Study the obesity effect and its associated diseases on the lipid profile and albumin levels in obese individual

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Summary

Obesity refers to body mass index (BMI) greater than 30 kg/ m^2. This study was conducted on the 44 obese subjects their biomass index over than 30 and 27 non-obese healthy control. Parameter assessed were (BMI) weight in kg / $hight^2$ in meter, lipid profile, and albumin. The results revealed that there are highly significant increase ($p<0.001$) in concentration of cholesterol, triglycerides, LDL and VLDL and significantly increased ($p<0.01$) in concentration of HDL comparing with the control. In addition albumin concentration was non significant difference ($p>0.05$) comparing with the control. The statistical analysis demonstrated that there wasn't significant difference ($p>0.05$) in lipid profile and albumin concentration between male and female but there was highly significant increase ($p< 0.001$) in female BMI comparing with male. When the subjects were classified into two groups depending on associated diseases, the result showed that there was highly significant increased ($p<0.0001$) in concentration of cholesterol, triglycerides and VLDL in obese subjects with diseases (57%) comparing with healthy obese subjects (43%). Also there was significant increase ($p<0.05$) in concentration of HDL and albumin in obese subjects with diseases when comparing with healthy obese, Whereas LDL concentration was significantly increased ($p<0.01$). In contrast when classified the subjects according to their age, group1 (18-40) year and group2 (41-80) year. The results appear that there were no significant differences ($p>0.05$) in concentration of lipid profile and albumin between these groups. Significant correlations were found between BMI and LDL in obese female ($p<0.05$) whereas there were significant correlation between BMI and HDL ($p<0.01$) and significant correlation between BMI with each VLDL and triglycerides ($p<0.05$) in obese male. In addition there wasn't significant correlation between age and lipid profile according to Pearson's coefficient.

The objective of this study was to validate the relationship of lipid profile with many diseases, such as diabetes mellitus, atherosclerosis, and coronary heart diseases in obese subjects comparing with healthy non-obese.

Key words: obesity, lipid profile, associated diseases.

الخلاصـــــة

السمنة تشير الى دليل كتلة الجسم عندما تكون اكثر من 30 كغم\ م^2. اجريت الدراسة على 44 شخصا دليل كتلتهم الحيوية اكثر من 30 و 27 شخصا من الاصحاء غير المصابين بالسمنة كسيطرة. العوامل التي تم قياسها كانت الكتلة الحيوية للجسم , مستوى الدهون والالبومين. أظهرت النتائج عن وجود زيادة معنوية عالية ($p<0.001$) في تركيز كل من الكوليسترول , الكليسيريدات الثلاثية, LDL, و VLDL وزيادة معنوية عالية ($p<0.01$) في تركيز HDL مفارنة مع السيطرة. بالاضافة الى ذلك لم تكن هناك فروقات معنوية ($p>0.05$) في تركيز الالبومين مقارنة مع السيطرة. اظهر التحليل الاحصائي عدم وجود فروقات معنوية ($p>0.05$) في تراكيز مستوى الدهون والالبومين بين جنس الاناث والذكور لكن وجود زيادة معنوية عالية ($p<0.001$) في الكتلة الحيوية للاناث مقارنة بالذكور. عندما صنفت العينات الى مجموعتين اعتمادا على الامراض المرافقة مع السمنة, اظهرت النتائج عن وجود زيادة معنوية عالية ($p<0.0001$) في تركيز الكوليسترول والكليسيريدات الثلاثية و VLDL في عينة المصابين بارتفاع الوزن مع حالات مرضية مرافقة لهم (57%) مقارنة مع عينة المصابين بارتفاع الوزن الاصحاء (43%). كذلك وجود زيادة معنوية ($p<0.05$) في تركيز كل من HDL و الالبومين للمصابين بارتفاع الوزن مع حالات مرضية مقارنة مع الذين عندهم ارتفاع وزن اصحاء بينما تركيز ال LDL كان في زيادة معنوية ($p<0.01$). على النقيض من ذلك عندما قسمت العينات حسب العمر الى مجموعتين, مجموعة 1 تراوحت اعمارهم من (18-40) سنة والمجموعة 2 تراوحت اعمارهم (41-80) سنة. اظهرت النتائج عدم وجود فروق معنوية ($p>0.05$) في تركيز الدهون والالبومين بين المجموعتين. ووجد ان هناك ارتباط معنوي بين ال BMI و LDL ($p<0.05$) عند الاناث اللواتي لديهن زيادة في الوزن بينما كان هناك ارتباط معنوي ($p<0.01$) بين BMI و HDL وارتباط معنوي ($p<0.05$) بين BMI مع كل من VLDL والكليسيريدات الثلاثية لجنس الذكور الذين لديهم ارتفاع في الوزن. بالاضافة الى ذلك لم يكن هناك ارتباط معنوي بين العمر مع مستوى الدهون والالبومين وفقا لمعامل بيرسون.

Introduction

In recent decades the prevalence of obesity (body mass index (BMI) ≥30 kg/m2) has dramatically increased in eastern societies. Overweight and obesity are major epidemics in much of the modern world today. The prevalence of obesity is increasing dramatically in many countries and is reaching alarming levels in several countries [1]. Obesity is a global problem. It affects all age groups. The effective prevention of adult obesity will require the prevention and management of childhood obesity [2]. The health risks of excessive body fat associated with relatively small increase in body weight, not only with marked obesity [2]. BMI is closely correlated with the degree of body fat in most settings [3].

Obesity is a condition of abnormal or excessive fat accumulation in adipose tissue to the extent that health may be impaired. However, because it is difficult to measure body fat directly, measures of relative weight for height, such as the Body Mass Index (BMI), are commonly used to indicate overweight and obesity in adults. In the new graded classification system developed by the World Health Organization, a BMI of 30 kg/m2 or above denotes obesity (Table 1). It is highly likely that individuals with a BMI at or above this level have excessive body fat [4]. Although several classifications and definitions for degrees of obesity are accepted, the most widely accepted is the World Health Organization (WHO) criteria based on BMI. Under this convention for adults, grade 1 overweight (commonly and simply called overweight) is a BMI of 25-29.9 kg/m^2. Grade 2 overweight (commonly called obesity) is a BMI of 30-39.9 kg/m^2. Grade 3 overweight (commonly called severe or morbid obesity) is a BMI greater than or equal to 40 kg/m^2 [3].

Obesity affects people of all ages and all social groups. It is already threatening the future wellbeing and longevity of many Pacific Island youth, as well as the economic prosperity of Pacific Island countries. Obese individuals and their families bear a considerable personal cost in the form of disability and premature death. More broadly, obesity imposes huge financial burdens on health care systems and the community at large. Of particular concern is that, because obesity-related illness begins at an early age, a high rate of obesity increases the demand for health services on an ongoing basis. Furthermore, the condition impairs an obese individual's productivity and contribution to his or her [4].

Obesity is a serious medical problem, increasing in prevalence, affecting millions, and of great interest to the public. To articulate the burden of obesity, investigators have used indicators such as prevalence, economic cost, and association with risk factors and diseases [5].

One of the most common problems related to lifestyle today is being overweight. Severe overweight or obesity is a key risk factor in the development of many chronic diseases such as Cardiovascular diseases ,respiratory diseases, non-insulin-dependent diabetes mellitus or Type 2 diabetes, hypertension, osteoarthritis, dyslipidaemia, ischaemic stroke, degenerative joint disease, gallstones, fertility problems (decrease in perceived quality of life) and some types of cancers, as well as early death. New scientific studies and data from life insurance companies have shown that the health risks of excessive body fat are associated with relatively small increases in body weight, not just with marked obesity [4,6].

Several studies investigating the epidemiology of obesity and overweight have used data from the United States and assessed associations between body weight and diseases. Must *et.al.* 1999 and Field *et. al,*2001 found that the associations between BMI and several chronic diseases increased with the severity of overweight both in men and women [7,8] and Patterson *et al* has shown that BMI was also associated with a broad range of self-reported health complaints [9]. The use of data from various European countries [10] or those also including health complaints and physical disabilities is less frequent [9, 11, 12].

Waist circumference is positively associated with health risk; hip and thigh circumferences are negatively associated with health risk. This implies a protective effect of a large hip or thigh circumference (or both), which could be due to a greater lean mass in the nonabdominal regions. Indeed, lean body mass is negatively associated with all-cause mortality. [13]

Dyslipidemia and the metabolic syndrome were defined according to the latest National Cholesterol Education Program guidelines; that is, dyslipidemia was defined as hypercholesterolemia (total cholesterol (≥240 mg/dL), high LDL cholesterol (≥160 mg/dL), low HDL cholesterol (<40 mg/dL), and high triacylglycerol (serum triacylglycerol ≥200 mg/dL), and metabolic syndrome was defined as 3 or 4 of the following: triacylglycerol concentration (≥150 mg/dL), HDL cholesterol concentration <40 mg/dL in men or <50 mg/dL in women, blood pressure ≥130/85 mm Hg, and fasting glucose concentration ≥110 mg/dL [14]. Dyslpidaemia is common among the obese and is characterized by raised plasma triglycerides and low density lipoprotein LDL and lower high density lipoprotein HDL cholesterol concentrations. This metabolic profile is often seen in those with abdominal obesity [15].

Table 1. Classification of overweight in adults according to BMI

Classification	BMI (kg/m2)	Risk of associated illness
Underweight	<18.5	Low (but greater risk of other clinical problems)
Normal range	18.5–24.9	
Overweight	>25.0	Average
Pre-obese	25.0–29.9	Increased
Obese class I	30.0–34.9	Moderate
Obese class II	35.0–39.9	Severe
Obese class III	>40.0	Very severe

Source: World Health Organization (2000)

Subjects and method

The obese subjects were 44 and 27 were non obese as control. These subjects were obtained from Al-Hussain Hospital. A body mass index (BMI) of obese was over than 30 kg/m^2 and non-obese was less than 30 kg/m^2. Obese female were 14 and 30 obese male whereas the healthy control were 13 female and 14 male. The age of subjects ranging from (18-81) year. The subjects classified into two groups, obese with associated diseases such as diabetes mellitus, hypertension, angina pectoris, thrombosis, and cardiovascular diseases and obese with not associated diseases.

Determination of plasma lipids and albumin

Blood samples were obtained to determine plasma lipid (cholesterol, triglycerides, and HDL) and albumin concentrations. Blood samples of 5 ml were drawn from the vein and collected in tube then centrifuged at 4000 rpm for 10 minuets. The lipids were determined by using reflotron plus apparatus.

Statistical analysis

Data were analyzed with statistical package for the social sciences (SPSS) version 16 and expressed as mean ± standard deviation (SD). A p-value of <0.05 was considered statistically significant.

Results

This study investigated the association between body weight and health. The clinical results of the concentration of lipid profile and albumin in subjects under study represented in (Table 1). The obtained results revealed highly significant ($p<0.001$) increase in concentrations of cholesterol, triglycerides, LDL, and VLDL and significant increase ($p<0.01$) in concentration of HDL, but there wasn't significant difference in concentration of albumin of obese subjects comparing with healthy non-obese.

Table (1) The concentration of lipid profile and albumin between obese and non-obese subjects

Parameters	Grouping	N	Mean ± SD.	p-Value
Cholesterol (mmol./l)	Obese Non-obese	44 27	6.43 ± 1.55 4.86 ± 1.11	P<0.001
Triglycerides (mmol./l)	Obese Non-obese	44 27	2.65 ± 1.37 1.75 ± 0.8	P≤ 0.001
HDL (mmol./l)	Obese Non-obese	44 27	1.48 ± 0.8 1.11 ± 0.27	P<0.01
LDL (mmol./l)	Obese Non-obese	44 27	4.41 ± 1.29 2.42 ± 1.49	P<0.001
VLDL (mmol. /l)	Obese Non-obese	44 27	0.531 ± 0.27 0.35 ± 0.16	P<0.001
Albumin (g/l)	Obese Non-obese	44 27	49.65 ± 11.65 48.29 ± 7.46	P> 0.05

P< 0.05 Significant
P> 0.05 No significant

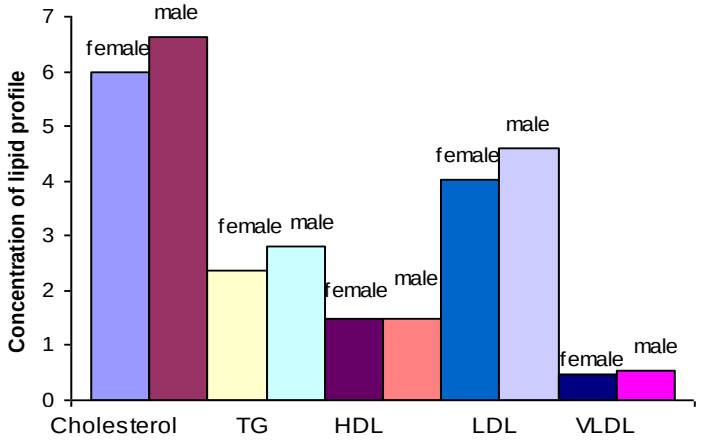
There were no significant differences ($p>0.05$) in concentration of lipid profile and albumin between obese female and male, but the BMI was significantly increased ($p<0.001$) in female than male (Table 2).

Table (2) The concentration of lipid profile and albumin between obese female and male

Parameters	Sex	N	Mean ± SD.	p-Value
Cholesterol (mmol./l)	Female Male	14 30	6 ± 1.12 6.6 ± 1.69	P > 0.05
Triglycerides (mmol./l)	Female Male	14 30	2.37 ± 1.17 2.79 ± 1.45	P > 0.05
HDL (mmol./l)	Female Male	14 30	1.492 ± 0.66 1.48 ± 0.87	P > 0.05
LDL (mmol./l)	Female Male	14 30	4.03 ± 0.85 4.59 ± 1.43	P > 0.05
VLDL (mmol. /l)	Female Male	14 30	0.47 ± 0.23 0.55 ± 0.29	P > 0.05
Albumin (g/l)	Female Male	14 30	50.14 ± 10.82 49 ± 12.19	P > 0.05
BMI	Female Male	14 30	50.142 ± 10.82 34.05 ± 2.77	P < 0.001

P< 0.05 Significant
P> 0.05 No significant

In spite of there weren't significant difference between male and female in the concentration of lipid profile but their concentrations in male were higher than female (Fig.1)



(Fig 1) Histogram explained the differences between male and female in concentration of lipid profile

According to the results of lipid profiles and albumin concentrations of obese subjects with associated diseases (57%) or not (43%) (Fig.2) the statistical analysis showed highly significant increased ($p<0.0001$) in concentration of cholesterol, triglycerides, and VLDL and significantly increased ($p<0.01$) in concentration of LDL and ($p<0.05$) in concentration of HDL and albumin of obese subjects with associated diseases compared with those not obese (Table 3).

Table (3) The concentration of lipid profile and albumin in obese subjects with diseases and no diseases

Parameters	Obese Grouping	N	Mean ± SD.	p-Value
Cholesterol (mmol./l)	No disease With diseases	20 24	5.35 ± 0.96 7.33 ± 1.36	P< 0.0001
Triglycerides (mmol./l)	No disease With diseases	20 24	1.73 ± 0.61 3.43 ± 1.35	P < 0.0001
HDL (mmol./l)	No disease With diseases	20 24	1.21 ± 0.28 1.71 ± 1.01	P < 0.05
LDL (mmol./l)	No disease With diseases	20 24	3.79 ± 0.84 4.93 ± 1.39	P < 0.01
VLDL (mmol. /l)	No disease With diseases	20 24	0.34 ± 0.122 0.68 ± 0.27	P < 0.0001
Albumin (g/l)	No disease With diseases	20 24	45.3 ± 8.33 53.29 ± 12.89	P < 0.05

P< 0.05 Significant
P> 0.05 No significant

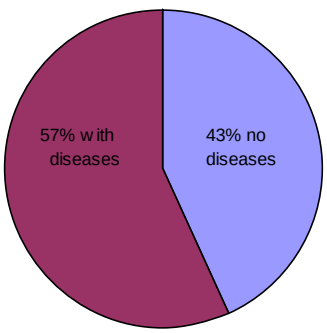


Fig (2) percentage of obese subjects with different diseases and with no diseases

The obese subjects under study classified into two groups depending on their age. Group aged (18-40) year and group were aged (41-80) year. Results of table 4 showed that there wasn't significant difference in concentrations of lipid profile and albumin between these groups.

Pearson correlation coefficients were used to examine the relations between BMI and lipid profile concentrations as well as between age and lipid profile concentrations. Significant correlations were found between BMI and LDL in obese female ($p<0.05$) whereas there were significant correlation between BMI and HDL ($p<0.01$) and significant correlation between BMI with each VLDL and triglycerides ($p<0.05$) in obese male (Fig.3). In addition there weren't significant correlation between age and lipid profile according to Pearson's correlation coefficient.

Table (4) The concentration of lipid profile and albumin in two age group

Parameters	Age Grouping of Obese	N	Mean ± SD.	p-Value
Cholesterol (mmol./l)	18-40 41-80	19 25	6.3 ± 1.4 6.52 ± 1.68	P>0.05
Triglycerides (mmol./l)	18-40 41-80	19 25	2.48 ± 1.37 2.78 ± 1.38	P>0.05
HDL (mmol./l)	18-40 41-80	19 25	1.4 ± 0.61 1.54 ± 0.93	P>0.05
LDL (mmol./l)	18-40 41-80	19 25	4.4 ± 1.12 4.42 ± 1.43	P>0.05
VLDL (mmol. /l)	18-40 41-80	19 25	0.49 ± 0.27 0.55 ± 0.27	P>0.05
Albumin (g/l)	18-40 41-80	19 25	48.05 ± 11.69 50.88 ± 11.71	P>0.05

P< 0.05 Significant
P> 0.05 No significant

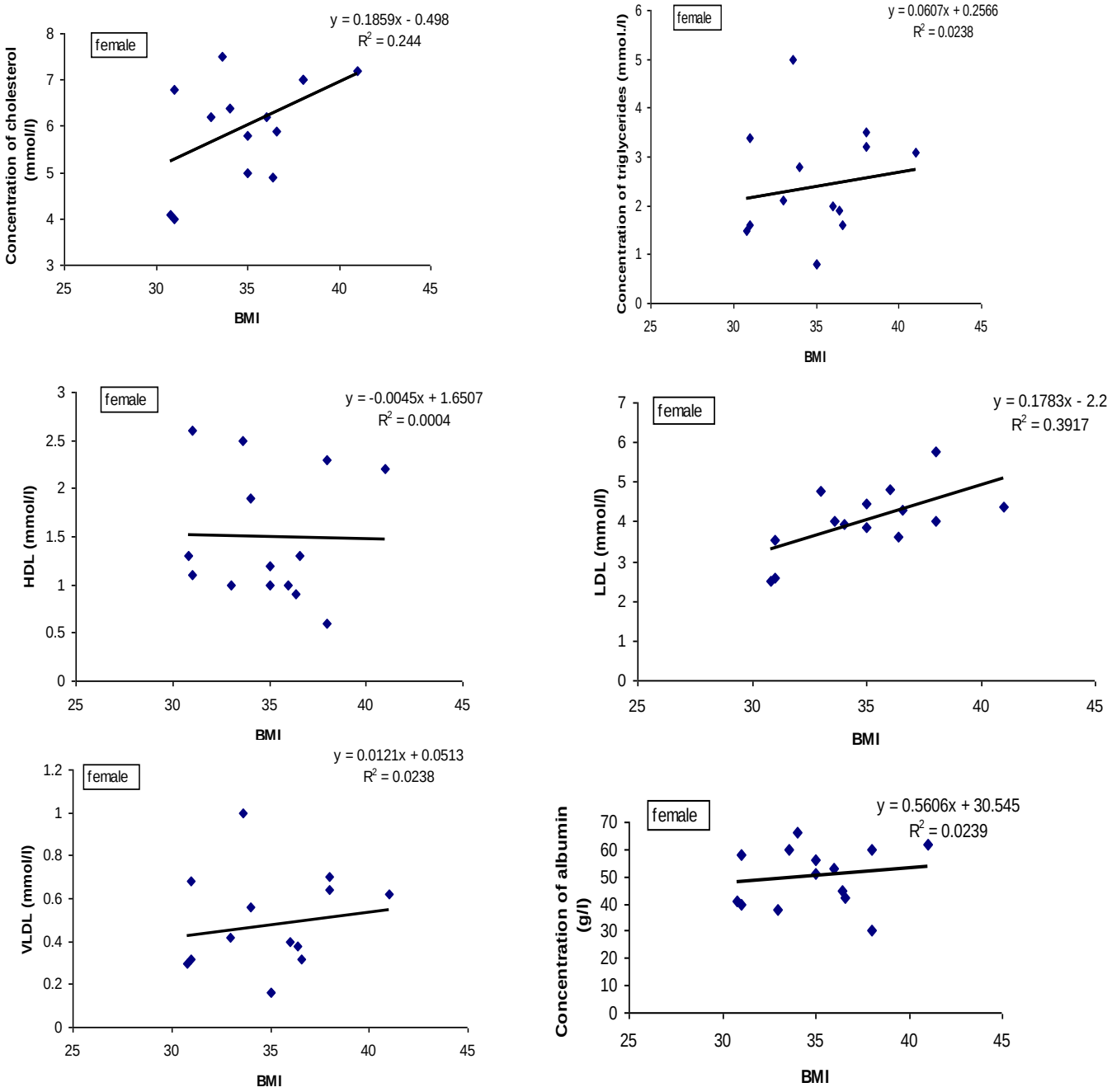


Fig.(3) The correlation between BMI and lipid profile

Discussion

The present study, adjusting for sex, and age, may provide conservative estimates of annual number of deaths attributable to obesity and do not control for confounding from prevalent chronic disease at baseline or residual confounding from which are associated with lower body weight and increased mortality. Thus, this study may underestimate risks of excess weight.

Several factors modulate the morbidity and mortality associated with obesity. They include age of onset and duration of obesity, severity of obesity, amount of central adiposity, other co morbidities, sex, and level of cardiorespiratory fitness [3].

This study has shown increase in the concentrations of lipids in obese individuals. Obese individuals are more likely to have elevated blood triglycerides (blood fats), low density lipoprotein (LDL) cholesterol ("bad cholesterol") and decreased high density lipoprotein (HDL) cholesterol (“good cholesterol”). This metabolic profile is most often seen in obese people with a high accumulation of intra-abdominal fat ("apples") and has consistently been related to an increased risk of CHD. With weight loss, the levels of triglycerides can be expected to improve. A 10 kg weight loss can produce a 15% decrease in LDL cholesterol levels and an 8% increase in HDL cholesterol (obesity and overweight) [16]

Our study revealed 57% of obese associated with diseases and 47% with no diseases. Frijters and Baron (2009) found that the obese are 18 percentage points more likely to have experienced high blood pressure in the current period; 14 percentage points more likely to have experienced diabetes; 1.2 percentage points more likely to have experienced chronic lung disease; 1.9 percentage points more likely to have experienced a heart attack (and related diseases); 3.7 percentage points more likely to have experienced emotional/psychiatric problems; and 13 percentage points more likely to have experienced arthritis [17].

For overweight and obesity, the odds for high blood pressure, high cholesterol, diabetes and arthritis were significantly and similarly increased for men and women. In addition, obese men and women were at elevated risk of any heart diseases and depression [9]. The early trends indicate that women become obese earlier than men, but now the rates for men are slowly becoming as high as those for women [1].

Obesity is a serious condition in its own right. It increases the risk of disability and death and requires focused prevention and control measures. It is also causally linked to many other chronic diseases such as diabetes, hypertension, heart disease and some cancers [4]. Overweight and obesity are closely associated with these diseases [1]. The relative risk of diabetes increases by approximately 25 percent for each additional unit of BMI over 22 kg/m^2 [18].

Many study in japan and and in French Canadian familial hypercholesterolaemic patients demonstrated the Visceral fat accumulation, with low HDL cholesterol and high plasma triglyceride levels, was reported as a coronary risk factor [19]. The expression of coronary heart disease among familial hypercholesterolaemic patients may be influenced by other risk factors, such as age, male sex, smoking, visceral obesity, high total cholesterol levels, low HDL cholesterol levels [19]. (Flegal *et al.* (2005) found that overweight people exhibit a higher risk of premature death compared to people with a normal Body Mass Index (BMI); the excess deaths due to overweight were in fact negative [20]. Janssen *et.al.* (2004) study showed that overweight and obese subjects were more likely to have hypertension, dyslipidemia, and the metabolic syndrome than were normal-weight subjects [13]. Real *et al* (2001) showed that only HDL cholesterol values were associated with coronary heart disease (beta 2·32±0·9, *P*=0·015 [19]. Kaur *et.al* (2008) demonstrated the significantly increased of the lipid profile level in patients with cardiovascular diseases [21].

The relationship of the age-adjusted prevalence of high total cholesterol, defined as 240 mg/dL (6.21 mmol/L), to BMI. At each BMI level, the prevalence of high blood cholesterol is greater in women than in men. In a smaller sample, higher body weight is associated with higher levels of total serum cholesterol in both men and women at levels of BMI > 25. Several large longitudinal studies also provide evidence that overweight, obesity and weight gain are associated with increased cholesterol levels. In women, the incidence of hypercholesterolemia also increases with increasing BMI. In addition, the pattern of fat distribution appears to affect cholesterol levels independently of total weight. Total cholesterol levels are usually higher in persons with predominant abdominal obesity, defined as a waist-to-hip circumference ratio of 0.8 for women and 1.0 for men [18].

The strong association of triglyceride levels with BMI has been shown in both cross-sectional and longitudinal studies, for both sexes and all age groups. In three adult age groups, namely 20 to 44 years, 45 to 59 years, and 60 to 74 years, higher levels of BMI, ranging from 21 or less to more than 30, have been associated with increasing triglyceride levels; the difference in triglycerides ranged from 61 to 65 mg/dL (0.68 to 0.74 mmol/L) in women 134 and 62 to 118 mg/dL (0.70 to 1.33 mmol/L) in men. HDL-cholesterol levels at all ages and weights are lower in men than in women. Cross-sectional studies have reported that HDL-cholesterol levels are lower in men and women with higher BMI. Longitudinal studies have found that changes in BMI are associated with changes in HDL-cholesterol. A BMI change of 1 unit is associated with an HDL-cholesterol change of 1.1 mg/dL for young adult men and an HDLcholesterol change of 0.69 mg/dL for young adult women [18].

The link between total serum cholesterol and CHD is largely due to low-density lipoprotein (LDL). A high-risk LDL-cholesterol is defined as a serum concentration of 160 mg/dL. This lipoprotein is the predominant atherogenic lipoprotein and is therefore the primary target of cholesterol-lowering therapy. Cross-sectional data suggest that LDL-cholesterol levels are higher by 10 to 20 mg/dL in relation to a 10 unit difference in BMI, from levels of 20 to 30 kg/m2. Clinical studies have shown that small, dense LDL particlesare particularly atherogenic and tend to be present in greater proportion in hypertriglyceridemic patients with insulin resistance syndrome associated with abdominal obesity [18].

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