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Evaluation of the risk factors for the development of metabolic syndrome in Babylon 2012.

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ABSTRACT:

Background: The metabolic syndrome has received increased attention in the past few years because it was considering a public health issue in both developed and developing countries. It is an unfavorable cluster of factors that increases the risk from cardiovascular disease, stroke, and type-2 diabetes. There were many criteria to define it, but all of these criteria agreed on core component of metabolic syndrome which is obesity, dyslipidemia (increase triglycerides and decrease High-Density Lipoprotein cholesterol), hypertension and diabetes mellitus type 2.
Aims: for the evaluation the risk factors that may be responsible for development of metabolic syndrome in Babylon city.
Patients and Methods: Across sectional study carried out to the randomly
selected patients attending Merjan teaching hospital in Babylon, within the period from first of April to thirty of June, 2012. Data obtained included questionnaires, measurement of anthropometric and blood pressure with laboratory investigation.
Results: This study shows the risk score for metabolic syndrome as follows, the low-risk score about [31.1%], moderate risk about [50.8%] and the high risk about [18.1%]. There was significant association for the risk of metabolic syndrome with the age and significant association of risk groups with hypertension, triglyceride, overweigh (BMI>25kg/m2), central obesity, diabetes millets, and low high density
Conclusions: There was increased in risk of metabolic syndrome with an increased number of risk factors and with progression of the age in Babylon.

Introduction:-

Metabolic syndrome (MS) also known as syndrome X, insulin resistance syndrome, Reaven's syndrome, cardio metabolic syndrome, or dys metabolic syndrome [1, 2]. MS is defined as clusters of individual's risk factors that increase the risk for developing cardio vascular disease (CVD)and Diabetes Mellitus DM type 2 [1-3]. The National Cholesterol Education Program's Adult Treatment Panel III (NCEP-ATP III) define this syndrome as it consists of multiple, interrelated risk factors of metabolic origin that appear to directly promote the development of atherosclerotic cardiovascular disease. Five factors are thought to comprise this syndrome, and it was defined when three or more of the following abnormalities are present, which are: abdominal obesity with a waist circumference for men >102 cm and women >88 cm, serum triglycerides =150 mg/dl (= 1.7 mmol/l), high-density lipoprotein (HDL) cholesterol for men <40 mg/dl (< 0.9 mmol/l and for women <50 mg/dl (< 1.0 mmol/l), blood pressure =130/85 mmHg, and fasting plasma glucose =110 mg/dl(6.1 mmol/l) [2,4,5]. Other major risk factors that may increase the risk of MS include physical inactivity, an unhealthy diet (like high carbohydrate and saturated fat diet), cigarette smoking, and increased aged [1,3,4]. The studies shows that the patients with MS, there are 30% to develop CVD and 50% to die from it, when compare with a patient have no MS [6,7,8]. The MS is not new, having been already observed in 1920s by Kylin, who described the clustering of hypertension, hyperglycemia, and gout as a syndrome [1, 6], but in 1980, this association became more clearly defined, and the term MS was used [9, 10]. In 1988, Gerald Reaven, a pioneer scientist and expert in the field of metabolism noted this clustering and he Called Syndrome X, and he recognized it as a multiplex risk factor for (CVD) [6, 9].

In Iraq, there are few population-based studies on MS .One of them in Babylon city [11] about prevalence of MS in a patient with DM type 2, found about 66.5% of DM type 2 have MS [2,11]. other study done in AL-Basrah city found overall prevalence of MS was 86% of the patient have DM type2 [13]. Another study done in Baghdad in the Ibn albetar hospital about the prevalence of MS in a patient have (IHD) found that the overall prevalence of metabolic syndrome was 69.33 % [12]. There is an increase in prevalence of MS with age and mainly effect on female in postmenopausal [14], and there are slight differences between the incidences

of MS among male and female before that age [4]

Definition of Metabolic syndrome

MS is a non-communicable, non-infectious disease, and according to the (WHO) recent update, considers the chronic disease which compose of MS are one of the top five continuing risk factors for cardiovascular deaths in the world [15], and the global prevalence of chronic diseases is projected to increase substantially over the next two decades to about 60% in developing countries, and CVD is already the leading cause of mortality [16, 17].

1-2 Epidemiology of Metabolic Syndrome:

Worldwide prevalence of metabolic syndrome ranges from <10% to as much as 84%, depending on age, region, urban or rural environment, ethnicity, and the criteria of metabolic syndrome used[18, 19]. It was estimated that around 20-25% of the world's adult population have the MS [4] also it was recorded that there is high prevalence of the MS and its key cardiovascular risk factors (15-60%) among Middle East population [18].

Accordingly (in the Arab world) the prevalence of MS varies widely, it was about 17% among Palestinians, 21% in Omani [20], from 20.8% to 39.3% in Saudi Arabia [2] and in Northern Jordan was 36.3% with a significantly higher prevalence in women than in men[18].It is about 46% in Yamani people, in Kuwait about18%[20],while from 23.1 to 33.7 in different parts of Iran [2].In Tunis, MS prevalence was 45.5% and in Turkey reported that the prevalence of MS was 33.9% [18].

While in the developed country approximately 20%-30% of the populations have MS [15]. In the US, about 25%-35% of American adult had MS and UK research suggests a similar numbers of peoples are affected in US [2 ,14, 21].

It was found that, the prevalence of MS increased with age affecting about 3-4% in younger age group and between (25- 40%) in elderly [2,15, 20]and there are slight differences according to gender (24%) in male and (23.4%) in female [11, 22].

Causes of Metabolic Syndrome:

MS is multi factorial; a combination of both metabolic and underlying risk factors is involved [23].

Genetics and the environmental factors both play important roles in the development of the MS in which the genetic factors influence each individual component of the syndrome [8]. A family history of type 2 DM, an individual will hypertension, and early heart disease greatly increase the chance that develop the MS [8,10,17].

lifestyle, progressive weight gain and Environmental factors such as sedentary unhealthy diet that rich with carbohydrate and fat also contribute significantly to the risk of developing the MS [10, 15]

Criteria for clinical Diagnosis of MS:

Although the risk associated with the MS is well-documented, the criteria of the syndrome are still in flux. In 1998, the (WHO) proposed a set of diagnostic criteria of MS based on insulin resistance [5, 8, 9]. It is included micro albuminuria, which does not appear in the later definitions [18]. In 1999, followed by definitions from the European Group for the Study of Insulin Resistance (EGIR) and its definition did not include diabetic patients [18].At 2001, the MS defined by the National Cholesterol Education Program's Adult Treatment Panel III (ATP III). The 2001 ATP III definitions have been regarded as probably the most practical for alerting clinicians to a patient at risk [8, 14, 22]. In 2005, the modification to 2001, ATP III definitions of MS by the American Heart Association and National Heart, Lung, and Blood Institute (AHA/NHLBI) were published. The 2001 ATP III criteria were maintained except for a reduced threshold for hyperglycemia that 100 mg/dl is the new set point for fasting glucose and referred to as the Modified ATPIII definition [1, 8, 11] as in (table 1) show differences between these main criteria [5].

In 2005, the International Diabetes Federation (IDF) issued new criteria that further modified the ATP III definitions [5, 18].This definition of IDF represents modifications of the WHO and ATP III definitions.

1. Raised Triglyceride >150mg/dl or on treatment for this abnormal lipid.
2. Reduced High density lipoprotein<40mg/dl in male and <50mg/dl in female or on treatment for this abnormality.
3. Raised blood pressure >130/85mmhg or on treatment for hypertension.
4. Raised fasting plasma glucose >100mg/dl or diagnosed as DM type 2. Definitions agreed on core component of MS, which included (hyperglycemia, obesity, dys- lipidaemia, and hypertension), but they differed in the details and criteria [5].

Table (1): Criteria for clinical diagnosis of MS.

Clinical Measure	WHO	ATP III	AHA/NHLBI
Waist Circumference		≥102 cm in men, ≥88 cm in women	Same as ATP III
BMI	BMI >30 kg/m2		
Triglycerides	≥150 mg/dL	Same as WHO	Same as WHO
HDL-C	<35 mg/dL in men, <39 mg/dL in women	<40 mg/dL in men, <50 mg/dL in women	Same as ATP III
Blood Pressure	≥140/90 mm Hg	≥130/85 mm Hg	Same as ATP III
Glucose	IGT, IFG, or NIDDM	Fasting >110 mg/dL (IFG)	Fasting ≥100 mg/dL (IFG)
Insulin Resistance	YES	NO	NO
Micro albuminuria	YES	NO	NO

Main component of MS

1- Obesity:

The global epidemic of overweight and obesity - "globosity" - is rapidly becoming a major public health problem in many parts of the world, and they are the serious risk factors for a number of chronic diseases, including DM, CVD, and cancer. Overweight and obesity are the fifth leading risk for global deaths [23]

According to WHO, Overweight and obesity are defined as abnormal or excessive fat accumulation that may be risk to the health [23].A crude population measure of obesity is the body mass index (BMI) which is equal to body weight in kilograms divided by the height in meters squared (BMI =Weigh kg/High m^2) and the values of BMI are age independent and same for both sexes as in table 2 [23].

Because a body mass index (BMI) provides little information on the location of body fat, only useful as an initial step towards crudely classifying patients based on their relative weight so there are additional methods to measure abdominal fat exist, such as waist circumference (WC) and waist to hip ratios (WHR) [24]. Measuring waist circumference (WC) is the simplest accurate anthropometrical indicators of central obesity [25,26]. In the measuring of (WC) as BMI, there is cut off values have been set to identify increased risk, but for (WC) need to be sex and population specific [25]. The (WC) can be measured at the midpoint between margin of last rib and iliac crest which is considered as an indicator of risk if >88cm in female and >102cm in male [5, 16] .The hip circumference (HC) can measure at a level of a greater trochanter, the (WHR)>1 in male and >0.85 in female consider as an indicator of risk of metabolic and CV complication of obesity [16, 24]

Table (2): BMI classification, the International Classification of adult underweight, overweight and obesity according to BMI (23).

Classification	BMI(kg/m^2)	
	Principal cut-off points	Additional cut-off points
Underweight	**<18.50**	**<18.50**
Severe thinness	<16.00	<16.00
Moderate thinness	16.00 - 16.99	16.00 - 16.99
Mild thinness	17.00 - 18.49	17.00 - 18.49
Normal range	**18.50 - 24.99**	**18.50 - 22.99**
		23.00 - 24.99
Overweight	**≥25.00**	**≥25.00**
Pre-obese	25.00 - 29.99	25.00 - 27.49
		27.50 - 29.99
Obese	**≥30.00**	**≥30.00**
Obese class I	30.00 - 34.99	30.00 - 32.49
		32.50 - 34.99
Obese class II	35.00 - 39.99	35.00 - 37.49
		37.50 - 39.99
Obese class III	≥40.00	≥40.00

2 . Diabetes mellitus type 2 and insulin resistance:

The term Diabetes mellitus (DM) describe a chronic metabolic disease which occurs when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin, it produces; this can lead to an increase of glucose of the blood (hyperglycemia) [27].

DM classified as type 1, type 2, other specific types of diabetes (e.g., secondary diabetes), and gestational diabetes [27,28].

3 Hypertension:

Systemic blood pressure(BP) rises with age, and the incidence of CVD is closely related to averaging(BP) at all ages, and the CV risk associated with BP are dependent the combination of risk factors such as age, gender, weigh, physical inactivity, smoking, family history, serum cholesterol, DM, and preexisting CVD[26] which similar to risk factors of MS. Therefore, the hypertension is a highly prominent feature of the MS, present in up to 85% of patients [29,30].

4 Atherogenic dyslipidemia:

Atherogenic dyslipidemia comprises a triad of increased blood concentrations of small, dense low-density lipoprotein (LDL) particles, decreased high-density lipoprotein (HDL) particles, and increased triglycerides. It was emerged as an important risk factor for myocardial infarction and CVD [31]. the triglycerides/HDL-C ratio has been shown to be an athero genic marker that links insulin resistance to CVD [31].

5 . A pro inflammatory state:

It is characterized by elevations of circulating inflammatory molecules such as C-reactive protein (CRP), tumor necrosis factor-alpha, plasma resistin, interleukin (IL)-6, and IL-18. CRP is a general marker of inflammation that has been linked to CVD in patients with MS [32]. Elevated levels of CRP are associated with many of the clinical features of the MS like increased waist circumference [32, 33].

6. Prothrombotic state:

Also called hemostatic abnormality characterized by increased level of plasma plasminogen activator inhibitor type 1 (PAI)-1 associated with hypo fibrinolysis, it considered to be the core feature of MS because closely associated with other components [5, 34] and responsible for thrombotic complication.

Others risk factors associated with MS are eating the inappropriate amounts and types of foods ,smoking , not exercising and having too much stress in the life [16,35] are the most importantly factors. The rate of chronic stress, combined with immobilization, wrong nutrition, depression and fear of social changes with run in families have increased statistically the prevalence of MS, DM and obesity in the US [36, 37].also women with

Polycystic ovary syndrome (PCOS) have 11-fold increase in the prevalence of MS compared with female have no PCOS [38] .also the MS increases in menopause women with the emergence or worsening of some risk factors: central obesity, systemic hypertension and dyslipidaemia. [39]. MS can also cause damage to the lining of coronary and other arteries; a key stepped toward the development of coronary heart disease also atrial fibrillation, heart failure, aortic stenosis, and ischemic stroke [6, 40]. it is found that between 1990 and 2020, mortality from CVD in developing countries is expected to increase by 120% for women and 137% for man who is expected to be substantially greater than from developed countries (29% and 48%, respectively) [16, 41] .In Iraq, found that the prevalence of MS was very much higher among patients with CVD (84%) than those without CVD (10%) [12]. Therefore, the preventive measures to control MS as consistent exercise routine , Commit to a healthy diet and Losing Weight and regular Checking the blood pressure, cholesterol and blood sugar levels regularly are important [40, 41,42].

There was no previous study in Babylon Governorate in Iraq about evaluation the risk factors that may be .responsible for development of MS and even in surrounding Arab countries,

So This study was conducted to evaluate the risk factors for the development of MS in order to put certain preventive methods to decrease the incidence of some preventable risk factors associated with MS in Babylon Governorate, 2012

Patients and methods

Across sectional study was conducted in Hilla city. Our study was done in a Merjan teaching hospital (out patient's clinic).Data collection was carried out during the period from 1st of April to 30 of June 2012.

The total patients collected were 380 patients (200 females and 180 males) with age ≥ of nineteen years old. About 30 patients refuse to participate in the study .The main reasons for a non-participant were fatigue or being too ill. Other 35 patients did not bring complete investigation. SO, a total of 315 out of 380 of an eligible patient took part in the study (177 were females, and 138 were males).

All the patients are randomly selected when attending the out patient's clinic in a Merjan teaching hospital during the time of study who accepted to participate in the study, Those patients with age ≥ 19 years old were included in the study while Any patient had DM type 1 or other chronic diseases like chronic renal failure, malignancy, and history of IHD and age< 19 years old, pregnant women and those who refuse to participate in the study Were excluded from this study.

Data collection tools:

A specially designed data sheet was used; to assess the risk factors of MS of randomly selected patients from out patient's clinic in Mirjan hospital and this sheet contain:

1. Questionnaires.
2. Blood pressure and anthropometric measurements (weight, height, BMI, WC, WHR).
3. Biochemical investigations and abdominal ultrasound.

The Questionnaires;Divided into four sections:

Section 1:include socio demographic factors :- name, age(divided into three age groups 19-39,40-59,and >60 years old), gender, residence (rural and urban) , occupation (Government employed, self-employed and un employed), type of diet (if rich with CHO and fat or not), eating disorders like eating at night, physical inactivity (less than 3 hours /week) and smoking [10].

Section 2: include health-related risk factors: - such as history of chronic disease (DM type 2, Hypertension, Hyper lipidemia) or on treatment for them, chronic stress, anxiety, (fatty liver and Gall bladder diseases) by abdominal ultrasound, sleep disturbances, and family history of DM, Hypertension, IHD or Obesity [10].

Section 3: include factors related to female such as PCOS (polycystic ovarian syndrome), MD (menstrual disturbance), and menopause.

Section 4: include factors related to male (premature anginal chest pain, premature sexual problem, and alcohol abuse).

The Risk assessment: We deepened in our results on NCEP/ATPIII definition of MS and the risk score assessment of MS as the study done in US [10].According to this score, we give to each abnormal finding (yes) and to each normal result (no), and then we count each (yes) answer as one point and add them up while (no) answers are zero points. If the total score is less than 10 mean, the patients had low risk of MS. If the score is higher than 20, mean the patients at high-risk and if the score is between 11 to 19 indicator of moderate risk of MS.

Data Analysis:

Recording information was checked for missing values and data entry errors. Statistical analysis was performed using Statistical Package for Social Science software (SPSS, version 17) and Microsoft office Excel 2010 was

used for data processing and statistical analysis. Variables were described using frequency distribution and percentage for the patients according to their characteristics and mean (ˉx); standard deviation (SD) for continuous variable .The chi-squared test was used for the assessment of association between the variables studied. The p- value of less than 0.05 was significant statistically.

Limitations of this study:

1-Not all responders gave their consent to fill the questionnairee.

2. Limited time for data collection.2

3.The findings of this study are limited by the use of the sample of patients from just one hospital, which is maybe not a representative of all populations in Hilla city

4.The data are based on self-reports of the patients, possibly leading to under or over reporting therefore, information bias cannot be excluded.

Results :

the total number of patient collected to these study (315) patients. The minimum age 19 years old and maximum 76 years old with mean age ± standard deviation (47.70±13.49 SD). Among those patients (24.1%) are government employed, (24.2%) are self-employed and (51.7%) unemployed). About (71.1%) of participants lived in urban area while (28.9%) lived in a rural area. In this study the number of the females about 177 (56.2%) with mean of the age± standard deviation (46.54±13.72 SD) and 138 (43.8%) male, their age mean ±standard deviation (49.19±13.09 SD).Then we classified the total number of patients into three risk groups of MS according to the number of risk factors. The overall proportions of these risk groups were low risk groups, moderate risk groups and high risk groups as (31.1%), (50.8%) and (18.1%) respectively as in table (3).

According to our questionnaire sheet in which we classified into female and male, some tables also divided according to the gender.

(Table 4) shows the female's socio demographic characteristics, the main age group between 40-60 years old (44.1%) and most of the female lived in urban area (76.3%). Majority of female were unemployed (74.6%).The percentage of the female consumed diet rich with carbohydrate and fat, physical inactivity, cigarette smoking, sleep disturbance and chronic stress were (63.3%), (84.7%), (6.8%), (65.5%), and(84.2%)respectively. (Table 5) shows the distribution of a female study group according to health-related factors; we found the females with overweight and obese were (43.5%) and (26.6%) respectively but those with central obesity was (89.3%).The percentage of other factors like hypertension, DM, low HDL, high triglyceride, PCOS, menstrual disturbance, menopause, gall bladder disease and fatty liver were (52.0%) ,(42.4%) ,(40.7%) ,(45.8%) ,(19.2%) ,(60.5%) , (47.5%), (18.1%) and (4.5%) respectively(Table 6) shows the distribution of a male study group by demographic characteristics in which the main age group between 40-60 years old with percentage (51.4%). Majority of the male sample lived in urban area (64.5%), and most of them were self –employed (47.8%). The percentage of males with unhealthy diet, physical inactivity, smoking, sleep disturbances and chronic stress were (48.6%), (81.9%), (65.9%), (65.2%), and (82.6%) .respectively

(Table 7) shows the distribution of health-related factors in males, the overweight and obesity were (35.5%) and (32.6%) respectively while central obesity about (77.5%).Other factors like hypertension, DM, low HDL, high triglyceride, family history of chronic disease and premature heart disease their percentages were (55.8%), (47.8%), (18.1%), (55.1%), (67.4%) and (27.5%) respectively.. Table (8) shows the high frequency distribution of many of risk factors central obesity, low HDL, gall bladder diseases and types of diet (89.3%), (40.7%), (18.1%) and (63.3%) respectively among females more than male (77.5%), (18.1%), (7.2%) and (48.6%) respectively with statistical association of these factors to female (p-value=0.005, 0.000, 0.005, and 0.009) respectively. While in male, there was high frequency distribution with statistical association to smoking (65.9%) than (6.8%) in female with (p-value=0.000).

In related to risk assessment score as in (table 9) shows the distribution of risk score according to gender, we found that higher percentage of females (53.1%) were moderate risk for development of MS while for males were (47.8%) and there was no statistical significant association between gender and risk for MS with p value=0.648. There was statistically significant association between the risk for development of MS to an age group's with (p-value= 0.002) as in (table 10) the distribution of risk groups for development of MS according to age, there was about (60%) of patients >60 years had moderate risk for developing of MS, (23.1%) at high-risk and only (16.9%) at low risk for development of MS within the same age group. While at age groups between 40-60 years, there was (53%) had moderate risk, (19.5%) to be at high-risk and (27.5%) at low risk for developing of MS(Table 11) shows, the association of other health factors to risk score was highly significant association for the risk to development of MS with hypertension and triglyceride mainly among high-risk group (71.9%) and (73.7%) respectively with (p value=0.000). There was statistical significant association of risk score

to BMI, central obesity, DM, low HDL, type of diet, and physical inactivity with p value = (0.048), (0.043), .(0.017), (0.018), (0.019), and (0, 004) respectively
(Table 12) show, the association of female's risk factors for development of MS and there was a statistical relation to menopause, mainly among the high risk groups (61.3%) with (p-value= 0004) but there was no statistical association to PCOS with (p-value= 0.427).

Table 3: Distribution of study group by risk score.

Risk score	number	%
<10(Low risk)	98	31.1
11-19 (Moderate risk)	160	50.8
>20 (High risk)	57	18.1
Total	315	100.0

Table(4): Distribution of the female's socio demographic characteristics.

Characteristics	**Number**	**%**
Age groups		
19-39 years	66	37.3
40-59 years	78	44.1
>60 years	33	18.6
Address		
Urban	135	76.3
Rural	42	23.7
Employment		
Government employed	35	19.8
Self Employed		
Unemployed	10	5.6
	132	74.6
Type of diet(rich with CHO and fat)		
YES	112	63.3
NO	65	36.7
Physical inactivity<3hr/week		
YES		
NO	150	84.7
	27	15.3
Smoking		
Yes	12	6.8
No	165	93.2
Sleep disturbance		
Yes	116	65.5
No	61	34.5
Chronic stress		
Yes	149	84.2
No	28	15.8

Table (5): Distribution of health-related factors in the females.

Characteristics	Number	%
BMI(BW/HT2)		
<18.5	9	5.0
18.5-24.9	38	21.5
25-29.9	77	43.5
30-39.9	47	26.6
>40	6	3.4
Central Obesity (WHR)		
Abnormal>0.85	158	89.3
Normal<0.85	19	10.7
Blood Pressure		
>140/90 Or On Treatment	92	52.0
Normal	85	48.0
Fasting Blood Sugar		
>110mg/dl Or On Treatment	75	42.4
Normal	102	57.6
High density lipoprotein(HDL)		
Abnormal<50mg/dl	72	40.7
Normal	105	59.3
Triglyceride (TG)		
>150mg/dl	81	45.8
Normal	96	54.2
Polycystic ovarian syndrome (PCOS)		
Yes	34	19.2
No	143	80.8
Menstrual disturbance		
Yes	107	60.5
No	70	39.5
Family history of chronic disease(DM,CVD, central obesity)		75.1
Yes	133	24.9
No	44	
Menopause		
Yes	84	47.5
No	93	52.5
Gall bladder disease		
Yes	32	18.1
No	145	81.9
Fatty liver		
Yes	8	4.5
No	169	95.5

Table (6): Distribution of the socio demographic characteristics in the male.

Characteristics	Number	%
Age groups		
19-39 years	35	25.4
40-59 years	71	51.4
>60 years	32	23.2
Address		
Urban	89	64.5
Rural	49	35.5
Employment		
Government employed	41	29.7
Self Employed	66	47.8
Unemployed	31	22.5
Type of diet(rich with CHO and fat)		
YES	67	48.6
NO	71	51.4
Physical inactivity<3hr/week		
YES	113	81.9
NO	25	18.1
Smoking		
Yes	91	65.9
No	47	34.1
Sleep disturbance		
Yes	90	65.2
No	48	34.8
Chronic stress		
Yes	114	82.6
No	24	17.4

Table (7): Distribution of the health related factors in the male.

Characteristics	Number	%
BMI(BW/HT2)		
<18.5	6	4.4
18.5-24.9	34	24.6
25-29.9	49	35.5
30-39.9	45	32.6
>40	4	2.9
Central Obesity (WHR)		
Abnormal>1	107	77.5
Normal<1	31	22.5
Blood Pressure		
>140/90 Or On Treatment	77	55.8
Normal	61	44.2
Fasting Blood Sugar		
>110mg/dl Or On Treatment	66	47.8
Normal	72	52.2
HDL		
Abnormal<40mg/dl	25	18.1
Normal	113	81.9
Triglyceride		
Abnormal>150mg/dl	76	55.1
Normal<150mg/dl	62	44.9
Family history of chronic disease(DM,CVD, central obesity)		
Yes		67.4
No	93	32.6
	45	
Gall bladder disease		
Yes	10	7.2
No	128	92.8
Fatty liver		
Yes	5	3.6
No	133	96.4
Premature heart disease or chest pain		
Yes		
No	38	27.5
	100	72.5

Table (8): Distribution of socio demographic and health related factors to the gender.

Characteristics	Gender		Chi-square	p-value
	Female %	Male %		
Central obesity	89.3%	77.5%	7.989	0.005
Low HDL	40.7%	18.1%	18.522	0.000
Gall bladder diseases	18.1%	7.2%	7.875	0.005
Types of diet	63.3%	48.6%	6.854	0.009
Smoking	6.8%	65.9%	123.333	0.000

Table (9): Distribution of risk groups for development of MS according to the gender.

Risk groups		**Gender**		**P-Value**
		Female	**Male**	
(Low risk)	number	52	46	0.648
	%	29.4	33.4	
(Moderate risk)	number	94	66	
	%	53.1	47.8	
(High risk)	number	31	26	
	%	17.5	18.8	
Total	number	177	138	
	%	100	100	

Table (10): Distribution of risk groups for development of MS according to age.

Risk groups		**Age groups**			**Total**	**p-value**
		19-39 years old	**40-60 years old**	**>60 years old**		
(Low risk)	Number	46	41	11	98	0.002
	%	45.5	27.5	16.9		
(Moderate risk)	Number	42	79	39	160	
	%	41.6	53.0	60.0		
(High risk)	Number	13	29	15	57	
	%	12.9	19.5	23.1		
Total	Number	101	149	65	315	
	%	100	100	100		

Table 11: Distribution the risk groups for metabolic syndrome according to the health related and demographic characteristics.

Characteristics	Low risk group Number %	Moderate risk group Number %	High-risk group Number %	Chi-square	p-value
BMI					
<18.5	7 7.1	2 1.2	6 10.5	15.025	**0.048**
18.5-24.9	26 26.5	35 21.9	11 19.3		
25-29.9	34 34.7	69 43.1	23 40.4		
30-39.9	29 29.6	46 28.8	17 29.8		
>40	2 2.1	8 5.0	0 0.0		
Central obesity					
Yes	75 76.5	141 88.1	49 86.0	6.294	**0.043**
No	23 23.5	19 11.9	8 14.0		
High blood pressure					
Yes	36 36.7	92 57.5	41 71.9	19.890	**0.000**
No	62 63.3	68 42.5	16 28.1		
High blood sugar					
Yes	38 38.8	68 42.5	35 71.9	8.136	**0.017**
No	60 61.2	92 57.5	22 28.1		
Low HDL					
Yes	20 20.4	54 33.8	23 40.4	8.059	**0.018**
No	78 79.6	106 66.2	34 59.6		
High Triglyceride					
Yes	35 35.7	80 50.0	42 73.7	20.787	**0.000**
No	63 64.3	80 50.0	15 26.3		
Family history of chronic disease				5.353	0.069
Yes	68 69.4	123 76.9	35 61.4		
No	30 30.6	37 23.1	22 38.6		
Smoking					
Yes	31 31.6	51 31.9	21 36.8	0.545	o.762
No	67 68.4	109 68.1	36 63.2		
Chronic Stress					
Yes	76 77.6	139 86.9	48 84.2	3.860	0.145
No	22 22.4	21 13.1	9 15.8		
Type of diet					
Yes	45 45.9	102 63.8	32 56.1	7.890	**0.019**
No	53 54.1	58 36.2	25 43.9		
Physical inactivity					
Yes	72 73.5	143 89.4	48 84.2	11.182	**0.004**
No	26 26.5	17 10.6	9 15.8		

Table 12: Distribution of female's health related factors according to risk groups for MS.

Characteristics	Low risk group Number %	Moderate risk group Number %	High risk group Number %	Chi-square	p-value
Menopause					
Yes	15 28.8	50 53.2	19 61.3	10.842	**0.004**
No	37 71.2	44 46.8	12 38.7		
PCOS					
Yes	7 13.5	21 22.3	6 19.4	1.701	0.427
No	45 85.5	73 77.7	25 80.6		

Discusion :

Metabolic syndrome (MS) is a complex disorder with high socioeconomic cost that is considered a worldwide epidemic. Although the presence of main criteria for MS can predict the risk of CVD and type 2 DM, but it cannot estimate the exact risk, as a significant part may be related to other factors such as smoking, type of diet, physical inactivity, age, and gender [32]. There are few international comparable studies of the risk assessment of MS among adult patients, but we could not find similar studies from nearby Arabic countries only study in US about global risk assessment of MS in adult by using a Framingham risk score [32].

In this study, the majority of patients (50.8%) were in moderate risk for developing MS, and it was more prevalent in female (53.1%) than male (47.8%) when compared to study done in US, found that high prevalence of low-risk group and it is more in female than male [32].This may be indicated to increase awareness of population in developed countries about many modifiable risk factors of MS compared to developing countries.

This study shows, there was high frequency distribution of most of metabolic risk factors among female (63.3%), compare to male like central obesity, type of diet, low HDL, and gallbladder diseases (89.3%), (40.7%), and (18.1%) with p-value (0.005), (0,009), (0.000), and (0.005) respectively while in male, the frequency was (77.5%), (48.6%), (18.1%), and (7.2%) respectively but there was no statistical association in male. There was no statically association of gender to other socio demographic and health related factors like (hypertension, DM, obesity and increase TG), the frequency between female were (52.0%), (42.4%), (26.6%), (45.8%) and in male (55.8%), (47.8%), (32.6%), (55.1%) respectively . This result was consistent with data collected by WHO in Iraq in 2005 found overweigh and obesity were (50.8%), (16.8%) and it was higher among female than male [25] and consistent with study in India found there was higher prevalence of central obesity among female than male [16]. The exact explanation of such gender variations was not entirely clear, it may attributed to women are less active compared with men ,limited exercise facilities for women, lack of physical education, sedentary lifestyle, unhealthy diet(rich with carbohydrate and fat) and absence of women's participation in organized sports.

While in male, there was only high frequency and highly significant association of cigarette smoking (65.9%) with p-value=0.000 more than female (6.8%) which may be attributed to universally high incidence of smoking among males compare to the female.

Also, in this study there was no statistical association of risk groups for development of MS to the gender although there was higher frequency of the moderate risk groups in female (53.1%) and (47.8%) in male with (p-value= 0.648) consisting with study done by Bamashmoos M.A. and *et al* in Yemen [20] found no gender variation in related to MS about (46.4%) in female and (45%) in male , in addition to study in Brazil found (33.0%) in female and (30.9%) in male [3].It was inconsistent with study done in Saudi Arabia [2] in which higher prevalence among male (22.8%) than (13.8%) in female with p-value 0.001 while study in Turkey shows higher among female (39.6%) than (28%) in male [18].

The study shows statistical significant association of risk groups for development of MS to the age (p-value= 0.002) mainly among the moderate risk groups which was higher prevalence (53%) and (60%) among age groups (40-60 years) and (> 60 years) respectively, and this result was in good agreement with study done by

Juda T.M. and *et al* in Hilla city [11], and other studies done in Saudi Arabia [2], Pakistan [15], Norwege [14], US [22,32] and in Brazil [37]. All these studies found that prevalence of MS increases with age may be indicated to increase the incidence of risk factors like obesity, DM, and hypertension with aging.

In this study, there was highly statistical significant association of risk for development of MS to hypertension mainly among the high-risk group (71.9%) with (p-value= 0.000). This result supported by study in Basrah in 2007 by Mansour A.A found higher prevalence of hypertension among the study groups (76.5%) [13], other study in Yemen in 2011 found (68%) have hypertension [20], and the study of American Heart Association statistical updated in 2011 found (33.5%) of US adult have hypertension [31].This may be attributed to hypertension associated with many laboratories and anthropometric abnormal findings, which linked to MS such as central obesity that recognized hypertension as main factors involved in pathophysiology of MS and also may be indicated to genetic predisposition factors [10].

There was highly statistical association of risk groups to elevated triglyceride, mainly among the high-risk group (73.7%) with (p-value= 0.000) this result was consisting with study done in Basrah found (69%) of the study group have increased TG [13], in Yemen study also found about (66%) of population have hyper triglycrideamia [20]. This result of high prevalence of TG may be attributed to type of diet, physical inactivity and central obesity or may be due to genetic causes [20].

There was statistical significant association between the risk for development of MS to overweight and obesity among moderate risk group (43.1%) and (28.8%) respectively, with (p-value= 0,048) and it was higher in female than male similar to many studies such as study done by Juda T.M. and *et al* in Hilla city [11] in addition to studies done in Saudi Arabia [2], Kuwait [25] and in Iran [16]. Also, this study shows significant association of risk for development of MS with central obesity among moderate risk group (88.1%) with (p-value= 0.043) and it was higher in females than males which agree to the study in Oman that found higher prevalence of central obesity mainly among female (64.6) and (31.5%) in male [18], Yemen [20] and in Iran (42% for female and 24% in male) [16]. While inconsistent with study done in Basrah found the prevalence of central obesity about (66.5%) and it was higher in male than female [13].

The study shows significant statistical association of risk for development of MS with DM type 2, mainly among high-risk groups (61.4%) with (p-value= 0.017) consisting with study done in Saudi Arabia [2] and in Pakistan [15].This may be attributed genetic factors or to increase prevalence of central obesity, which was considered as risk factors to DM type 2 and also related to unhealthy diet [28].

There was statistical significant association of risk to development MS with low HDL among the high-risk group (40.4%) with (p-value= 0.018) which consistent with study done in Basrah found about (45%) of the patients with MS have low HDL[13], study done in Yemen found about (64%) of patients with MS complain from low HDL [20], study in Saudi Arabia [2] and with study done by Ahmad M., and *et al* in Pakistan found the frequency of low HDL was (87.6%)[15]. This was explained by the physical inactivity, genetic predisposition, as well as dietary habits.

The study shows, a significant association of the risk for development MS with type of diet (rich with carbohydrate and fat) and physical inactivity, among the moderate risk groups (63.8%), (89.4%) with (p-value= 0.019 and 0.004) respectively and mainly among females than males. This consisting with many studies [16, 20, 25] which may be related to high prevalence of obesity and central obesity in developing countries and relation to sedentary lifestyle and unhealthy diet.

In females health related risk factors, we found there was statistical significant association of risk for development MS among moderate risk group to menopause (53.2%) with (p-value=0.004) similar to cross-sectional study done in Brazil in 2010 found (44.4%) of menopausal women have risk of MS [39], and cross-sectional study in Latin America found (42%) of the study group of menopausal women have risk of MS [19].This may be indicated to that female in postmenopausal have higher risk than premenopausal to develop MS due to coincides with the climacteric, hormonal effect, and menopause was characterized by the emergence or worsening of some risk factors: central obesity, systemic hypertension and dyslipidaemia [39]. But we found there was no statistical significant relation of a risk to MS with PCOS (p-value=0.661) which is inconsistent with case-control study done in University of Iowa found significant association of risk to MS with PCOS [38]. This may be attributed to the sample size, and the study was done in a medical hospital while most females with PCOS attending gynecological hospital.

Conclusions:

*The study demonstrates that MS is a multifactorial problem. It shows that (obesity, central obesity, type of diet and physical inactivity) are main modifiable risk factors to MS mainly in moderate risk group. Therefore, public health programs should consider these factors when planning strategies aimed at preventing or reducing incidence of MS in our society.

*This study provides comprehensive and alarming data about the high percentage of many traditional risk factors

of MS (central obesity, DM, hypertension, dyslipideamia) among the population of Babylon especially in females and this risk increase with advancing the age. The results suggest that reducing health education inequalities may be an important public policy goal to improve health outcomes mainly among females.

Recommendations:

* The results of this study have to be further assessed using a more elaborate analytical study and enrolling a bigger sample size.
* The high proportion of risk factors mainly in moderate risk group for MS mandates the conduct of community based surveys for early recognition and prevention of MS and associated risk factors and to reduce the impact of MS on the community.
*As MS is considered global health problem and because the central obesity was the main preventable risk factor, the nutrition and health promotion programs should be encouraged to promote healthy life style and to improve the awareness of population and mainly health workers about nutrition and healthy eating habits and to reduce the tendency to overweigh and obesity.
*The risk of MS is high even at a young age female with PCOS, highlighting the importance of early and regular screening for PCOS.
*This is the may be the first study about the risk assessment of MS in Babylon; its results provide valuable information on the risk factors of MS in such high risk group and should encourage researchers to investigate more such an emerging, health problem.

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