

# Effect of age and sex on Obesity Average of Population Sample in Baghdad City

Khalid M Salih      Jamela A K Jouda      Luma Qasim Ali

Department of Biology / College of Science  
Al-Mustansiriyah University

## Abstract

Obesity is a condition characterized by an excess of body fats. Obese persons differ in the amount of excess fat that stores and the regional distribution of that fat within the body. It is therefore essential to distinguish between those at risk as a result of abdominal obesity than those with generalized obesity. There are many studies about the obesity rate in Asia but these studies did not give a clear idea about it in the Asian subgroups, the present research aims to study: 1) obesity rate in another ethnic and cultural Asian subgroups , in Iraq, it depend on gender and age of the groups using different ways such as Body mass index (BMI) and percentage of total body fat (TBF), 2) studies which one way is better to give a realty average of obesity, and 3) diseases risk depend on gender and age of the groups using waist/hip ratio (W/H ratio). this study included 780 individuals. The age of the group was in the range of 6-60 years of both genders with apparently healthy status. The individuals were distributed to different age groups; (6-12 years) including primary school students, (13-19) years including secondary school students, (18-23 years) including undergraduate university students, and ( $\geq 24$  years) including university employees. BMI, TBF, and W/H ratio were measured in all individuals as WHO reported. This study found that 1) the general frequencies of obesity status according BMI did not exceed (7.8%) from total number of subjects (5.7% in female and 2.1% in male) most of them were  $\geq 24$  years old, while it found that obese percentage increased to (44.7%) from total number of subjects according TBF (39% in females and 8% in males) most of them were  $\geq 24$  years old. 2) the high risk rate was higher in female compared to males. This risk is elevated with the age, the highest high risk was recorded in  $\geq 24$  years group which reached 66% (54.5% in females and only 11.5% in males). In conclusion, such high risk ratio related with the obesity rate according TBF is not reassuring especially for  $\geq 24$  year's group and needs serious stand by, re-measured again larger than the current samples and gives a solution for this problem.

**Key word:** Obesity, MBI, TBF, W/H ratio.

## **Introduction**

Obesity is a condition characterized by an excess of body fats<sup>1</sup>. Obesity is defined as a body fat content of over 20% in average adult males and 30% in females<sup>2</sup>. According to the World Health Organization, there were about 1.6 billion overweight adults aged between 15 years and above and about 400 million adults worldwide in 2005<sup>1</sup>. WHO has recommended classifications of bodyweight, which included underweight and degrees gradient of excess weight or overweight that are associated with increased risk of certain non-communicable diseases<sup>3,4</sup>. It is important to develop appropriate anthropometric measures of obesity in order to identify and prevent the development of obesity-related disorders<sup>5</sup>.

However, obese persons differ in the amount of excess fat that stores, the regional distribution of that fat within the body, and the health-related impact vary noticeably amongst these obese individuals<sup>2,6</sup>. It is therefore essential to distinguish between those at risk as a result of abdominal obesity than those with generalized obesity<sup>7</sup>. The expert committee confirmed in 1993 that overweight in adult life is associated with increased morbidity and mortality increase with BMIs, and those cut-off points for the amount of weight gain should not be interpreted in isolation but in conjunction with other risk factors of morbidity and mortality. Cardiovascular disease, type 2 diabetes, musculoskeletal disorders, limitations of respiratory function, reduced physical functioning and quality of life, and increase the mortality rate are the sequelae of the most important of obesity and abdominal fatness<sup>8</sup>.

Asia umbrella term distinguishes a vast and diverse part of the world's population. Diversity of Asian countries is based on sub-groups of ethnic and cultural, degrees of urbanization, socio-economic conditions, and shafts nutrition. Many Asian are immigrants throughout the world whose considerations addressed in the consultation may apply. When taken together, these populations cover a wide range of morbidity and mortality of personal, social and economic determinants of health, with high absolute risks in some cases. What these populations have in common is that, in general, average or median BMI is less than that observed for non-Asian populations, although the tendency toward obesity in the abdominal area might be greater than in non-Asian populations<sup>9</sup>. As mentioned earlier, Asians have a higher 3-5% body fat than whites, at any given BMI<sup>7,10</sup>. Chinese have the lowest percentage of body fat, while Indians have the highest, among Asians who have the same BMI<sup>10,11</sup>. At a given waist size, Asians have greater body fat and metabolic abnormalities<sup>7,12</sup>.

## Effect of age and sex on Obesity Average of Population Sample in Baghdad City .....Khalid M Salih, Jamela A K Jouda, Luma Qasim Ali

These evidences did not give a clear idea about the obesity in the Asian subgroups, the present research aimed to: 1) study the obesity rate in another ethnic and cultural Asian subgroup, in Iraq, depend on gender and sex using different ways such as Body mass index and percentage of total body fat to understand the obesity status in Iraq, 2) study which way is better to give a really average of obesity, and 3) study the diseases risk depend on gender and sex using W/H ratio.

### Materials and methods

This study included 780 individuals. The age of the group in the range of 6-60 years of both genders with apparently healthy status was. After taking consent, 422 males and 362 females participated in the study and comply with the research study. The individuals were distributed to different age groups; (6-12 years) included primary school students, (13-19 years) included secondary school students, (18-23 years) included undergraduate university students, and ( $\geq 23$  years) included university employees. These individual were randomly selected from students of different primary and secondary Iraqi schools in Baghdad and from students and employees of Department of Biology – College of Science - Al-Mustansiriyah University in Baghdad / Iraq.

#### *Body Mass Index (BMI)*

The body weights of individuals were measured by body balance and the body heights of them were measured by paper tape. BMI was calculated as weight in kilograms divided by height in meters squared ( $W/H^2$ )<sup>9</sup>. The BMI of individuals was classified according WHO classification in Table-1

**Table-1: BMI classification**

BMI Classifications	BMI (kg/m <sup>2</sup> )
Normal weight	$\leq 24.9$
Overweight	25.0-29.9
Obesity (Class 1)	$\geq 30.0$

#### *Percentage of total body fat (TBF%)*

The relationship between densitometrically-determined body fat percentage (TBF%) and BMI, taking age and sex (males = 1, females = 0) into account, was analyzed using Deurenberg equation<sup>13</sup> as following:

$$TBF\% = 1.2(BMI) + 0.23(\text{age}) - 10.8(\text{sex}) - 5.4$$

Obesity is defined as a body fat content of more than 20% in average males and over 30% in females<sup>2</sup>

#### *Waist-Hip Ratio (WHR)*

## Effect of age and sex on Obesity Average of Population Sample in Baghdad City .....Khalid M Salih, Jamela A K Jouda, Luma Qasim Ali

The waist and hip circumference of individuals was measured using paper tap depend on WHO steps protocols <sup>14</sup>. The waist circumference measurement should be made at the approximate midpoint between the lower margin of the last palpable rib and the top of the iliac crest. The hip circumference measurement should be taken around the widest portion of the buttocks. For both measurements, the subject should stand with feet close together, arms at the side and body weight evenly distributed, and should wear little clothing. The subject should be relaxed, and the measurements should be taken at the end of a normal expiration. Each measurement should be repeated twice; if the measurements are within 1 cm of one another, the average should be calculated. If the difference between the two measurements exceeds 1 cm, the two measurements should be repeated. Then, the ratio waist and hip circumference was calculated

The WHO states that abdominal obesity is defined as a waist–hip ratio above 0.90 for males and above 0.85 for females. The WHR has been used as an indicator or measure of health, and the risk of developing serious health conditions according WHO classification in Table-2

**Table-2: the risk of health according waist-hip ratio**

Men	Women	Health Risk Level
0.95 or less	0.80 or less	Reduced Risk
0.96 to 1.0	0.81 to 0.85	Elevated Risk
1.0 or higher	0.85 or higher	High Risk

### *Statistical analysis*

Results are expressed as mean  $\pm$  standard error (M $\pm$ SE). Data were analyzed by one-way analysis of variance (ANOVA) followed by Fisher's test for multiple comparisons, using Stat view version 5.0. Differences were considered significant when  $p < 0.05$ .

### **Results:**

According to age, Figure-1 showed frequency of obesity using BMI in both 6-12 and 19-23 years groups (1.2%, 2.4% respectively) were significantly ( $P < 0.05$ ) lower than those in 13-18 and  $>24$  years groups (5.7%, and 6.4% respectively), the frequency of overweight was significantly ( $P < 0.05$ ) differ among the different age groups, in which 6-12 years group revealed the lowest overweight (3.2%), while  $>24$  years group showed the highest overweight (37.5%), and the frequency of normal weight was also significantly ( $P < 0.05$ ) differed among the different age groups, the highest was revealed in 6-12 years group (95.7%), while the lowest was showed in  $>24$  years group (56.1%).

**Effect of age and sex on Obesity Average of Population Sample in Baghdad City .....Khalid M Salih, Jamela A K Jouda, Luma Qasim Ali**

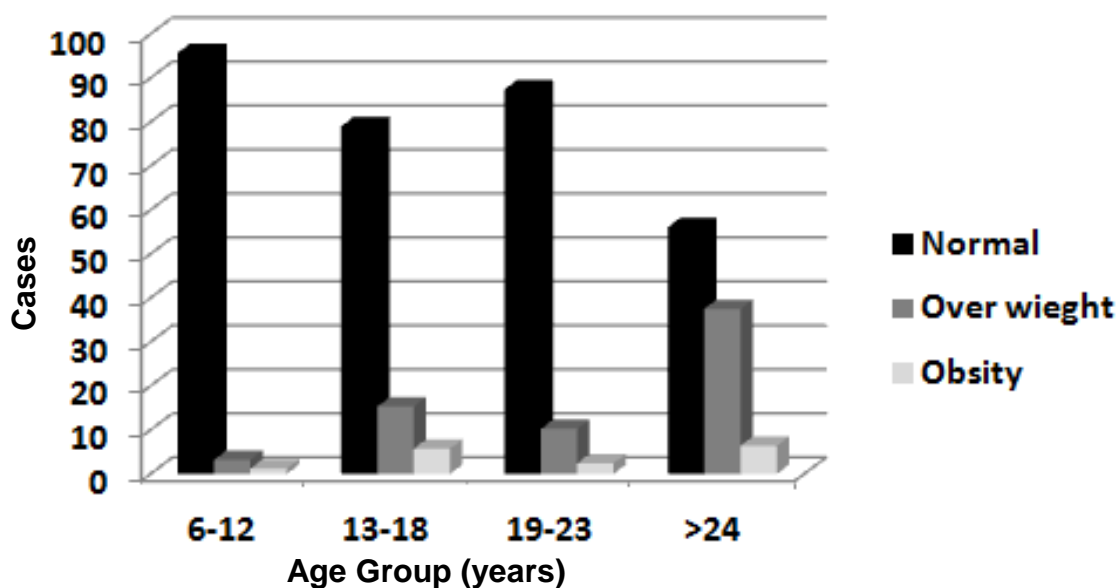


Figure-1: frequency of BMI among age groups

However, the gender of participants showed significant differences ( $P < 0.05$ ) in obesity status using BMI between female and male subjects (5.7% and 2.1% respectively, while no significant differences in overweight and normal weight were revealed as shown in Figure-2.

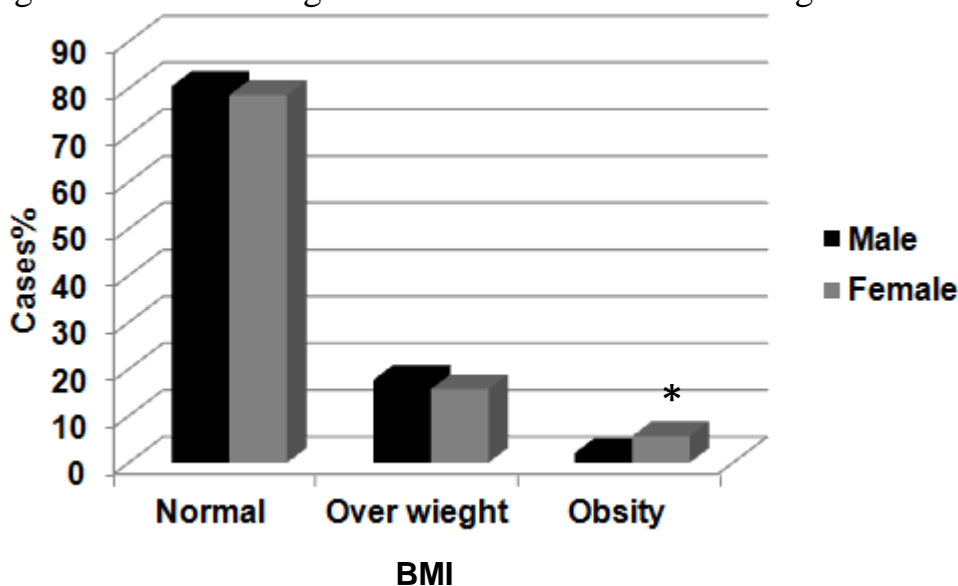
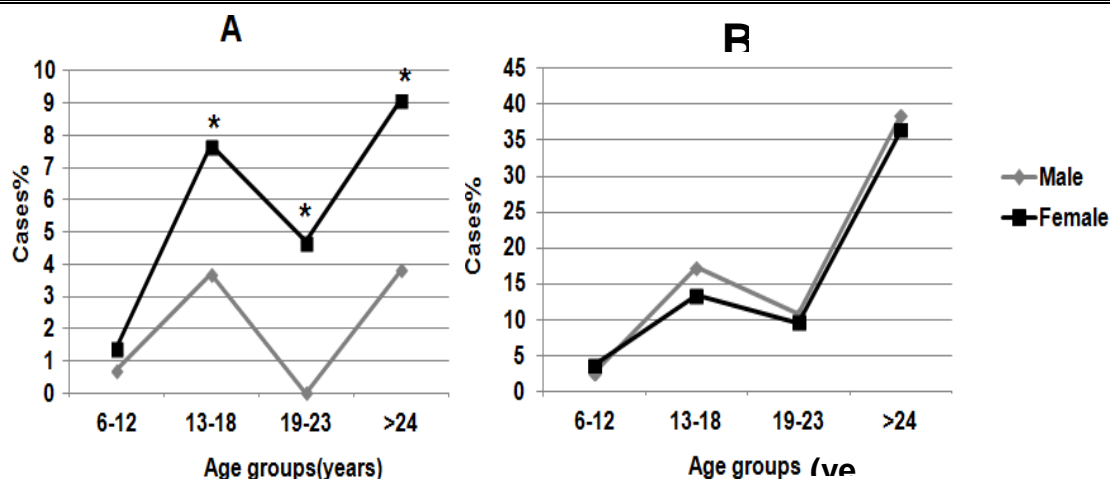


Figure-2: frequency of BMI among gender, \* obesity frequency in female vs. in male.

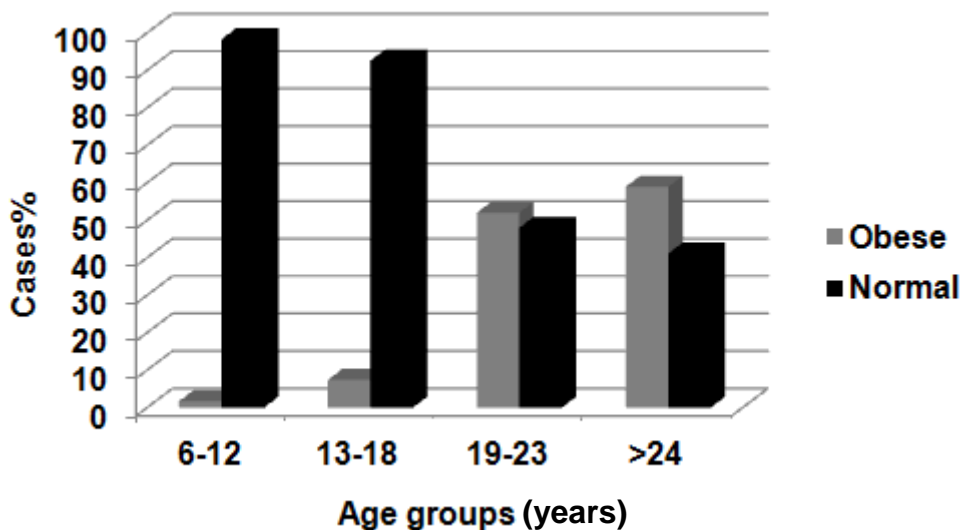
When taking the gender and age factors together, the Figure-3 showed the frequency of the obesity and overweight in all age groups depending on the gender. While no differences were detected between the overweight frequencies in male as compared to female, significantly ( $P < 0.05$ ) higher obesity frequency in female as compared to male in all age groups except in 6-12 years group was detected.

**Effect of age and sex on Obesity Average of Population Sample in Baghdad City .....Khalid M Salih, Jamela A K Jouda, Luma Qasim Ali**



**Figure-3: frequency of BMI among age groups depend on gender, (A) obesity frequency, (B) overweight frequency, \* obesity frequency in female vs. in male.**

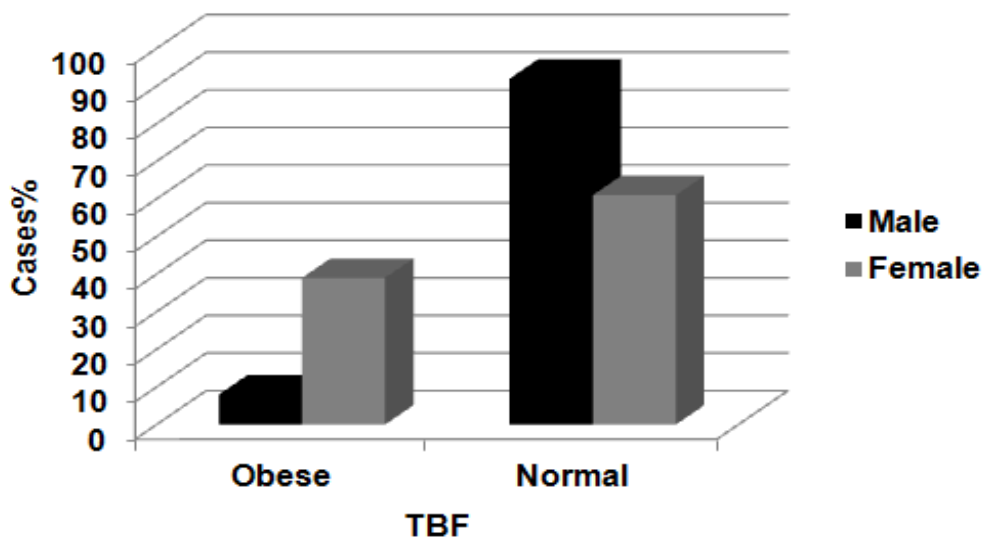
Figure-4 showed frequency of obese and normal subjects using TBF according to age. In both 19-23 and >24 years groups (52%, 58.9% respectively) was significantly ( $P < 0.05$ ) higher obese than those in 6-12 and 13-18 years groups (1.7%, and 7.4% respectively), while the frequency of normal were significantly ( $P < 0.05$ ) lower in 19-23 and >24 years groups (48%, 41% respectively) than in 6-12 and 13-18 years groups (98.3%, 92.9% respectively).



**Figure-4: frequency of TBF among age groups**

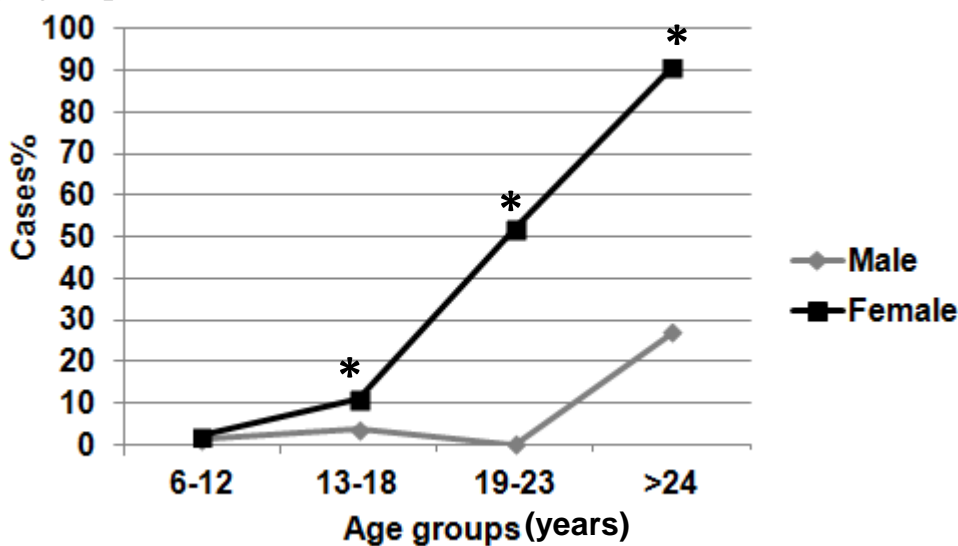
According to the gender, obese frequency using TBF was significant ( $P < 0.05$ ) higher in female subjects (39%) than those male subjects (8%), Figure-5.

**Effect of age and sex on Obesity Average of Population Sample in Baghdad City .....Khalid M Salih, Jamela A K Jouda, Luma Qasim Ali**



**Figure-5: frequency of TBF among gender**

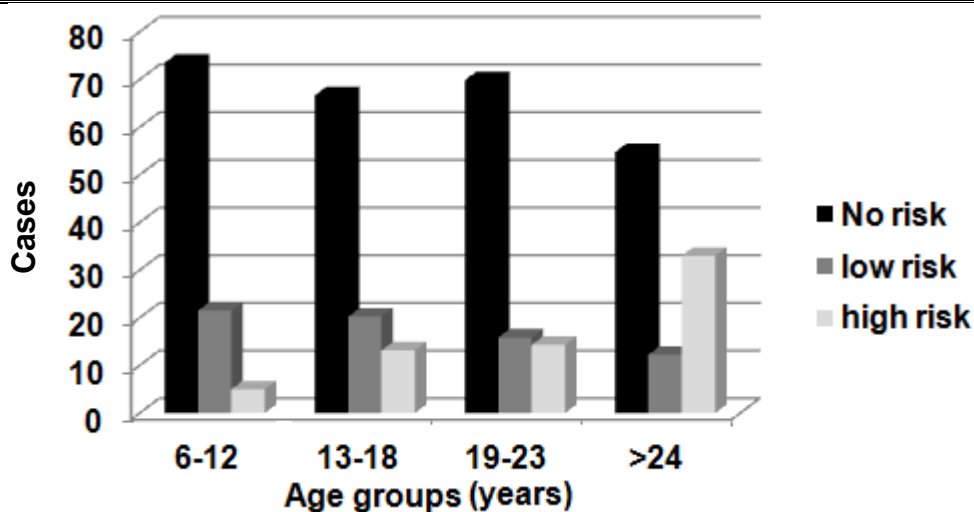
When taking the gender and age factors together, the Figure-6 showed the distribution of the obese weight in all age groups depending on the gender. Since no difference was detected in 6-12 years group, significantly ( $P < 0.05$ ) higher obese frequencies in female as compared to male in all other age groups were detected.



**Figure-6: frequency of TBF among age groups depend on gender, \* obese frequency in female vs. in male.**

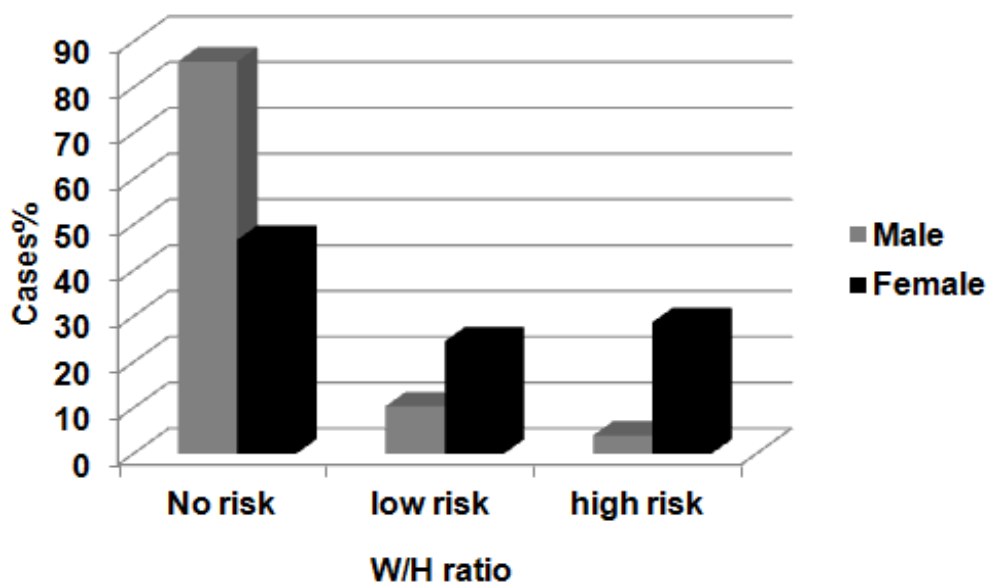
The W/H ratio was calculated, While no significantly differences were detected in frequencies of no and low risk among the age groups, significantly ( $P < 0.05$ ) lowest high risk frequency was detected in 6-12 years group (5%) was rep and significantly ( $P < 0.05$ ) highest in >24 years group (33%) (Figure-7).

**Effect of age and sex on Obesity Average of Population Sample in Baghdad City .....Khalid M Salih, Jamela A K Jouda, Luma Qasim Ali**



**Figure-7: frequency of W/H ratio among age groups**

Significantly ( $P < 0.05$ ) higher high and low risk was detected in the female (28.7% and 24.6% respectively) than the male (4% and 10.4% respectively) and lower no risk in the female (46.7%) as compared to male (86%) (Figure-8).



**Figure-8: frequency of TBF among gender**

If the gender and age factors were taken together, significantly ( $P < 0.05$ ) higher high risk frequencies were detected in female as compared to male in all age groups (Figure-9A) and significantly ( $P < 0.05$ ) higher low risk frequencies were detected also in female than male in all age groups except in >24 years group, in which the low risk frequencies were significantly lower in the female compared to male (Figure-9B).



## Effect of age and sex on Obesity Average of Population Sample in Baghdad City .....Khalid M Salih, Jamela A K Jouda, Luma Qasim Ali

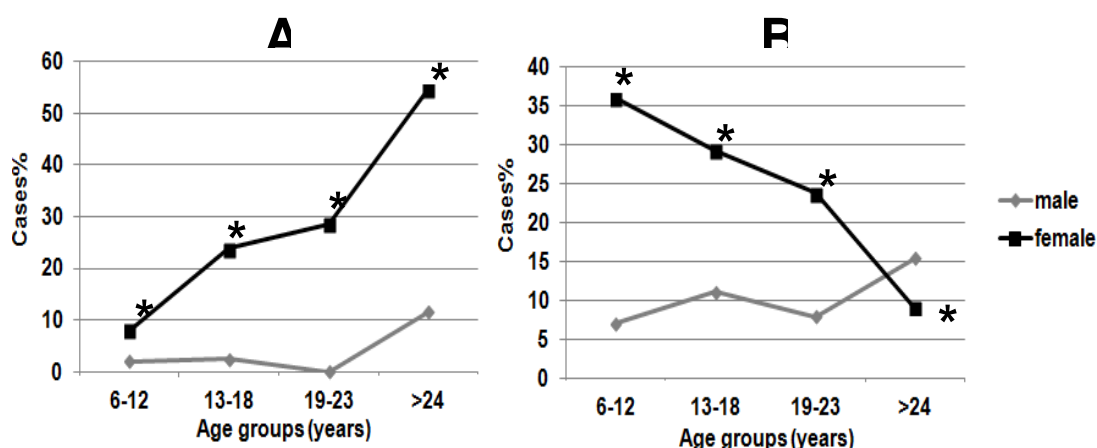


Figure-9: frequency of W/H ratio among age groups depend on gender, (A) high risk frequency,(B) low risk frequency, \* risk frequency in female vs. in male.

### Discussion

Our results showed that the frequencies of obesity status in female subjects were (5.7%) and in male subjects were (2.1%) most of them were >24 years old. If we calculated the general rate of obesity, the value does not exceed (7.8%) from total number of individual included in this study. This value is very low as compared to obesity rate in worldwide. In 2007, WHO reported was showed that the obesity rate has reached a 34% in the adult and 20% in the children<sup>15</sup>. This rate is also nothing compared to the obesity rate in the Middle East country, including Arabic countries, which has reached 40%, mostly in women<sup>16</sup>.

Iraq still is one of the third world countries which feature the low living standard of its members. Many studies suggested a positive relationship between high living standard for individuals and obesity rate<sup>17</sup>. The high living standard increases the intake of calories, While the low living standard does not affect only the amount of food intake, but also on its quality as well as the lifestyle of the individual, which makes them don't like to laziness and comfort, but to work in order to receive his strength<sup>18</sup>. These factors could be a reason to lower obesity rate in the current study sample.

In this study, the obesity rate was high in > 24 years compared to other age groups. The members involved in this group are university employees, who spend so much time outside their homes tend to eat a meal or more of fast food, soft drinks and juices, which have a role in increasing the body weight<sup>19</sup>. In addition, most of these members are married, where its known that the obesity rate is increasing at married subjects to 7% of women and 4% of men than it is when they are unmarried<sup>17</sup>.

## Effect of age and sex on Obesity Average of Population Sample in Baghdad City .....Khalid M Salih, Jamela A K Jouda, Luma Qasim Ali

Our results were showed the fact that the percentage of obesity calculated on the basis of the BMI scale differ from those calculated on the basis of the TBF scale for the same subjects, where it found that obese percentage increased to 39% of the total number of females compared to 5.7% according to BMI scale, and increases to 8% of the total number of males instead of 2.1% according to BMI scale. Also when we calculated the general rate of obesity depend on TBF scale, the value rise to (44.7%) from total number of individual included in this study compared to (7.8%) according to BMI scale. The reason, which can explain the difference between these scales, is that BMI cannot investigate all the stored fat and the places of its collected in the body as TBF do it, and its known that the individuals differ than each other in their body fat rate and body fat places<sup>20</sup>. On the other hand, Several studies have indicated that obesity rate, which calculated on the basis Deurenberg equation, streaked many disadvantages, it may not reflect a true result to the reality of body fat in people who have a good muscular build and the children using offset equation above gives high-fat ratio and puts them in obesity ranking, while the relationship between BMI and BF% in children is found to differ from that in adults due to the height-related increase in BMI in children<sup>13</sup>.

The purpose of used W/H ratio is not to confirm the reality of obesity shown by previous standards, but to determine the degree of risk to human health as a result of increase body weight. The females are different anatomically from male, they have a greater pelvis capacity than males, so the waist circumference proportion to hip circumference in women are lower than in men, where the ratio in healthy women is 0.8 or less compared to 0.95 or less in healthy men<sup>14</sup>. Any increase in the body weight means accumulation of fats in the abdominal area, thereby increasing waist circumference, which will eventually lead to increased waist / hip ratio. If this ratio increased than 1 in males and 0.86 in women, become the higher degree of risk of cardiovascular disease, infertility, diabetes and prostate cancer, as well as high risk for ovarian cancer in females<sup>21,22</sup>.

Our results were showed, that the high risk rate was higher in female compared to males. This risk is elevated with the age, the highest high risk was recorded in >24 years group which reached 66%, 54.5% in the females and only 11.5% in the males. Such a ratio is not reassuring especially for women and need serious stand by, re-measured again larger than the current samples, and give a solution for this problem.

## Effect of age and sex on Obesity Average of Population Sample in Baghdad City .....Khalid M Salih, Jamela A K Jouda, Luma Qasim Ali

### References

1. Low, S., Chin, M.C., Ma, S., Heng, D. and Deurenberg-Yap, M. Rationale for redefining obesity in Asians. *Ann Acad Med Singapore* **38**, 66-69 (2009).
2. Kopelman, P.G., Caterson, I.D. and Dietz, W.H. *Clinical Obesity in Adults and Children*, (Blackwell Publishing, New Delhi, 2006).
3. WHO. Physical status: the use and interpretation of anthropometry. Report of a WHO Expert Consultation. WHO Technical Report Series Number 854. (Geneva: World Health Organization, 1995.).
4. WHO. Obesity: preventing and managing the global epidemic. Report on a WHO Consultation on Obesity, Geneva, 3–5 June, 1997. WHO/NUT/NCD/98.1. Technical Report Series Number 894. (Geneva: World Health Organization, 2000).
5. Yang, J.J., Shiwaku, K., Nabika, T., Masuda, J. and Kobayashi, S. High frequency of cardiovascular risk factors in overweight adult Japanese subjects. *Arch Med Res* **38**, 337-344 (2007).
6. WHO. Technical report series 894: Obesity: Preventing and managing the global epidemic. (Geneva: World Health Organization, 2000).
7. Enas, E.A. and Kannan, S. *How to Beat the Heart Disease Epidemic among South Asians.*, (Downers Grove, IL: Advanced Heart Lipid Clinic, 2008).
8. Seidell, J.C., Kahn, H.S., Williamson, D.F., Lissner, L. and Valdez, R. Report from a Centers for Disease Control and Prevention Workshop on use of adult anthropometry for public health and primary health care. *Am J Clin Nutr* **73**, 123-126 (2001).
9. WHO. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Report of a WHO Expert Consultation. . Vol. 363 (Geneva: World Health Organization, 2004).
10. Deurenberg, P., Deurenberg-Yap, M. and Guricci, S. Asians are different from Caucasians and from each other in their body mass index/body fat per cent relationship. *Obes Rev* **3**, 141-146 (2002).
11. Deurenberg-Yap, M., Schmidt, G., van Staveren, W.A. and Deurenberg, P. The paradox of low body mass index and high body fat percentage among Chinese, Malays and Indians in Singapore. *Int J Obes Relat Metab Disord* **24**, 1011-1017 (2000).
12. Razak, F., *et al.* Ethnic differences in the relationships between obesity and glucose-metabolic abnormalities: a cross-sectional population-based study. *Int J Obes (Lond)* **29**, 656-667 (2005).
13. Deurenberg, P., Weststrate, J.A. and Seidell, J.C. Body mass index as a measure of body fatness: age- and sex-specific prediction formulas. *Br J Nutr* **65**, 105-114 (1991).
14. WHO. Waist Circumference and Waist–Hip Ratio: Report of a WHO Expert Consultation. (Geneva, World Health Organization, 2008).
15. Flegal, K.M., Carroll, M.D., Kit, B.K. and Ogden, C.L. Prevalence of obesity and trends in the distribution of body mass index among US adults, 1999-2010. *Jama* **307**, 491-497 (2012).
16. Ng, M., *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**, 766-781 (2014).
17. McLaren, L. Socioeconomic status and obesity. *Epidemiol Rev* **29**, 29-48 (2007).

## Effect of age and sex on Obesity Average of Population Sample in Baghdad City .....Khalid M Salih, Jamela A K Jouda, Luma Qasim Ali

18. Salmon, J. and Timperio, A. Prevalence, trends and environmental influences on child and youth physical activity. *Med Sport Sci* **50**, 183-199 (2007).
19. Rosenheck, R. Fast food consumption and increased caloric intake: a systematic review of a trajectory towards weight gain and obesity risk. *Obes Rev* **9**, 535-547 (2008).
20. Gallagher, D., *et al.* Healthy percentage body fat ranges: an approach for developing guidelines based on body mass index. *Am J Clin Nutr* **72**, 694-701 (2000).
21. Swami, V., Jones, J., Einon, D. and Furnham, A. Men's preferences for women's profile waist-to-hip ratio, breast size, and ethnic group in Britain and South Africa. *Br J Psychol* **100**, 313-325 (2009).
22. Derby, C.A., Zilber, S., Brambilla, D., Morales, K.H. and McKinlay, J.B. Body mass index, waist circumference and waist to hip ratio and change in sex steroid hormones: the Massachusetts Male Ageing Study. *Clin Endocrinol (Oxf)* **65**, 125-131 (2006)..

### تأثير العمر والجنس على معدل السمنة لنموذج سكاني في مدينة بغداد

#### الملخص:

السمنة هي زيادة تواجد كميات الدهون في الجسم. الأشخاص المتصفين بالسمنة يختلفون في كمية واماكن تواجد الدهون المخزونة في أجسامهم. لهذا فمن المهم جدا التمييز بين الأشخاص الذين يعتبرون في مرحله الخطر نتيجة لتواجد الدهون في المنطقة البطنية من اجسامهم عن الاخرين المصابين بالسمنة العامة. هنالك العديد من الدراسات التي اجريت حول معدلات السمنة في قارة آسيا لكن هذه الدراسات لا تعطي فكرة واضحة حول معدلات السمنة في الاقسام الفرعية من قارة آسيا, هذا العمل يهدف الى دراسة: (1) معدل السمنة في قسم فرعي من آسيا مختلف من حيث العرق والحضارة, وهو العراق, بالاعتماد على المجاميع العمرية والجنس باستخدام عدة طرق ميل مؤشر كتلة الجسم والنسبة المئوية لمجموع الدهون في الجسم, (2) اي الطرق المستخدمة في (1) هي الافضل لإعطاء القيمة الحقيقية للسمنة, (3) معدل الخطر الناجم من السمنة بالاعتماد على المجاميع العمرية والجنس باستخدام نسبة محيط الخصر / الورك. تضمنت هذه الدراسة 780 شخص اعمارهم تتراوح بين 6-60 سنة في كلا الجنسين وبحالة صحية جيدة. هذه الحالات توزعت في مجاميع عمرية مختلفة: (6-12 سنة) تضمنت طلاب المدارس الابتدائية, (13-19 سنة) تضمنت طلاب المدارس الثانوية, (20-23 سنة) تضمنت طلاب جامعيين من الدراسات الأولية, و ( $\leq 24$  سنة) تضمنت موظفي الجامعة. هذه الدراسة وجدت ان: (1) التردد العام لحالات السمنة اعتمادا على مؤشر كتلة الجسم لا يتعدى (7.8 %) من مجموع الحالات (5.7 % في الاناث و 2.1 % في الذكور) اغلبهم من اعمار  $\leq 24$  سنة, بينما النسبة المئوية للسمنة بالاعتماد على مقياس النسبة المئوية للدهون الكلية في الجسم ازدادت لتصل الى (44.7 %) من المجموع الكلي للحالات (39% في الاناث و 8% في الذكور) اغلبهم من اعمار  $\leq 24$  سنة. (2) معدل الخطورة العالي كان اعلى في الاناث عنه في الذكور والذي يرتفع مع العمر, هذا المعدل وصل في المجموعة العمرية  $\leq 24$  سنة الى 66% (54.5% في الاناث و 11.5% فقط في الذكور). ان مثل هكذا معدل خطورة عالي معتمد على معدل السمنة لا يدعو للارتياح خصوصا في المجموعة العمرية الاكبر من 24 سنة ما يحتاج الى وقفة جادة ولهذا ندعو الى اعادة القياس لهذه المجموعة العمرية خصوصا النساء مرة اخرى وبشكل اوسع واعطاء الحلول الناجعة لهذه المشكلة.