

Effect of Obesity on Serum Estrogen concentration and ovarian growth with uterine development in Mature Female Wistar Rats

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Abstract

The present study has been carried out at the College of Veterinary Medicine ,AL-Qadisiya University to determine the effect of obesity on serum Estrogen concentration in mature female Wistar rats.Fifty immature female rats (14-20 days age,30-40g.) were housed at the animal house during the period extended from 25th March,2011 to 10th June,2011.Animals were randomly divided into two equal groups. Control fed on standard feed and treated fed on high fat feed (32.3%fat by weight and 4828 k cal/kg energy). Daily body weights were recorded during the experiment period extended to the 100th day of age .At 60 days of age ,eight of mature female Wistar rats from each group were anesthetized, dissected and blood samples were obtained from abdominal vein for assessment of Estrogen concentration in serum. Ovaries and uteri were also obtained, weighted and fixed in formalin 10% for histopathological study.Ovarian and uterine weights of treated group recorded significant decrement in comparison with that of control.Hormonal assay in sera showed significant decrement of estrogen in treated mature female rats in comparison with that of control female rats. Ovarian sections of treated female rats revealed lower level of proliferation in the follicular tissue and predominance of Graffian follicles compared with control. Similarly uterine sections of treated female rats showed filtration of adipose tissue with less proliferated changes and less uterine glands compared with that in control.

Introduction

The primary consequence of energy excess is obesity, which is associated with decreased life span, increased incidence and severity of degenerative diseases ,earlier onset and incidence of neoplasia (1).Obesity is a major cause of ill health and mortality in countries where it is prevalent largely via increased rates of ischaemic heart disease, stroke, diabetes ,hypertension and osteoarthritis, with cancer (2).The rat is a useful model for the study of obesity because the obesity is expressed only when the rats are fed a diet

moderately high in energy and fat content(3) Estrogen induces LH and FSH receptors and stimulates the LH surge required for ovulation. Estrogen also modulates its own production, and the estrogen concentration in the follicular fluid has been correlated to the oocyte maturation (4).Excess energy more than any specific nutrient is the most important dietary factor contributing to obesity(5).Obesity decreases successful pregnancy rate in both natural and assisted conception cycles(6).

Materials and Methods

Experimental Animals

Fifty immature female Wistar rats,14-20 days of ages ,weighted(30-40g.) were reared in plastic cages with a bottle for drinking water and food containers and stay in animal house was prepared for this experiment. The animal house was supplied with ventilator, fan and air conditional in order to control the room temperature between 21-23⁰c. The duration of lighting was standardized to be 8L:16D hours. Experimental animal supplied with

food (standardized diet according to NRC,1976)and high fat diet(Mercer and Archer,2005) and drinking water ad lebitum during the experimental period (from 25 March 2011 until 10 June 2011) .

Experimental Design

Fifty immature female Wistar rats (14-20days of ages, weighted 30-40g.)were randomly divided into two equal groups (control and treated groups),and animals were treated as follows:

1-Control (C) :25 immature female Wistar rats were supplemented with standard food.

2-Treated group (T): 25 immature female Wistar rats were supplemented with fat – rich food.

Daily body weight was recorded ,at 60 days of age eight of mature female rats from each group were anesthetized, dissected and blood samples were obtained

from abdominal vein, then serum separated from coagulated blood samples by centrifugation at (3000 rpm) for 15minutes , stored at-18C° till hormonal analysis. Weight of uterus and ovaries were recorded and preserved in formalin 10% for histopathological examination. Estrogen concentration in serum was detected by ELIZA technique as ABO Switzerland co.,LTD company procedure.

Results and Discussion

Results of serum concentration of estrogen (ng/L) clarified in (Fig.1) revealed significant ($p \leq 0.05$) decrement in mean value of estrogen concentration in serum of treated mature female rats (208.26 ± 30.34) as compared with concentration of this hormone in serum of control mature female rats (302.90 ± 48.86), this decrement causes significant decreasing in mean value of ovarian weight of treated mature female rats (0.84 ± 0.06 g./100g. B.W.) as compared to control (2.13 ± 0.17 g./100g. B.W.). Uterine weights recorded significant decrement in mean value of treated mature female rats (0.85 ± 0.14 g./100g.B.W.) compared with control (1.78 ± 0.27 g./100 g B.W.). The principle function for estrogens is to cause cellular proliferation and growth of the tissues related to reproduction (7). Histological sections obtained from ovaries of mature female rats of treated group showed increment in number of secondary follicles with no(or) few number of small Graffian follicles, inhibition of follicular development and filtration of adipose tissue through the ovary (Fig.2) compared with histological

sections obtained from control mature female rats which revealed high number of Graffian follicles with large size and increase of tissue proliferation with normal appearance(Fig.3). Estrogen stimulate the follicular and endometrial growth of ovaries and uterus respectively (8). Examination of the histological sections obtained from uteri of mature female rats revealed that high fat diet has a negative role in proliferation and differentiation of uterine layers, mainly endometrium and myometrium with filtration of adipose tissue and decrease number of uterine glands (regression of uterine layers)(Fig.4) in compare with sections of mature female rats in control which showed thickness in endometrium with high number of uterine glands and thickness in myometrium (Fig.5). This results agree with previous result of this study(significant decrement in serum concentration of Estrogen). Estrogens act on the uterus to increase the mass of both endometrium and myometrium .The increased growth is due to both cell hyperplasia and hypertrophy (Reeves,1987).

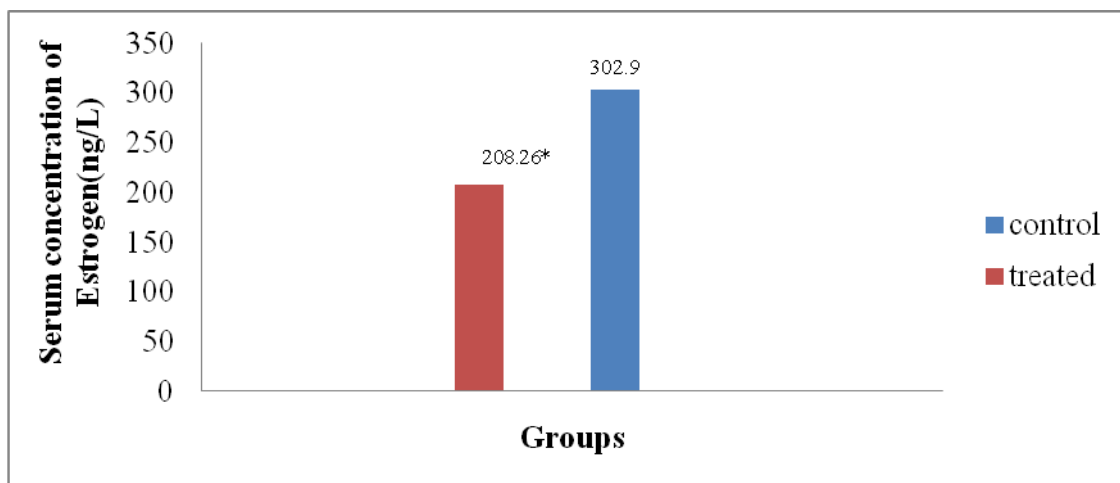


Fig.(1):Effect of obesity on Estrogen concentration (ng/L) in serum of mature female rats, n=8.

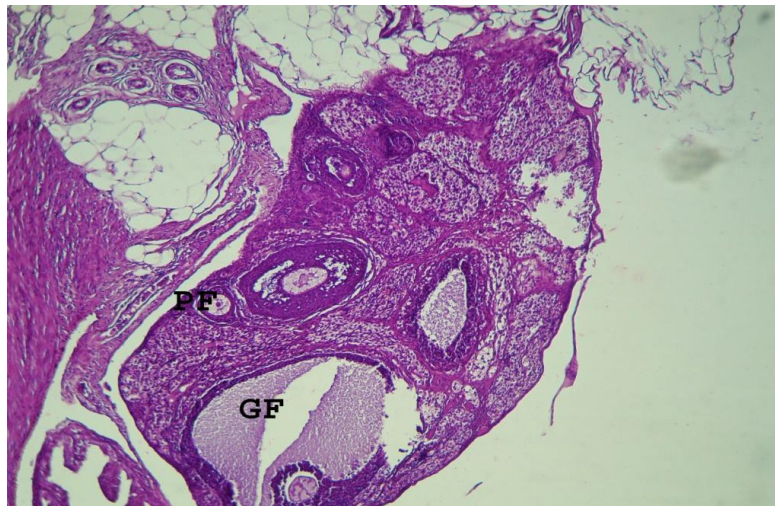


Fig.(2): Section of mature ovary from treated female rat show few number of primary follicles(PF) and one Graafian follicle(GF)(H&E X100).

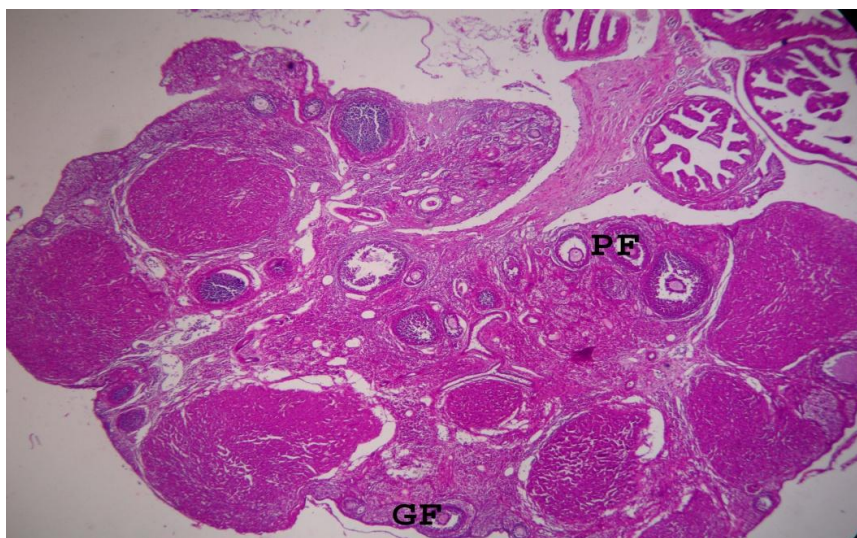


Fig.(3):Section of mature ovary from control female rat show tissue proliferation with large number of primary follicles(PF) and Graafian follicles(GF) (H&E X100).

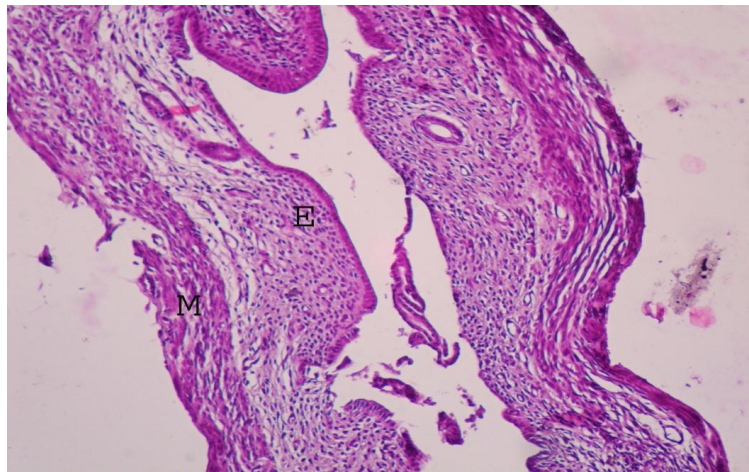


Fig.(4):Section of mature uterus from treated female rat show regression in uterine layers thin endometrium(E)and thin myometrium(M)(H&E X100).

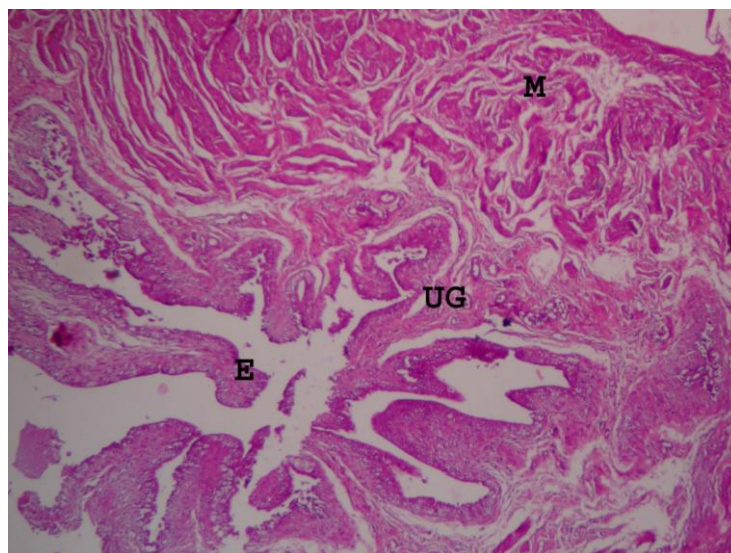


Fig.(5):Section of mature uterus from control female rat show thickness in endometrium(E) with high number of uterine glands(UG)and thickness of myometrium(M)(H&E X100).

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تأثير السمنة على تركيز هرمون الاستروجين في مصل الدم ونمو المبايض وتطور الرحم في اناث جردان الوستر الناضجة

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أجريت الدراسة الحالية في كلية الطب البيطري بجامعة القادسية بهدف تحديد تأثير السمنة على تركيز هرمون الاستروجين في مصل الدم نمو المبايض و تطور الرحم في اناث جردان الوستر الناضجة. تضمنت الدراسة ايواء 50 من اناث جردان الوستر غيرا لناصرجة (بعمر 20 -14 يوما" وتزن 40-30غم) في البيت الحيواني للمدة من 25 اذار الى 10 حزيران من العام 2011. قسمت اناث الجردان عشوائيا على مجموعتين متساويتين (السيطرة والمعاملة) وسجلت أوزانها الابتدائية، إذ أعطيت اناث السيطرة عليه قياسية حسب جداول إل NRC وأعطيت اناث المعاملة عليه عالية الدهن (بنسبة 32.3%) طول فترة التجربة .استمر تسجيل أوزان الجسم يوميا للمجموعتين ولغاية نهاية التجربة.بعمر 60يوما،ثمانية من اناث الجردان الناضجة تم تخديرها وشرحت واخذت منها نماذج دم من الوريد البطني لغرض قياس تركيز هرمون الاستروجين،كما تمت إزالة المبايض والأرحام وسجلت أوزانها وحفظت في الفورمالين 10% لغرض إجراء الدراسة النسيجية عليها.أوزان المبايض والأرحام سجلت انخفاضا" معنويا" في اناث مجموعة المعاملة عند مقارنتها مع السيطرة.كما وأظهرت نتائج الدراسة انخفاضا" معنويا" في تركيز هرمون الاستروجين في اناث المجموعة المعاملة بالمقارنة مع تركيزها في اناث السيطرة.أظهرت الدراسة النسيجية مستوى منخفض من تطور النسيج الحويصلي وبالاخص جريبات كراف.وبشكل مشابه،أظهرت المقاطع النسيجية المأخوذة من أرحام اناث المعاملة انتساح للنسيج الدهني مع قلة في نمو و تطور الطبقات الرحمية وقلة أعداد الغدد الرحمية مقارنة مع أرحام اناث السيطرة.