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Original Research Article

A Cross-sectional Study to Evaluate the Correlation Between Haematological Profile and Body Mass Index in Adults

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Abstract

Aim: To study the correlation between haematological profile and body mass index in adults.

Methods: This cross-sectional study was carried out in the Department of Physiology, Govt. Medical College, Bettiah, Bihar, India, for 1 year. 200 participants, 100 males and 100 females in the age group 18 to 32 years were included in this study. Under aseptic precaution 10 ml blood sample taken from antecubital vein and then transfererd to EDTA tube. Then full haematological profile was taken using sysmex haematology analyser.

Results: In our study, PCV is statistically increased in overweight and obese individuals as compared to other BMI groups in both males and females. Total leucocyte count was significantly higher in overweight and obese subjects when compared to normal subjects. We found no change in Haemoglobin concentration and RBC count in all BMI groups.

Conclusion: In our study we observed leucocytosis and higher PCV in overweight and obese individual groups when compared to underweight and normal weight BMI groups. There is direct positive correlation between BMI and total leucocyte count. RBC count and haemoglobin concentration shows no statistical significance among all BMI groups.

Key words: BMI, haematological profile, Obesity

Introduction

An excess of weight including obesity have reached epidemic rates in all age groups, both in developed and developing countries. It is notable that overweight children and adolescents have a higher likelihood of becoming obese adults and to present health-related problems early in life including diabetes, cardiovascular disease (CVD) and dyslipidaemia's. Dyslipidemia, characterized by altered circulating levels of blood lipids and/or lipoprotein concentrations, has

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a genetic or environmental etiology. Alterations in low-density lipoprotein cholesterol (LDLc), total cholesterol and triglycerides are associated with the development of atherosclerotic plaques, which in turn have a relationship with high fat mass, in particular visceral fat.[1,2] Body mass index is simple formula to classify obesity in adults. It is defined as person's weight in kilograms divided by height in meter squares (m^2). Obesity and elevated BMI are the major causes for development of chronic diseases like stroke, hypertension, Type 2 diabetes and other cardiovascular disorders. Previous studies reported that obese individuals more susceptible to infections, and they have impaired granulopoiesis or reduced bacterial clearance upon infections.[3] These may suggest a negative effect on immunity and defense against infection as a result of overweight/obesity. WBC count may be associated with onset of dysregulated glucose metabolism and also early signs of liver and vascular damage, hence suggested to be an effective tool for identifying overweight children who are at risk of overweight/obesity complications. Recent studies have observed disturbances in lymphoid tissue integrity and alterations in leukocyte development and activity as a result of obesity. PCV is the most important indicator to determine viscosity of the blood. Viscosity of the blood is good indicator of vascular risks, and increased BMI is known to increase viscosity of the blood. [4] BMI is the modifiable risk factors of type 2 diabetes, hypertension, stroke and cardiovascular diseases. This study was undertaken to assess the relationship between BMI and haematological profile among young Indian population.

Materials and Methods

This cross-sectional study was carried out in the Department of Physiology, Govt. Medical College, Bettiah, Bihar, India, for 1 year. 200 participants, 100 males and 100 females in the age group 18 to 32 years were included in this study. Individuals whose response from well-structured questionnaire was in the affirmative for cigarette smoker, alcoholics, pregnant, known diabetics, has endocrine disorders, peptic ulcers, human immunodeficiency virus, tuberculosis, hypertensive; or on medication for any of these diseases were excluded from the study.

Methodology

Under aseptic precaution 10 ml blood sample taken from antecubital vein and then transfererd to EDTA tube. Then full haematological profile was taken using sysmex haematology analyser. The weight of the subject was measured by using weighing machine in kilograms (kg). The height of the subject was measured in centimetre without the shoes. BMI was calculated by dividing weight in kilogram by square of height in meter (kg/m^2).

WHO classification of BMI	
BMI <18.5	Underweight
BMI 18.5-24.9	Normal
BMI25-29.9	Overweight
BMI >30	Obese

Statistical analysis

Subjects were grouped into underweight, normal, overweight and obese subjects. Statistical significance was determined by ANOVA. Scheffe post-hoc test was used to determine significance while pearson correlation was used to determine relationship between the variables. Data was analysed using SPSS software 25.0 and presented as mean standard deviation. Values of P>0.05 were considered significant.

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Table 1: Haematological parameters in males and in females according to body mass index (kg/m^2) class

Parameters Males PCV (%)	Underweight N= 10 44.5 ± 0.11	Normal N=45 44.5±0.87	Overweight N=20 47.5±0.12	Obese N=25 48.5±0.45	P value 0.51
Haemoglobin concentration(g/dl)	14.4±1.63	14.2±1.69	14.1±1.75	13.7±1.98	**0.32**
RBC Count (x10^6 μL	5.5±1.87	5.6±2.23	5.7±1.45	5.8±1.25	0.47
WBC count (x10^3 μL	5.2±3.43	5.1±1.23	5.8±0.87	6.4±0.23	0.24
Females PCV (%)	**N=05** 42.6±1.23	**N=55** 43.5±2.23	**N= 30** 45.7±1.26	**N=10** 46.2±2.35	0.67
Haemoglobin concentration(g/dl)	12.4±1.43	12.2±1.54	12.7±1.54	12.9±1.98	**0.44**
RBC Count (x10^6 μL	4.6±1.23	4.4±2.25	4.5±1.87	4.6±2.3	0.66
WBC count (x10^3 μL	4.6±2.34	4.8±1.45	5.2±2.34	5.5±1.34	0.36

Table 2: Haematological parameters of the study population according to body mass index(kg/m^2)

Parameters	**Underweight N=15**	**Normal N=100**	**Overweight N=50**	**Obese N=35**	**P value**
PCV (%)	43.6±0.51	43.4±0.38	45.2±0.21	45.8±1.21	0.55
Haemoglobin concentration(g/dl)	13.4±1.63	13.4±1.55	13.4±1.67	13.6±1.77	0.55
RBC Count (x10^6 μL	4.8±0.003	4.8±0.21	4.9±0.34	4.9±1.23	0.55
WBC count(x10^3 μL	5.2±1.2	5.21±0.21	5.4±2.3	5.7±3.2	0.63

Discussion

In our study, we found increased WBC count in overweight and obese group individuals in both males and females and it was statistically significant. It may be due to hypertrophy and hyperplasia of adipocytes leading to release of inflammatory leucocytes.[2] Higher WBC count in obese individuals indicates an inflammatory process which has been suggested to play some roles in diseases including obesity, atherosclerosis, and other cardiovascular diseases. It may even suggest the onset of metabolic syndrome in obese subjects. [2]

Previous studies reported that obese individuals more susceptible to infections, and they have impaired granulopoiesis or reduced bacterial clearance upon infections.[3] These may suggest a negative effect on immunity and defense against infection as a result of overweight/obesity.[5] WBC count may be associated with onset of dysregulated glucose metabolism and also early signs of liver and vascular damage, hence suggested to be an effective tool for identifying overweight children who are at risk of overweight/obesity complications.[6] Recent studies have observed disturbances in lymphoid tissue integrity and alterations in leukocyte development and activity as a result of obesity. [7]

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In our study we also observed that there is increased PCV in overweight and obese groups in both males and females compared to other BMI groups. Increased PCV in obese individuals is important risk factor for development of cardiovascular diseases and stroke. [8] PCV is the most important indicator to determine viscosity of the blood. Viscosity of the blood is good indicator of vascular risks, and increased BMI is known to increase viscosity of the blood. [9] Therefore, higher PCV that was observed in obese males could be a sign of cardiovascular risk in obese males in the study. In addition, the significant association that was observed between BMI and PCV could further support the changes that may have occurred in PCV with increase in BMI. [10]

Conclusion

RBC count and Haemoglobin concentration between all BMI groups shows no stastistical significance In our study we observed leucocytosis and higher PCV in overweight and obese individual groups when compared to underweight and normal weight BMI groups. There is direct positive correlation between BMI and total leucocyte count. RBC count and haemoglobin concentration shows no statistical significance among all BMI groups. There is need for promotion of a healthy life style, regular exercise, healthy nutrition, stress free life in young population.

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