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Original Article

Association of obesity with total leucocyte count in patients of Metabolic syndrome

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ABSTRACT

White blood cells are a routine haematological parameter for the assessment of tissue damage, infection and many inflammatory conditions. Aim : To assess the association of total leucocyte count (TLC) with obesity in the patients of Metabolic Syndrome. Method : Waist circumference, as a criteria for obesity was used to compare the total leucocyte count in 30 controls and 30 patients aged 20 – 60 years. TLC was determined using automated Coulter (Diatron) by venepuncture . Results: In comparison with the controls, TLC was higher in patients and statistically significant difference ($p < 0.0001$) was observed between the two groups. Conclusion: This finding could be attributed to proinflammatory cytokines (TNF- α and IL- 6) released from adipose cells, insulin resistance mediated increase in inflammatory markers, decrease in adiponectin and increase in leptin. Thus, TLC in obese patients of Metabolic syndrome can be used as a predictor for future complications in them.

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1. Introduction

Metabolic Syndrome has received increased attention in the past few years. It is a cascade of disorders characterized by the presence of obesity, insulin resistance, fasting hyperglycaemia, lipid abnormalities and hypertension. All these features of Metabolic Syndrome are closely related to excess weight gain especially when it is associated with accumulation of adipose tissue in abdominal cavity around visceral organs. Since this syndrome mainly increases the risk of Diabetes Mellitus and cardiovascular complications, its early diagnosis becomes essential in clinical practice.

There are growing evidences that obesity is associated with a host of medical disorders like hypertension, diabetes, cardiovascular and respiratory diseases. In addition, obese tend to have higher levels of functional limitation than the non – obese. Though clinically BMI is most commonly used method for the assessment of obesity, it is not a direct estimate of obesity. It does not take into account the fact that some individuals have high BMI due to a large muscle mass. Wang et al [1] studied that obesity

related health risks can be better explained by waist circumference than by BMI. Moreover, an increased girth is most readily recognized clinically and an excess abdominal fat is correlated more closely Metabolic Syndrome risk factors than total body fat. Recent research works have stressed upon the prognostic importance of TLC in obesity and its related complications. The potential involvement of leucocytes in obese has been emphasized upon by a study conducted by Anna Veronelli [2] et al. They stressed on the importance of weight loss in reducing WBC count in morbid obesity. This strongly suggests that obesity and increased TLC are inter – related.

2. Materials and Methods

The present study was conducted in Grant Medical College, Mumbai. 60 subjects (both males and females) in the age group of 26 – 60 years were selected for the study. Among these, 30 were controls (Group 1) and 30 were diagnosed patients of Metabolic Syndrome (Group 2). Written informed consent was obtained from the study groups after explaining the full details of the protocol. The study met the approval of Ethical Committee of the institute. Detailed history was taken and thorough clinical examination of the subjects was done. Those with history of infection, allergies, malignancy, malnutrition, smoking, alcoholism and medication with sulphonamides, steroids, barbiturates, chloramphenicol and anti – thyroid drugs were excluded from the study. Female subjects with history of recent child birth, pregnancy, menstruation were

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also excluded. Group 1 included 30 healthy males and females who were students and staff of the college with TLC within normal range (4,000 – 11,000/cumm). Group 2 included 30 male and female patients diagnosed with Metabolic Syndrome based on International Diabetes Foundation (IDF) criteria for Asian population [3,4].(Table 1)

Subjects showing increased waist circumference plus any two or more features as per IDF criteria and TLC > 11,000cumm were included in Group 2.

Table 1. IDF criteria for diagnosis of Metabolic Syndrome

Parameters	Cut off values
Body Weight	>90cms(35")in males >80 cms (32")in females
Lipid	Triglycerides>150mg/dl HDL<40mg/dl in men HDL<50mg/dl in women Or on hypo-lipidaemic treatment
Blood Pressure	>130mmHg systolic or >85mm Hg diastolic or on anti-hypertensives
Fasting blood sugar	>100mg/dl Or on anti-diabetics

2.1. Study protocol

The waist circumference of all the subjects was taken by a measuring tape placed in a horizontal plane around abdomen at the level of iliac crest. It was ensured that the tape snugged but did not compress the skin. Measurement was made at the end of normal expiration.

TLC was determined using automated Coulter (Diatron) by venepuncture technique. The subjects were made comfortable and their samples were collected during morning hours after having a light breakfast.

2.2. Statistical Analysis

Data was expressed as Mean±S.D. All the statistical analysis was done using SPSS 9.0 version software. Unpaired t-test with a P value < 0.05 was considered statistically significant.

3. Results

Table 2 and 3 show the statistical values of waist circumference and TLC for Group 1 and Group 2 respectively. It has been observed that waist circumference of Group 2 (38.53 ± 2.285) was higher than that of Group 1 (33.80 ± 3.836) [figure 1]. Also, TLC in Group 2 (13,350 ± 49.845) was found to be higher than that of Group 1 (8412 ± 1025.638)[Figure2]. Table 4 shows statistical comparison between the waist circumference and TLC along with their level of significance in Group 2. It is found that there is a strong association between waist circumference and TLC in patients of Metabolic Syndrome and values are highly significant. (p value < 0.0001)

Table 2. Statistical Values of Group 1

Parameters	Mean	S.D
Waist Circumference in inches	33.80	3.836
Total Leucocyte Count/cumm	8412	1025.638

Table 3. Statistical Values of Group 2

Parameters	Mean	Standard Deviation
Waist Circumference in inches	38.53	2.285
Total Leucocyte Count/cumm	13,350.67	820.735

Figure -1

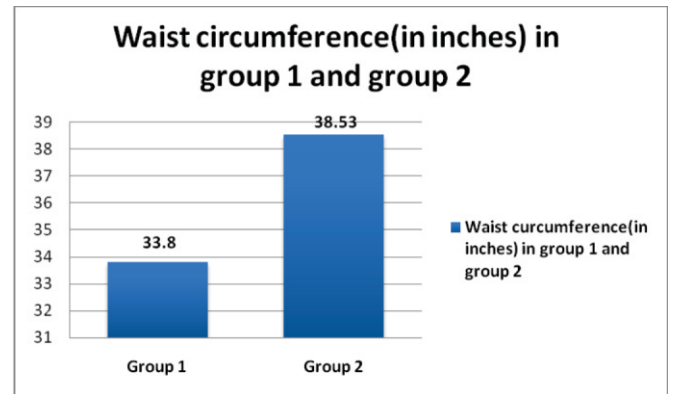


Figure -2

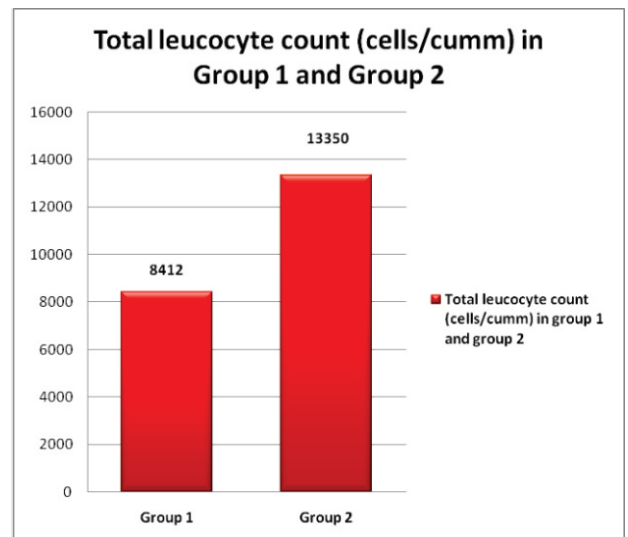


Table 4. Comparison between waist circumference and TLC in Group 2 using unpaired t-test

Parameters	Waist Circumference (in inches)	Total Leucocyte Count/cumm	t value	p value
Group 2	38.53±2.285	13351±149.84	486.54	<0.0001

4. Discussion

As observed in prior studies, TLC appears to be a simple, inexpensive and powerful prognostic tool in Metabolic Syndrome. Despite the potential prognostic importance of other novel biochemical inflammatory markers like *C-reactive protein* many of them are not routinely available. However, TLC being a simple test, available universally, immediately applicable at bed side proves to be better indicator. The present study reveals an increase in total leukocyte count in obese patients of Metabolic Syndrome. Obesity and metabolic Syndrome which often co-exist are associated with an increased cardiovascular risk [5]. High TLC is also associated with increased cardiovascular risk [6]. This suggests a strong relationship between obesity and TLC. Some studies have also reported similar findings. Desai MY [7] et al sought to assess the influence of Metabolic Syndrome on association of obesity and leucocyte count. Higher TLC was observed in patients in whom obesity co-existed with other components of Metabolic Syndrome. Anna Veronelli [2] studied TLC in obese and diabetic patients and concluded that TLC was more increased in obese persons than in diabetics. There were studies where BMI was used as a measure of obesity instead of waist circumference but their results were similar as that of present study. Thang et al [8] reported a positive correlation between TLC and BMI.

The observation made in the current study could be due to the release of tumor necrosis factor- α (TNF- α) and interleukin 6 (IL-6) which are found to be in higher concentrations in the obese. These pro-inflammatory cytokines act as growth factors causing increased WBC production in the bone marrow.

Visceral fat accumulation causes dysregulation of adipocyte functions including over secretion of TNF- α , Plasminogen activator inhibitor type I and heparin binding epidermal growth factor. All these adipocytokines contribute to the development of vascular disorders [9]. Recently, visfatin, a visceral-fat-specific protein has been identified as one of the contributors of obesity-related diseases [10].

Visceral obesity also causes hyposecretion of adiponectin. Adiponectin is an adipose tissue product which is anti-inflammatory, anti atherogenic and anti diabetic. Obese patients have generally low levels of adiponectin and hence may be deprived of its anti-inflammatory effects. This may have a major role in the occurrence of complications of Metabolic Syndrome like diabetes, atherosclerosis, hypertension and hyperlipidaemia. It is also been reported that TNF- α is a strong inhibitor of adiponectin promoter activity. Over secretion of TNF- α in obese decreases the anti-inflammatory effect of adiponectin leading to inflammation and increase in TLC [10].

It is observed that insulin resistance plays an important role in the genesis of Metabolic Syndrome and obesity accelerates insulin resistance. As insulin reduces the mediation of acute phase response by interleukin-6, insulin resistance could lead to higher concentrations of inflammatory markers. This may support the hypothesis that subclinical inflammation is a component of Metabolic Syndrome leading to an increase in TLC.

Another factor which may be held responsible could be Leptin [11] which is increased in obesity. Leptin is a hormone secreted by fat cells and is especially important in appetite regulation [12]. It stimulates myeloid differentiation from human bone marrow and causes proliferation, differentiation and activation of WBCs

. Thus, keeping in mind the role of these inflammatory markers like WBCs which increase in number in patients of Metabolic Syndrome, [13,14] their count may be an useful indicator of complications of Metabolic Syndrome.

5. Conclusion

Thus, to conclude, TLC has a strong association with obesity in Metabolic Syndrome. Hence, it can serve as a better prognostic indicator and an early diagnostic marker for obesity-related complications of Metabolic Syndrome.

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