WWJMRD 2021; 7(3): 44-49
www.wwjmrd.com
International Journal
Peer Reviewed Journal
Refereed Journal
Indexed Journal
Impact Factor SJIF 2017: 5.182 2018: 5.51, (ISI) 2020-2021: 1.361
E-ISSN: 2454-6615

Abeer Ataallah Ayyed Al-Hadidy
Biology department, College of Science, Mosul University, Mosul, Iraq.

Mowafak Khalil Hassan
H.O.D., Department of Biology department, College of Science, Mosul University, Mosul, Iraq.

Shaimaa Obaid Mostafa
Biology department, College of Science, Mosul University, Mosul, Iraq.

Correspondence:
Abeer Ataallah Ayyed Al-Hadidy
Biology department, College of Science, Mosul University, Mosul, Iraq.

Relationship between some hormones and obesity

Abeer Ataallah Ayyed Al-Hadidy, Mowafak Khalil Hassan, Shaimaa Obaid Mostafa

Abstract
Obesity has become a real problem. Its existence cannot be ignored because of the great harms and its association with serious diseases such as heart disease, blood vessels diseases, diabetes and the digestive system diseases, in addition to its association with hormonal diseases, so the imbalance in some hormones is a major cause of obesity, such as hypothyroidism, adrenal glands disorders, also women affected with polycystic ovaries syndrome because of its characteristics which lead to obesity, that obesity may develop many another disorders such as infertility and insulin resistance. In addition to growth hormone deficiency and hypogonadism. Finally the relationship between obesity and adipose tissues hormones like leptin hormone, which increase in obese peoples, thus, it exposes them to the risk of contracting the aforementioned diseases.

Keywords: Obesity, Body mass index, Hypogonadism, Polycystic ovaries syndrome, Leptin resistance.

Introduction
In the last few decades, most countries of the world have witnessed changes in the lifestyle of individuals, especially those emerging from them, these changes have negative consequences for the health of society, including increased physical inactivity, a decrease in the rate of physical activity, an increase in the rate of energy intake through food and an increase in the amount of fat in the body (Al-Salem, 2016).

Many may view obesity as a simple matter, and some may view it as just an unacceptable view or a distortion of the beauty of the body, and a few may perceive its danger, yet they stand idly by and are unable to stop it, and obesity was historically considered a sign of wealth and prosperity, and the Greeks were the first who define obesity as a health disorder, as Hippocrates wrote, “Obesity is not only a disease in itself, but it is a precursor to other diseases as well (Al Suleiman, 2007).

The phenomenon of overweight or obesity in human societies has received the attention of many scientists and researchers in terms of its causes and risk factors resulting from it due to the danger it poses to health, due to its association with many chronic diseases such as heart disease, blood vessels diseases, diabetes, the digestive system diseases, and arthritis, and some hormonal diseases, in addition to other negative psychological, social and economic effects, also obesity impedes community development and incurs money and human losses, through what is spent on obese patients in their treatment, whether with medication or surgery, such as sleeve gastrectomy surgery (Mohamed, 2017).

In 1997 the World Health Organization declared obesity a global epidemic, and according to the organization’s 2008 estimates, 1.5 billion adults (20 years and over) are overweight, more than 200 million men, and nearly 300 million women suffer from obesity, and that more than 700 million will suffer from obesity by the year 2015, and by 2025 it is expected that about 60% of deaths around the world will be due to vascular diseases, and this confirms that avoiding the problem of obesity and controlling it must be taken seriously in industrialized and developing countries; (Kelly *et al*., 2008); (WHO, 2016) It has also been reported that the number of adolescents, males and females, jumped from 5 million females and 6 million males since 1975 to 50 million males and 74 million females in 2016 (Collaboration NCDRF, 2017). The problem of overweight and obesity is one of the most prominent

contemporary problems in Iraqi society today, as the Iraqi Ministry of Health and Environment announced in 2016 that the number of people suffering from obesity in 2015 reached about 65%, equivalent to 29 million people, and this is due to the lack of physical activity (Al Mada journal, 2018).

Definition of obesity

Obesity is one of the common health problems among different peoples of the world, and the terms overweight and obesity refer to a person's weight in general and from where this increase, so the term overweight means an increase in body weight in terms of muscle, bone, fat and water, and the term obesity means the presence of large amounts of excess fat in the body (Salama, 2005).

There are several definitions of obesity, including that it is an increase in body weight beyond its normal limit as a result of the accumulation of fat in it, and the accumulation may be all over the body or in specific places of it, and this accumulation results from an imbalance between the energy provided by food and the energy consumed by the body and results in the accumulation of fat in the body. As a result of either the increase in the size of the fat cells or due to the increase in their number (Mohamed, 2017).

Obesity is a cumulative process that does not form within days or weeks, but rather it comes as a result of overeating over the years, and the person is the one who controls the required percentage of calories or the ability to burn and drain the surplus of them through movement and sports activities (Abu Hamed, 2009).

There are those who defined it as the accumulation of fat as a result of an imbalance between food energy and the energy consumed by the body, and this happens in the following cases:

1) An increase in energy intake.
2) Lack of energy consumed by the body.
3) An increase in energy intake and a decrease in energy consumed at the same time.

A person is considered obese if his weight exceeds 20% of his normal weight according to age and height and if his body mass index (BMI) is 30% or more (Radwan, 2004).

It is noticed from the foregoing that the excess energy from the body's need is stored in the form of fats that lead to obesity, so it became necessary to know the source of this energy and the unit of measurement. Energy is measured in caloric unit, which is the energy needed to raise the temperature of one kilogram of water by one degree celsius, and a person gets energy from foods of all starchy, fatty and protein types when eating starches, complex sugars turn into monosaccharides that the body uses directly as energy, and part of it is stored in the liver and muscles in the form of glycogen, the body uses it when needed, and the excess turns into fats for storage in adipose tissue, as for fats, they turn into fatty acids that are stored as fats and glycerol, which turns into glycogen and monosaccharide to produce energy when needed, and proteins are convert into simple compounds, which are amino acids that are taken by the muscles, and what remains are transformed into fats that are stored in the fatty tissues. The sum of what was mentioned that nutrients of all kinds and all the energy that is surplus to the body's need are converted into fats that are stored and lead to obesity (Guyton and Hall, 2006).

The human body contains 30-35 billion fat cells that increase in size when increasing weight and with the continuation of the increase, new adipose cells are formed and these new cells are difficult to get rid of later (Abdel-Al, 1995). Fat cells differ in their functions, composition and locations, as they are divided into two types:

1) White fat cells: They are found directly under the skin and around the thighs and buttocks, and their function is to store energy. They represent 90% of the fat in the body.
2) Brown fat cells: They are found around the spine and around the internal organs, and their function is to consume stored energy, as they convert calories into heat and provide the body with energy using the fat consumed.

The distribution of these two types of cells is determined by genes, but the ratio of white cells to the brown changes with age, as brown cells decrease with age, in contrast, white cells increase, and this explains the tendency of the body to increase in weight with age (Giralt and Villarroya, 2013).

How to measure obesity (when a person is said to be obese)?

Obesity is measured by measuring body fat, not by measuring weight alone, because weight gain in a person may be caused by an increase in muscle mass in the body and there are several ways to measure obesity, the most important of which are:

1. Body Mass Index (BMI)

This indicator is known by dividing the body weight in kg by the square of height in meters, for example a person whose height is 1.6 m and weighs 80 kg will be:

$$BMI = 80 \div (1.6)^2$$

$$BMI = 31.25$$

The BMI percentage can be calculated based on the previous equation, multiplying the result by 100, so it is 31.25% (Fan *et al*., 2017).

This person is considered obese based on the following schedule:

BMI classification	
Underweight	<18.5
Normal range	18.5 – 24.9
Overweight:	>=25.0
Preobese	*25.0 – 29.9*
Obese:	>=30.0
Obese class I	*30.0 – 34.9*
Obese class II	*35.0 – 39.9*
Obese class III	*>=40.0*

Classification of adults according to BMI (James *et al*., 2001)

As for growing children, there are tables of BMI by age group and gender, as well as people with large muscle masses such as athletes also pregnant women. (Jackson *et al*., 2002).

Body mass index is considered the best way to measure body weight and its accuracy is less in the case of athletes who have excess weights due to the large muscles and not the accumulation of fat in the body (Miller *et al*., 2004).

2. Measure the waist circumference

Fat accumulated in the waist is the most important indicator of the occurrence of diseases resulting from obesity, and we must beware of weight if the waist circumference is greater than 88.5 for women and 92.5 for men.

3. Other ways

Tomography, magnetic resonance imaging and ultrasonography (Mozaffarian *et al*., 2016).

Forms of obesity

1) Female obesity "Gynoid": the location of fatty tissue in the hips, thighs, and pelvis below the trunk.
2) Male obesity "Android": the localization of adipose tissue in the abdominal wall, around the stomach and chest wall, with an accompanying risk factor for arterial sclerosis resulting from this form of obesity (Palmer and Clegg, 2015).

Types of obesity

Type I: It begins in childhood and continues with longevity and is usually difficult to treat because obesity is due to an increase in the number of fat cells "hyperplasia" and these cells cannot be eliminated in old age by limiting calories.
If the number of fat cells increases, they do not decrease in number even with the practice of various weight loss programs, but the size of fat cells only decreases with more difficulty than simple obesity, and therefore most children with obesity remain in their condition even after puberty.

Type II: Appears in middle age and in women more than the men and its reason is due to an increase in the size of adipose cells "Hypertrophy", not an increase number of them, and this type can be treated with proper nutrition (Purnell, 2018).

Causes of obesity

There are several reasons that may lead to obesity, including:

1. Dietary style

Adopting a high-calorie-rich food without dispensing these calories leads to the accumulation of fats, knowing that fats have a higher efficiency of agglomeration in the fatty tissues of the body more than proteins and carbohydrates and are the cause of 90% of obesity cases (Fedorcsa´ck et al., 2000).

2. Genetic factor and family history

Genetic factors play a role in the body's effectiveness in converting food into energy, as well as in the amount of fats stored in the body and the places where it is distributed, but genetic configuration does not guarantee obesity.
The family's history increases the chances of obesity due to common genes or a common environment such as eating foods rich in calories Heat and lack of physical activity (Salama, 2005). As for family and twin studies, they indicate that the cause of obesity is primarily heritable, with a contribution for this reason ranging between 84-60% (Miller *et al*., 2004). The genes leading to obesity have been shown to be related to the work of mitochondria, which in turn determines the rate of metabolic reactions in humans, and is usually inherited through the mother (Eaaswarkhanth *et al*., 2019).

3. Age

Obesity rates increase with age, due to which metabolism rates decrease and the body's need for energy decreases (Kim and Shin, 2020).

4. Lack of sleep

Hormonal changes that make the individual feel hungry and the need to eat caused by lack of sleep. People who stay up at night feel hungry despite eating enough food, due to the low levels of the satiety hormone "leptin" and the high hunger hormone "ghrelin". (Spiegel *et al*., 2004), in addition to the high level of the "cortisol hormone", which leads to rapid weight gain. Good sleep allows the body to get rid of toxins and maintain the balance of the metabolism (Karam and McFarlane, 2007). Some have also hypothesized that sleep deprivation and its effects on intestinal hormone secretion may contribute to the development of obesity (Spiegel *et al*., 2004).

5. Sex or race

There are some races prone to obesity, such as the Mediterranean region, Americas and Negroes, while it is lower in the Far Eastern races such as Japan and China, and the white races in Europe. (Lincolin *et al*., 2014).

6. Psychological state

Obesity is affected by the emotional state of a person, where in many cases of frustration, failure, or loneliness, some resort to eating large quantities of food, and there are individuals who are on the contrary, as their ability to eat increases in cases of happiness and success (Banting, 2017).

7. Some medications

These include corticosteroids, antidepressants and contraceptives, and these lead to slowing down the speed of metabolism, increasing appetite hormones, increasing absorption and storage of glucose in the body, and fluid retention in the body, all of which lead to obesity. (Simmons *et. al*., 2016); (Ranjbar *et. al*., 2013).

8. Hormonal disorders

Hormonal disorders include several types, all of which lead to obesity as one of its symptoms, including:

1) Hypothyroidism

The thyroid gland at the base of the neck produces three hormones: T_3, T_4, and calcitonin. The T_3 and T_4 hormones regulate the metabolism and growth in general, and increase the metabolism rate by burning the fat tissue, and in the event of a deficiency of these hormones, a deficiency in the function of the gland results in which the metabolic rates decrease with unexplained weight gain and a feeling of laziness and physical fatigue (Salem, 2017).
These hormones are characterized by their function related to the metabolism of carbohydrates, fats and proteins, thus regulating growth, fetal formation and maturation, and in adults, gland insufficiency is often associated

with a lack of iodine in food, which results in an enlarged thyroid gland, and these hormones increase metabolism rates by increasing the general body metabolic rate, which is the rate that is when the body uses oxygen to transport all kinds of nutrients and also increases the production of body heat for all body tissues resulting from the burning processes.

T_3 and T_4 hormones are also necessary for normal growth because it works together with Growth Hormone in building protein, so when these hormones are absent during the growth phase, the ability of growth hormone to proteins synthesis decreases. In addition to its important role in organ development, especially the nervous system (Karam and McFarlane, 2007)

2) Adrenal gland disorder

They include an important disease called Cushing syndrome:

Cushing syndrome occurs when the body is exposed to high levels of the cortisol hormone for a long time. Cushing syndrome, sometimes called hypercortisolism, may be caused by oral corticosteroid medications. This hormone is produced by the adrenal cortex and may increase its production due to an overproduction of Corticotropin realizing hormone (CRH) or Adrenocorticotropic hormone (ACTH) from the hypothalamus and the pituitary gland respectively, which leads to overstimulation of the adrenal cortex or by adrenal gland tumor that leads to a significant increase in the production of this hormone without relying on the hormone ACTH to stimulate the cortex to produce cortisol.

High level of cortisol can cause some of the hallmarks of Cushing's syndrome: a fatty hump between the shoulders, a round face, and pink or purple stretch marks on the skin. Cushing syndrome can also result in high blood pressure, osteoporosis, and, in some cases, type 2 diabetes due to the role of the hormone cortisol in raising blood sugar by breaking down glycogen in the liver and muscles. (Guyton and Hall, 2006).

Common signs and symptoms of Cushing syndrome include weight gain and fatty tissue deposits, especially around the middle and upper back, on the face (the full face), and between the shoulders (the buffalo hump).

As the hormone cortisol plays an effective role in the metabolism of carbohydrates, proteins and fats, and for fats, it increases the effectiveness of the enzyme lipoprotein lipase in fat cells, and this ultimately leads to the accumulation of fats in the body in addition to that the hormone cortisol have a role in the differentiation of fat cells during their transformation into mature fat cells and its role In fat distribution, especially in the abdominal area (Karam and McFarlane, 2007).

Women with Cushing syndrome may experience these signs and symptoms, as well as hirsutism, and irregular or absent menstruation. As for the signs and symptoms that men with Cushing's syndrome may experience, decreased sexual desire, and decreased fertility due to a decrease in the levels of the male hormone Testosterone (Guyton and Hall, 2006).

3) Polycystic ovaries syndrome

It is considered one of the most important diseases that infect women, and it affects about 10-5% of women before menopause, as the polycystic ovary is characterized by the collection of small sacs whose number ranges between (10-6) bags or more surrounded by layers of enlarged theca cells of the enlarged follicles (Koivunen, 2001).

It is characterized by symptoms including insulin resistance, lack of ovulation, hirsutism and obesity, as obesity is considered a disorder associated with this syndrome, and usually their obesity is similar to the pattern of obesity in males or central obesity concentrated in the trunk and extremities, i.e. the rise of the circumference of the abdomen to the circumference of the hip, and this causes a disturbance in the level of fat in the body, which is itself a risk factor for cardiovascular disease, and the relationship between polycystic ovaries,

insulin resistance and obesity is not known to cause, but the increase in insulin, especially in the presence of obesity, leads to an increase in the level of androgens by stimulating their synthesis in theca cells in the ovaries (Karam and McFarlane, 2007).

Obesity is one of the most important causes of female infertility, as it leads to a lack of ovulation, and results in insulin resistance and thus hyperinsulinemia, and this rise leads to inhibit the conversion of testosterone into estrogen, and the low level of this hormone causes lack of ovulation and then to infertility (Al-Fakhoury and Dawood, 2017).

4) Growth hormone deficiency

Decreased secretion of growth hormone is one of the most important hormonal diseases of the pituitary gland, as the hormone plays an important role in regulating energy consumption, the level of body stores, as well as bone mineral density and lipid metabolism, as growth hormone inhibits the lipoprotein lipase enzyme and increases the breakdown of fat in adipose cells (Dietz and Schwartz, 1991), in addition to its role in proteins synthesis and increasing muscle mass, deficiency of this hormone in adults leads to a decrease in muscle mass, an imbalance in the distribution of fats, and a clear increase in weight (Karam and McFarlane, 2007).

5) Hypothalamic obesity

Obesity is the most important characteristic of patients with hypothalamic tumor, and this leads to a decrease in the body's metabolism, which leads to the accumulation of fat in the body and thus to obesity, due to a significant increase in the production of the cortisol hormone (Daousi et al., 2005).

6) Hypogonadism

Genital steroids play an important role in regulating fat distribution in the body, especially during puberty, and male hormones, "androgens", are involved in fat metabolism. Testosterone inhibits the enzyme lipoprotein lipase, so the decrease in androgens is associated with obesity and the metabolic syndrome.

Women in the postmenopausal stage and beyond suffer from obesity, especially concentrated in the abdomen, due to the loss or decrease of estrogen, as well as progesterone, a decrease in the concentration of growth hormone, a clear imbalance in the body's metabolism, and an increase in cholesterol and blood sugar (Garaulet *et al*., 2002). Therefore, treatment with artificial or natural estrogens from medicinal plants alleviate these symptoms (De-Luis *et al*., 2006).

7) Insulinoma

It is an increase in insulin secretion as a result of a tumor in the secreting cells of this hormone, and it is considered a rare case as a result of a sharp increase in the secretion of the insulin hormone, and this condition is often associated with obesity in about 39-18% of them, and the occurrence of obesity is due to an increase in food consumption and increased energy entering the body As a result of the action of the insulin hormone (Karam and McFarlane, 2007).

8) Melatonin hormone disorder

The hormone melatonin is secreted by the pineal gland that helps maintain the circadian rhythm, i.e. sleep. Melatonin levels tend to rise from evening until late at night and go down early in the morning, so it is better to sleep in a dark room, when melatonin levels rise, body temperature drops, and growth hormone is released, which helps the body to heal, helps build and strengthen muscles, and increases bone density. However, the lack of adequate sleep or the required darkness, increased tension and insomnia are all factors leading to weight gain due to the deficiency of this hormone (Cipolla-Neto *et al*., 2014).

9) Leptin resistance

The hormone leptin regulates the energy balance in the body by inhibiting hunger, and it is called the satiety hormone, produced by fat cells. Leptin
reduces appetite by acting in specific centers of the brain to reduce the desire to
eat. Levels of leptin tend to be higher in obese people, compared to normal- weight people. However, despite the presence of higher levels of this hormone, which reduces appetite, obese people are not sensitive to the effects of the hormone leptin, and as a result, they do not tend to feel full during the meal, especially if the food is rich in sugar. Excess fructose convert to fats that are deposited in the liver, abdomen and other areas of the body, but in the case of extravagance, the brain stops receiving the signal to stop eating (Leptin resistance) (Facey *et al*., 2017), and this ultimately leads to weight gain. In turn, these foods reduce the concentration of the hormone adiponectin, which leads to a decrease in glucose metabolism. Thus, it leads to obesity (Kadowaki *et al*., 2006).

Acknowledgment

The author is grateful to the university of Mosul/ College of Science.

References

1. Abu Hamed, S. (2009). Obesity is a disease of the century from A to Z. 1st edition, Khatarat for publishing and distribution. Damascus. Syrian Arab Republic.
2. Al-Fakhoury, H. and Dawood, I. (2017). Polycystic ovary syndrome. A mystery that baffles doctors despite the ease of treatments. New Life journal, (7799): 17.
3. Al-Salim, A.A. (2016). Lifestyle and its relationship to overweight and obesity in adolescents: a field study on high school students in Riyadh. Doctoral thesis, College of Arts / Department of Social Studies. King Saud University. Saudi Arabia.
4. Al Suleiman, N. A. (2007). Nutritional and health factors related to chronic diseases among Saudi women in Jeddah. Master Thesis. College of Education for Home Economics / Department of Nutrition and Food Sciences. King Abdulaziz University. Saudi Arabia.
5. Banting, E. (2017). Understanding the psychological factors associated with overweight and obesity. Doctoral thesis. Harris Manchester College. University of Oxford. UK.
6. Block, N. and Buse M. (1989). Effects of hypercortisolemia and diabetes on skeletalmuscle insulin receptor function *in vitro* and*in vivo*. *Am. J. Physiol.* 256: 39-48.
7. Cipolla-Neto, J.; Amaral, F.; Afeche, S. *et al*. (2014). Melatonin, Energy Metabolism and Obesity: a Review. *J. Pineal Res*., 56:371-381.
8. Collaboration NCDRF. (2017). Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128.9 million children, adolescents, and adults. Lancet, 390: 2627-2642.
9. Daousi, C.; Dunn, A.; Foy, P.; MacFarlane, I. and Pinkney, J. (2005). Endocrine and neuroanatomic features associated with weight gain and obesity in adult patients with hypothalamic damage. *Am. J. Med,*. 118(1): 45-50.
10. De- Luis, D.; Aller, R.; Sagrade, J. (2006). Effects on health of soy in menopausic women. *Rev. Clin. Esp*., 206(4): 205-207.
11. Dietz, J. and Schwartz, J: (1991). Growth Hormone alters lipolysis and hormone-sensitive lipase activity in 3T3-F442A adipocytes. *Metabolism* 40(8):800-806.
12. Eaaswarkhanth, M.; Melhem, M.; Sharma, P. *et al*., (2019). Mitochondrial DNA D-loop sequencing reveals obesity variants in an Arab population. *The Application of Clinical Genetics*, 12: 63–70.
13. Facey, A.; Dilworth, L. and Irving, R. (2017). A Review of the Leptin Hormone and the Association with Obesity and Diabetes Mellitus. *J Diabetes Metab*, 8(3): 1-8.
14. Fan JG, Kim SU, Wong VW. (2017). New trends on obesity and NAFLD in Asia. *J Hepatol.*, 67:862-873.
15. Fedorcsa´ck, P.; Storeng, R.; Dale, P. and Tanbo, T. (2000). Obesity is associated with early pregnancy loss after IVF or ICSI. *Acta Obstet Gynecol Scand*., 79(8):43.
16. Garaulet, M.; Pérez-Llamas, F.; Baraza, J. *et al.* (2002). Body fat distribution in pre- and post-menopausal women: metabolic and anthropometric variables. *J. Nutr. Health Aging*, 6(2): 123-126.
17. Giralt, M. and Villarroya, F. (2013). White, Brown, Beige/Brite: Different Adipose Cells for Different Functions. Endocrinology, 154:2990-3000.
18. Guyton, A. and Hall, J. (2010). "Text Book of Medical Physiology". W.B. Saunders Company, China.
19. Jackson AS, Stanforth PR, Gagnon J, Rankinen T, Leon AS, Rao DC, Skinner JS, Bouchard C, Wilmore JH. (2002). The effect of sex, age and race on estimating percentage body fat from body mass index: The Heritage Family Study. *Int J Obes Relat Metab Disord*., 26: 789-796.
20. James, W.; Leach, R.; Kalamara, E. and Shayeghi, M. (2001). The Worldwide obesity epidemic. *Obesity research*, 4(11): 228-233.
21. Kadowaki, T. and Yamauch, T. (2005). Adiponectin and adiponectin receptors. *Endocrnol. Rev*., 26: 439-

451.
22. Karam, J. and McFarlane, S. (2007). Secondary causes of obesity. *Therapy.*, 4(5), 641-650.
23. Kelly T., Yang W., Chen C.-S., Reynolds K. & He J. (2008). Global burden of obesity in 2005 and projections to 2030. *Int. J. Obes.*, 32:1431-1437.
24. Kim, K. and Shin, Y. (2020). Males with Obesity and Overweight. *J obesity metabolic syndrome*, 29: 18-25.
25. Koivunen. (2001). Endocrine and metabolic changes in women with polycystic ovaries and polycystic ovary syndrome. University of Oulu, Finland.
26. Lincolin, K; Abdou, C, and Lioyd, D. (2014). Race and Socioeconomic Differences in Obesity and Depression among Black and Non-Hispanic White Americans. *J Health Care Poor Underserved*, 25(1): 257-275.
27. Miller, J.; Rosenbloom, A. and Silverstein, J. (2004). Childhood Obesity. *J. Clin. Endocrinol. Metab*., 89(9): 4211-4218.
28. Mohamed, R. (2018). Effect of Obesity on Females Hormones among patientsattended Dr. Elsir Fertility Center 2017. Master thesis. College of medicine. International university of Africa.
29. Mozaffarian D, Benjamin EJ, Go AS, Arnett DK *et al*. (2016). Heart Disease and Stroke Statistics-2016 Update: A Report from the American Heart Association. *Circulation*, 133: 348-360.
30. Palmer B. and Clegg D. (2015). The sexual dimorphism of obesity. *Mol Cell Endocrinol*., 402:113-119.
31. Purnell, J. (2018). Definitions, Classification, and Epidemiology of Obesity. *NCBI*, www.endotext.com.
32. Radwan, M. R. (2004). The personal health of the athlete. 1st. Rashid Library for Publishing and Distribution. Zagazig. Egypt.
33. Ranjbar, S.; Pai, N. and Deng, CH. (2013).The Association of Antidepressant Medication and Body Weight Gain. *Online J Health Allied Scs*., 12(1): 1-9.
34. Salama, KH. M. (2005). The effect of daily lifestyle on fat percentage and body weight in healthy university youth. PhD thesis. Faculty of Physical Education. Zagazig University. Egypt.
35. Salem, A. (2017). 9 hormones responsible for weight gain in women. Journal of Medicine and Life, (8026).
36. Simmons, K. and Edelman, A. (2016). Hormonal contraception and obesity. *Fertility and Sterility*, 106(6): 1282-1288.
37. Spiegel, K.; Tasali, E.; Penev, P. and Cauter, E. (2004). Brief communication: Sleep curtailment in healthy young men is associated with decreased leptin levels, elevated ghrelin levels, and increased hunger and appetite. *Ann. Intern. Med*., 141 (11), 846-850.