the first group included 18 samples with weight range of (20-30 kg/m2) and while the second group included 32 samples with weight range of (31-45 kg/m2) which has a clear obesity. The P-value of the body weight relation with the testosterone of is ($P < 0.05$) as shown in figure 2. The average hormone concentration of the first group is (0.9611 ± 0.08305) ng/ml while that of the second group is (1.1857 ± 0.10206) ng/ml.

The results indicate that body weight is directly proportional to the level of hormone concentration in women, whereas the higher the weight the higher the levels of the hormone in the blood. This causes many other disorders in the gland and sex hormones and this is consistent with the study of Daniela at al[25].

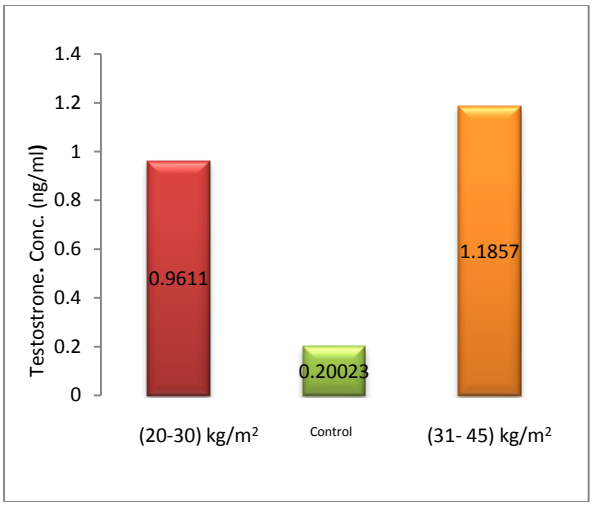
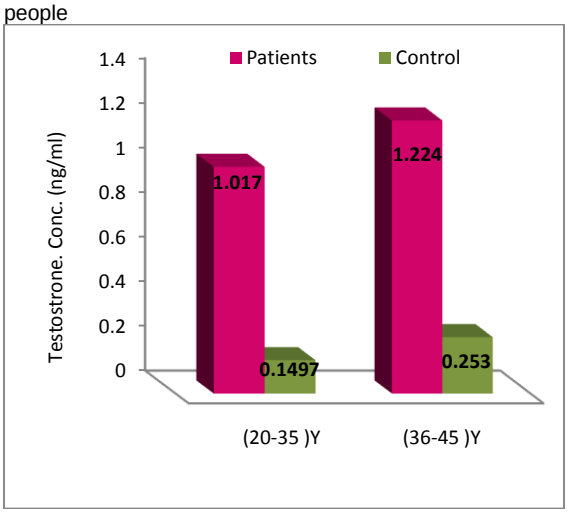


Figure 2: the effect of body weight on the testosterone level in the blood of obese women compared to healthy woman group.

Effect of age: The effect of the age and its relationship with the level of hormone concentration is considered, whereas the age progress had a significant effect on the level of hormone in obese women's blood compared to the control group. The samples were divided into two groups, the first group included 27 samples of (20-35) years old and 23 samples of(36-45)years old of blood of obese women compared to 26 samples of (20-30) years old and 24 samples of (36-45)years old of the control group. The average testosterone concentration of the first group is (1.017±0.107) ng/ml compared to (0.1497±0.0403)ng/ml in the healthy group, while that in the second group is (1.224±0.0927)ng/ml compared to (0.2536±0.0860)ng/ml in the control group, as illustrated in figure 3 below:

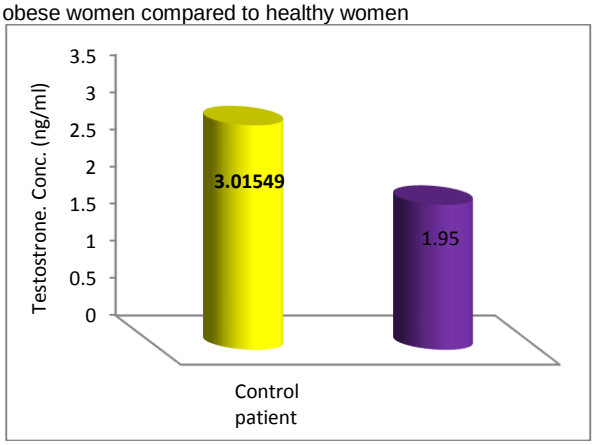
Figure 3: Effect of the rate of age on the level of hormone concentration in the blood of obese women compared to healthy people



From the above results, it is clear that the P value differences is at the level of $P<0.05$ where aging increases testosterone levels, which consequently causes many disorders for women such as androgen icing levels which is contrary to Sbolour[30].

Testosterone level in obese women's urine: The results of the study showed that testosterone appears in the urine of obese women compared to healthy women is at P value differences of P<0.05,where previous studies indicated in different ways its estimation in human urine[31]. The average hormone concentration in the obese women are (1.953±0.1676) ng/ml in comparison to (3.015±0.3022) ng/ml in the healthy woman as shown in figure 4 below.

Figure 4: The level of concentration of testosterone in theurines of obese women compared to healthy women



From the results above, it has been observed that a decrease at the level testosterone. The samples were divided according to weight and age and the effect was observed by dividing the samples into two groups. The first group according to the body weight are depicted in figure 5, whereas the concentration of testosterone is (2.24481±0.221) **kg/m2** and the second group(1.896522±0.11344) **kg/m2** compared to non-obese women.

Figure 5: Effect of body weight on testosteronelevel in the women with obesity compared to healthy women

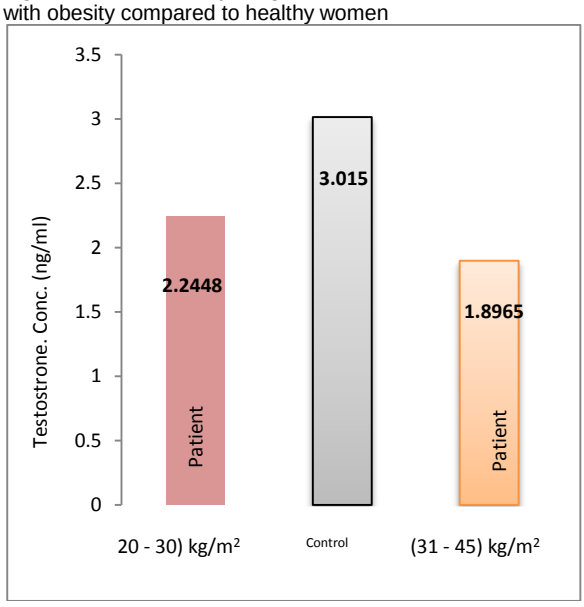
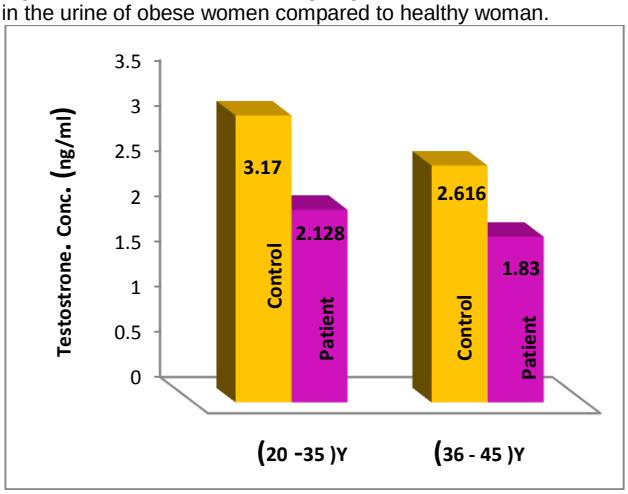


Figure 6 shows the effect of the average age on the level of testosterone in the urine of obese women compared to healthy women, where it is (2.128±0.083) ng/ml in the first group of (20-35) years for women with obesity compared to healthy women(3.17±0.301) ng/ml and the second group (36-45) is(1.835±0.084) ng/ml for women with obesity compared to (2.616±0.2449) ng/ml for the healthy woman. These results show that urine be used as anindicator of testosterone disorders which indicates metabolic disorders and some other diseases and their relationship to obesity[32,33].

Figure 6: The effect of the average age on the level of testosterone in the urine of obese women compared to healthy woman.



CONCLUSIONS

The results showed that obesity has a clear effect on the hormone cetotserone, as wellas age and body mass a direct relationship with it, which was evident in the blood andyield of samples for obese women compared to non-obese women.

REFERENCES

1. Haynes, M.William, ed. CRC Handbook of Chemistry and Physics(92nd ed.). CRC Press.(2011)p. 3.304. ISBN 978-1439855119.
2. S.Melmed, K.S. Polonsky , P.R. Larsen , HM.Kronenberg . Williams Textbook of Endocrinology. Elsevier Health Sciences. (November 30, 2015)pp. 711–. ISBN 978-0-323-29738-7.
3. "Understanding the risks of performance-enhancing drugs". Mayo Clinic. Retrieved December 30, 2019.
4. C.M. Luetjens, G.F. Weinbauer. "Chapter 2: Testosterone: Biosynthesis, transport, metabolism and (non-genomic) actions". In Nieschlag E, Behre HM, Nieschlag S (eds.). Testosterone: Action, Deficiency, Substitution (4th ed.). Cambridge: Cambridge University Press.(2012) pp. 15–32. ISBN 978-1-107-01290-5.
5. A.D. Mooradian, J.E. Morley, S.G. Korenman. Biological actions of androgens. Endocrine Reviews. **8** (1):(1987) 1–28. doi:10.1210/edrv-8-1-1. PMID 3549275.
6. N.Bassil, S.Alkaade, J.E. Morley. The benefits and risks of testosterone replacement therapy: a review. Therapeutics and Clinical Risk Management. **5** (3): (June 2009)427-448.doi:10.2147/tcrm.s3025. PMC 2701485. PMID 19707253.
7. S.P Tuck, R.M.Francis ."Testosterone, bone and osteoporosis. Advances in the Management of Testosterone

Deficiency. Frontiers of Hormone Research. **37**.(2009) pp. 123–32.doi:10.1159/000176049. ISBN 978-3-8055-8622-1. PMID 19011293.
8. A.Qaseem, C.A. Horwitch, S. Vijan, I. Etxeandia-Ikobaltzeta, D. Kansagara. Testosterone Treatment in Adult Men With Age-Related Low Testosterone: A Clinical Guideline From the American College of Physicians. Annals of Internal Medicine. doi:10.7326/(January 2020)M19-0882. PMID 31905405.
9. N.M. Parry. New Guideline for Testosterone Treatment in Men With 'Low T. Medscape.com. Retrieved January 7, 2020
10. V.E Bianchi .The Anti-Inflammatory Effects of Testosterone. Journal of the Endocrine Society. **3**(1):(January 2019). 91–107. doi:10.1210/js.2018-00186. PMC 6299269.PMID 30582096.
11. R. Krysiak, K. Kowalcze, B .Okopień. The effect of testosterone on thyroid autoimmunity in euthyroid men with Hashimoto's thyroiditis and low testosterone levels. Journal of Clinical Pharmacy and Therapeutics. **44**(5)(October 2019): 742–749. doi:10.1111/jcpt.12987. PMID 31183891
12. Testosterone. Drugs.com. American Society of Health-System Pharmacists. December 4, 2015. Retrieved September 3, 2016.
13. Obesity and overweight Fact sheet N°311. WHO. January 2015. Retrieved 2 February 2016.
14. R. C. Kessler, &E. J. Bromet. The epidemiology of depression across cultures.Annu. Rev. Public Health 34,(2013) 119–138.
15. M.Ng, et al.Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet 384,(2014) 766–781
16. N.Jantaratnotai, K.Mosikanon, Y. Lee, &R. S.McIntyre. The interface of depression and obesity. Obes. Res. Clin. Pract. 11, (2017)1–10
17. S.Sidhu, T.Parikh, & K. D. Burman. in Endocrine Changes in Obesity (eds Feingold, K. R., Anawalt, B., Boyce, A., Chrousos, G., Dungan, K., Grossman, A.,et al.) (Endotext, South Dartmouth, MA,(2000).
18. R.Pasquali, &V. Vicennati. The abdominal obesity phenotype and insulin resistance are associated with abnormalities of the hypothalamic-pituitaryadrenalaxis in humans. Horm. Metab. Res. 32,(2000) 521–525.
19. S.Taponen, et al. Hormonal profile of women with self-reported symptoms of oligomenorrhea and/or hirsutism: Northern Finland birth cohort 1966 study. J.Clin. Endocrinol. Metab. 88, (2003) 141–147 .
20. B.Zumoff &G. W Strain. A perspective on the hormonal abnormalities of obesity: are they cause or effect? Obes. Res. 2, (1994) 56–67.
21. H.Jovanovic, et al. Effects of estrogen and testosterone treatment on serotonin transporter binding in the brain of surgically postmenopausal women—a PET study. Neuroimage 106, (2015)47–54 .
22. J.McHenry, N.Carrier, E.Hull, &M.L Kabbaj. Sex differences in anxiety and depression: role of testosterone. Front. Neuroendocrinol. 35, (2014)42–57 .
23. K. S. Kendler&, C. O Gardner. Sex differences in the pathways to majordepression: a study of opposite-sex twin pairs. Am. J. Psychiatry 171,(2014) 426–435.
24. P. R. Albert. Why is depression more prevalent in women? J. Psychiatry Neurosci.40, (2015) 219.
25. C.Sikorski, J.Spahlholz, M.Hartlev &S. G. Riedel-Heller. Weight-based discrimination:an ubiquitary phenomenon? Int. J. Obes. 40, (2016) 333–337.
26. S.Daniela, et al.Testosterone imbalance may link depression and increased body weight in premenopausal women , Translational Psychiatry 9:(2019) 160 ,https://doi.org/10.1038/s41398-019-0487-5.
27. F.T Yazdi , S.M Clee , D. Meyre.Obesity genetics in mouse and human: back and forth, and back again. PeerJ. **3**: (2015)e856, doi:10.7717/peerj.856 . PMC 4375971. PMID 25825681.
28. Kassotis, D.Christopher, Vandenberg, N.Laura. Demeneix, Barbara A.; Porta, Miquel; Slama, Remy; Trasande, Leonardo .Endocrine-disrupting chemicals: economic, regulatory, and policy implications. The Lancet Diabetes & Endocrinology. 8 (8): (1 August 2020). 719–730. doi:10.1016/S2213-8587(20)30128-5. ISSN 2213-8587. PMC 7437819. PMID 32707119.
29. S.Bleich , D.Cutler, C.Murray, A.Adams .Why is the developed world obese?. Annual Review of Public Health (Research Support). 29: .(2008)273–95. doi:10.1146/annurev.publhealth.29.020907.090954. PMID 18173389.
30. P.Renato, Obesity and androgens: facts and perspectives Affiliations expand. 85(5): (2006 May) 1319-40. doi: 10.1016/j.fertnstert.2005.10.054 PMID: **16647374.**
31. S. Bolour, G.Braunstein. Testosterone therapy in women: a review" International Journal of Impotence Research. Volume 17, (12 May 2005) pages399–408(2005)Cite this article.
32. A. A. A.Ismail, R. A. Harkness. A method for the estimation of urinary testosterone , Biochem J. ,99(3):(1966) 717–725. doi: 10.1042/bj0990717PMCID: PMC1265063.PMID: 5964968
33. A.Eleni , L. Irene .Androgens and cardiovascular disease in women and men. Affiliations expand, 104:(2017 Oct)54-72. doi: 10.1016/j.maturitas. 2017.07.010. Epub 2017 Jul 29. PMID: **28923177.**
34. **J .**Hugo, , et al**.**Overweight, Obesity, and Survival After Stroke in the Framingham Heart Study. Affiliations expand. **6**(6):.(2017 Jun 24) e004721. doi: 10.1161/JAHA . 116.004721 . PMCID: PMC5669145. PMID: 28647687