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Original Research Article

Correlation between haematological profile and body mass index in adults

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ABSTRACT

Background: Obesity is defined as excessive accumulation of fat in various tissues in the body which causes ill health in the body. The basic cause of obesity is imbalance between calories intake and calories expenditure. There is increased intake of calorie rich foods and reduced physical activity due to urbanization all over the world.

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.

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 study comprises 200 participants comprising 100 males and 100 females aged between 18 to 30 years. The design for this study was cross-sectional survey. Ethical approval was taken from ethical committee of BMCH, Chitradurga.

Collection of Blood Sample: Under aseptic precaution, 10 ml of venous blood sample collected from antecubital vein and then transferred to EDTA tube. Then haematological parameters like PCV, Haemoglobin concentration, RBC, WBC count was estimated using Sysmex haematology analyser.

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 and presented as mean \pm standard deviation. Values of $P \leq 0.05$ were considered significant.

Result: 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.

There is need for promotion of a healthy life style, regular exercise, healthy nutrition, stress free life in young population.

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1. Introduction

Obesity is defined as excessive accumulation of fat in various tissues in the body which causes ill health in the body. The basic cause of obesity is imbalance between

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calories intake and calories expenditure There is increased intake of calorie rich foods and reduced physical activity due to urbanization all over the world.¹

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.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.

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.

2. Materials and Methods

This study comprises 200 participants. 100 males and 100 females in the age group 18 to 30 years. The design for this study is cross-sectional survey. Informed consent was taken from all the subjects. Institutional ethical clearance was obtained from BMCH, Chitradurga.

2.1. Exclusion criteria

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.¹

2.2. Collection of blood sample

Under aseptic precaution 10 ml blood sample taken from antecubital vein and then transferred 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 centimeter 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
BMI 25-29.9	Overweight
BMI >30	Obese

2.3. 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 and presented as mean \pm standard deviation. Values of $P \leq 0.05$ were considered significant.

3. 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

4. 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 indicate 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

Table 1: Haematological parameters of the study population according to body mass index(kg/m²)

Parameters	Underweight N=13	Normal N=117	Overweight N=47	Obese N=23	P value
PCV (%)	43.8±0.51	43.2±0.38	45.1±0.21	45.9±1.29	0.547
Haemoglobin concentration(g/dl)	13.6±1.94	13.6±1.23	13.7±1.65	13.6±2.43	0.547
RBC Count (x10 ⁶ μL)	4.9±0.003	4.7±0.21	4.8±0.34	4.9±1.23	0.547
WBC count(x10 ³ μL)	5.1±1.2	5.2±0.21	5.5±2.3	5.7±3.2	0.675

Table 2: Haematological parameters in males and in females according to body mass index (kg/m²) class

Parameters	Underweight N= 08	Normal N=55	Overweight N=22	Obese N=15	P value
Males					
PCV (%)	44.3 ± 0.12	44.5±0.87	47.5±0.12	48.5±0.45	0.547
Haemoglobin concentration(g/dl)	14.4±1.26	14.3±1.34	14.2±2.23	13.6±2.65	0.234
RBC Count (x10 ⁶ μL)	5.5±1.87	5.6±2.23	5.7±1.45	5.8±1.25	0.456
WBC count (x10 ³ μL)	5.2±3.43	5.1±1.23	5.8±0.87	6.4±0.23	0.231
Females	N=05	N=62	N= 25	N=08	
PCV (%)	42.6±1.23	43.5±2.23	45.7±1.26	46.2±2.35	0.654
Haemoglobin concentration(g/dl)	12.5±1.23	12.3±1.45	12.8±3.23	12.9±2.24	0.456
RBC Count (x10 ⁶ μL)	4.5±1.23	4.3±2.25	4.4±1.87	4.5±2.3	0.657
WBC count (x10 ³ μL)	4.5±2.34	4.7±1.45	5.1±2.34	5.4±1.34	0.345

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

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

RBC count and Haemoglobin concentration between all BMI groups shows no statistical significance.

5. 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 leukocyte 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.

6. Source of Funding

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7. Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this article.

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