RELATIONSHIP OF BODY MASS INDEX AND DYSLIPIDEMIA IN DIFFERENT AGE GROUPS OF MALE AND FEMALE POPULATION OF PESHAWAR

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Background: BMI is linearly related to the total cholesterol, LDL cholesterol and triglyceride concentrations and is, however, inversely related with HDL cholesterol, Dyslipidaemia has been recognized to be strongly associated with overweight and obesity and its comorbid conditions. Overweight and obesity is conveniently determined from body mass index (BMI). Present study was conducted in Khyber Medical College, Peshawar to investigate the importance of age in relation to BMI with dyslipidaemia. **Methods:** The study was conducted in Khyber Medical College Peshawar during a span of period covering from 2008 to 2009. A total of 500 volunteer male and female subjects were included, which were grouped according to age. Lipid profile was obtained against BMI of the subjects, categorized as normal, overweight and obese in different age groups. **Results:** The prevalence of dyslipidaemia was both age and gender dependent. Dyslipidaemia show an increasing trend with age in both male and female subjects. In females, dyslipidaemia shows a gradual increase with age for all BMI categories. However, in males, the trend is different. It has been observed that the percentage of females having dyslipidaemia was less as compared to males in the age between 20 and 59 years. On the other hand, dyslipidaemia shows a dramatic increase in females above the age of 59 years. **Conclusion:** There is increase in dyslipidaemia trend in our subjects with increase in BMI and age.

Keywords: BMI, Dyslipidaemia, HDL-C, LDL-C

INTRODUCTION

Clinically, obesity is a complex multi-factorial chronic disease in which excessive accumulation of body fat accompanied by overweight results health risk.[1] The issue of overweight and obesity has become a serious public health concern throughout the world during the last few decades. Overweight and obesity continue to increase substantially worldwide, affecting all ages, sexes and races.[2] The prevalence of overweight and obesity is increasing and obesity is now estimated to be the second leading cause of mortality and morbidity, causing an estimated 2.6 million deaths worldwide and 2.3% of the global burden of disease.[3] Pakistan National Representative Survey showed 25% of the population to be overweight according to the Asian-specific BMI cut-off values and 10.3% are obese. This data confirm a major public health problem in Pakistan.[4] In the Middle East too high levels of obesity exist particularly among women, but often amongst men too, in many countries including Egypt, the Gulf States and Saudi Arabia. Obesity rates of 25–30% and even higher are not atypical in Kuwait, the United Arab Emirate and Bahrain. In Iran obesity rates vary from rural to urban populations rising to 30% among women in Tehran. Adult obesity in Japan averages 20%, rising to 30% in men over 30 years old, and in women over 40 years old, representing a three to four fold increase over the last 40 years.[5] In the World Health Report April 25, 2003, the WHO identifies the main global risks affecting today's disease, disability and death rates. The top 10 risks account for 40% of global deaths, while the next 10 are responsible for <10%. Obesity is an increasingly prevalent metabolic disorder affecting world population as documented in WHO report (2002). More than 2.5 million deaths are weight related.[6]

Very little documentation is available on the problem of obesity among the population of North West Frontier Province (NWFP), Pakistan, where the problem of obesity is becoming an overwhelming health issue. The major reason is attributed to the eating, living and social habits of the people, which is responsible for high levels of adiposity. Populations in which high levels of adiposity are common, such as the population of Pakistan, especially, those living in North-West Frontier Province, the relationship of BMI with dyslipidaemia needs to be investigated.

The present research study is aimed to describe and evaluate relationships between BMI, cholesterol, and high-density lipoprotein-cholesterol (HDL-C). The raised total cholesterol, and low levels of HDL-C is called dyslipidemia. The ratio of total cholesterol to HDL-C of ≥4.5 is considered dyslipidemia.[7] In addition, the study will provide detailed information on the distribution of total cholesterol, and on the impact of dyslipidemia, in relation to levels of BMI for representative samples of adult men and women in NWFP. Furthermore, the research will present new information on relationships between BMI and HDL-C. In recent years, BMI has become the medical standard used to measure over weight and obesity. This is a measure of how appropriate a person's weight is for

his/her height.[4] BMI is calculated by the following formula:

$$BMI(kg/m^2) = \frac{Weight}{Height^2}$$

A desirable BMI according to the WHO recommended cut-offs for Asians is considered to be between 18.5 and 22.9 kg/m^2. A BMI of 23–24.9kg/m^2 is defined as 'overweight' and ≥25 kg/m^2 as 'obese'.[8]

Overweight, Obesity & Dyslipidaemia

In recent findings from the Framingham Offspring[9], indicate that BMI is linearly related to the total cholesterol, LDL cholesterol and triglyceride concentrations and is, however, inversely related with HDL cholesterol, especially in non-smoking men and women. It has been found that most of the comorbidities, which relates obesity to coronary artery disease, increases as BMI increases, and in this way they are associated to body fat distribution.[10]

The link between abdominal obesity and heart disease is partly modulated by the relationship of abdominal obesity to lipid abnormalities: excess visceral or abdominal fat has also been shown to be independently associated with larger very low-density lipoprotein (VLDL): small, dense LDL; and lower levels of HDL-2.[11]

MATERIAL AND METHODS

In this study, data was collected through a questioner. Weight, height and total lipid profile were measured. The BMI was calculated from the data.

Subjects were chosen in the district of Peshawar, where majority of inhabitants are from the rest of the province, belonging to the tribal belts, Bannu, Swat, Swabi, Hazara area and DI Khan. Ethnically, Peshawar bears importance in that it consists of those speaking Pushto (Pakhtoons) and those speaking Hindko (Those belonging to Hazara, Kohat, DI Khan and Peshawar City itself). For the present investigations, the subjects were 500 volunteers (adults men and women), to be categorized as obese, overweight and control. Obese are those with BMI of 25 kg/m^2 or greater. Overweight are those with BMI of 23 kg/m^2 up to 24.9 kg/m^2 and those with BMI less than 18.5 kg/m^2 are considered as control or normal. Subjects were screened through a medical history questionnaire, physical examination, weight measurement, blood test and lifestyle. All the necessary tests were conducted at Pakistan Medical Research Council (PMRC) Laboratory at Khyber Medical College, Peshawar.

Categorization and Age Grouping of Subjects

In the present work the age grouping/categorization was made according to Brown *et al*[7] These are classified as those with age 20–39 years is group I. Group II is between 40–59 years, and group III is between 60–79 years.

Further grouping was prepared in terms of BMI, so as to categorize the subjects as normal, overweight and obese. In the present research, BMI of 18.5 to 22.9 kg/m^2 is termed as normal, BMI between 23 and 24.9 kg/m^2 as overweight and those with BMI ≥25 kg/m^2 as obese for both male and female.

RESULTS

The graph is obtained from the tables below for all subjects having dyslipidaemia and compared with the BMI and age categories in both the male females.

Table-1: BMI Classes and Dyslipidaemia cross tabulation

BMI Classes (Normal, Overweight & Obese	Dyslipidaemia category		Total
	No	Yes	
Normal BMI	42	15	57
Overweight	120	66	186
Obese	139	118	257
Total	301	199	500

Table-2: Age Dyslipidaemia Cross-tabulation

Age (Yrs)	Dyslipidaemia category		Total
	No	Yes	
20–39	90	45	135
40–59	173	115	288
≥60	38	39	77
Total	301	199	500

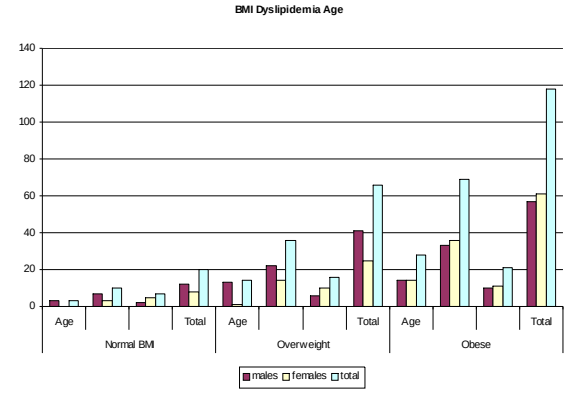

Figure-1: BMI Dyslipidaemia age

Group I (Normal BMI)

The figure shows a typical graph of subjects (both male and female) with BMI between 18.5–22.9 kg/m^2. Referring to figure, a total of 23 subjects (18 males and 5 females) in this BMI category, with having age between 20 and 39 years were included. The results that 3 cases of dyslipidaemia were found in the 18 male subjects tested which comes to be about 16.6%, whereas none of the female subjects showed any sign of dyslipidaemia. A total of 26 subjects (17 males and 9 females) with age between 40 and 59 years were examined in the normal BMI category. It was found that 7 males and 3 females showed a positive sign of dyslipidaemia. The results show about 39% risk of

dyslipidaemia in males as compare to 33% in females. For subject of ages ≥60 years a total of 13 subjects (6 males and 7 females) were examined for dyslipidaemia. The results indicate that out of the total subjects examined, one male and 3 female subjects were tested positive for dyslipidaemia. The result indicates approximately 17% risk in males whereas the risk is about 42% in females.

Group 2 (Overweight)

The graph shows both male and female subjects falling in the category of overweight BMI (23–24.9 kg/m^2). The total male and female subjects falling in the age group between 20–39 years is 41, out of 31 males 13 were recorded as dyslipidaemic showing a result to be about 42% and one female out of 10 was dyslipidaemic it is about 10%. In the age group between 40–59 years the total male and female subjects evaluated were 109, of the total males subjects of 66, 22 were dyslipidaemic and of the total 43 females dyslipidaemia was noted in 14 subjects showing the results to be about 50% and 33% respectively. From the above data it is evident that dyslipidaemia is more prevalent in males in this age group like the previous group. The total male and female subjects in the overweight BMI category having age ≥60 years were 35. The male subjects recording dyslipidaemia were 6 out of 18, i.e., about 32% and 10 out of 17 were female subjects that come out to be about 59%.

Group 3 (Obese)

The figure represents all the subjects coming under the category of obese BMI (≥25 kg/m^2). The total obese individuals evaluated in the age group of (20–39 years) were 70, amongst these 30 were male and 40 were female while the prevalence of dyslipidaemia was 14 males and 14 in females indicating risk of dyslipidaemia in male subjects to be approximately 47% and 34% in female subjects showing an insignificant inclination towards males. In the age group between (40–59 years) the total subjects examined were 145 and the male subjects found to be dyslipidaemic were 33 out of 55 (60%). The female subjects recorded were 87 and out of the total 87, 36 were diagnosed to be dyslipidaemic showing the risk to be about 41%. The results were consistent with the previous results exhibiting the high risk of dyslipidaemia in male subjects as compared to female in the above-mentioned age group. The obese individuals falling in the risk comes out to be about 69%, reflecting the importance of age for females to be more at risk for dyslipidaemia in this age group.

Table-3: Chi-Square Test

	Value	Asymp. Sig. (2-sided)
Pearson Chi-Square for BMI and Dyslipidemia	9.782(a)	0.008
Pearson Chi-Square for Age and Dyslpipidemia	6.141(a)	0.046

Analysis of the study suggests that the optimum mean BMI for the whole sample is around 31.17 kg/m² with a standard deviation of 6.70. Among the 270 males the mean BMI is 29.67 kg/m^2 and out of the total 230 females the mean BMI is 32.74 kg/m^2. The results indicate high prevalence of obesity in females. The chi-square test also indicates a rising trend of dyslipidaemia with increasing BMI and age.

DISCUSSION

Referring to the above figures, it is evident that there is a general trend of increase in dyslipidaemia with increasing BMI in both males and females with age. This is consistent with the findings of Brown *et al*[7], Must *et al*[12] and Malnick *et al*[13]. It is also noticed that the prevalence of dyslipidaemia is more significant in males in the younger and middle ages for all BMI categories. The findings are consistent with other studies.[14] However, the prevalence of dyslipidaemia is more significant in females above age of 60 years. Several reasons may be taken as responsible for this trend. The first and important reason is the hormone changes that are effected with menopausal age above age of 60 years in women. The less significance of dyslipidaemia in early ages in females may be attributed to the protective effect of female hormones. Secondly, most women above age of 60 years in our socio-economic setup suffer from arthritis leading to inactivity. Thirdly multiple psychological complexes such as age acceptance and family and social domination. This leads to the development of condition of stress, thereby resulting in depression. All these and other causes may therefore give rise to situations whereby the lipid profile may tend to become abnormal.[14]

CONCLUSION

1. Dyslipidaemia is directly related with BMI, showing that with the increase in the BMI the trend of dyslipidaemia rises in both females and males. In males, however, dyslipidaemia shows a decreasing trend above the age of 60 years.
2. The prevalence of dyslipidaemia is both age and gender dependent. Dyslipidaemia shows an increasing trend with age in both males and females. In females, dyslipidaemia shows a gradual increase with age for all BMI categories. However, in males, the trend shows a peculiar behaviour. That is it increases with age below 60 years but a decline in this trend occurs with age above 60 years. It has also been observed that the percentage of females having dyslipidaemia is less as compared to males in the age between 20 and 59 years. On the other hand, dyslipidaemia shows a dramatic increase in females above the age of 59 years. However, for age below 40 years, higher

percentage of males is having dyslipidaemia with a risk of 2.7 times as compared to females.

3. Dyslipidaemia is more common in overweight and obese class in both males and females.

REFRENCES

1. Clinical Guidelines on the Identification Evaluation and Treatment of Overweight and Obesity in Adults. NIH Publication No:98–4083.1998. Available at: http://www.nhlbi.nih.gov/ guidelines/obesity/ob_gdlns.pdf
2. Tanner. The Scientific Definition of Obesity and its Danger. Mercola Author: Total Health Program 2005. Available at: http://www.mercola.com
3. Ezzati M, Martin H, Skjold S, Vander Hoorn S, Murray CJ. Trends in National and State-Level Obesity in the USA after correction for self-report bias Analysis of Health Surveys. J R Soc Med 2006;99:250–7.
4. Jafar TH Chaturvedi N and Papps G. Prevalence of Overweight and Obesity and their Association with Hypertension and Diabetes Mellitus in an Indo-Asian Population" CMAJ 2006;175(9):1071–7.
5. International Obesity Task Force Press Statement (embargo Monday August 25, 2003). Avaiable at: http://www.iotf.org/ media/iotfaug25.htm
6. Deitel M. Overweight and Obesity Worldwide now Estimated to Involve 1.7 Billion People**.** Obes Surg 2003;13:329–30.
7. Brown CD, Higgins M, Donato KA, Rohde FC, Garrison R, Obarzanek E, et al Body Mass Index and the Prevalence of Hypertension and Dyslipidemia Obes Res 2000;8(9):605–19.
8. Low S, Chin MC, Ma S, Heng D, Deurenberg-Yap M., Rationale for Redefining Obesity in Asian. Ann Acad Med Singapore 2009;38:66–9.
9. Kannel WB. Risk stratification of dylipidemia: Insight from the framingham Study. Curr Med Chem Cardivasc Hematol Agents 2005;3(3):187–93.
10. Narayan KM, Boyle JP, Thompson TJ, Gregg EW, Williamson DF.. Effect of BMI on lifetime risk for diabetes in the U.S. Diabetes Care 2007;30:1562–6.
11. James RW; Brulhart-Meynet MC; Lehmann T; Golay A. Lipoprotein distribution and composition in obesity: their association with central adiposity. Int J Obes Relat Metabol Disord 1997;21:1115–20.
12. Must A, Spadano J, Coakley EH, Field AE, Colditz G, Dietz WH. The disease burden associated with overweight and obesity. JAMA 1999;282:1523–9.
13. Malnick SDH, Knobler H, The Medical Complications of Obesity. Q J Med 2006;99:565–79. Health Hazards of Obesity. http://www.goodhealthnyou.com
14. Willett WC; Manson JE; Stamper; Colditz G Weight, Weight Change and Coronary Heart Disease in Women. Risk within the Normal Weight Range. JAMA 1995:273:461–5.

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