



## Systemic Immune Inflammatory Index Is A Novel Predictor Of Metainflammation In Obesity

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### Abstract

**Background:** Obesity is an important preventable cause of death and is a major risk factor for many diseases like cardiovascular diseases.

**Aim:** The aim of the study is to evaluate the efficacy of Systemic Immune Inflammatory Index (SIII) in predicting systemic inflammation in Obesity.

**Methods:** A case-control study with 40 cases (overweight and obese) and 40 controls of both sexes in the age group of 25-45 years was done at Thanjavur Medical College. Subjects with diseases like Diabetes, Hypertension and Hematological disorders were excluded. Body Mass Index (BMI) was calculated and a Complete blood count (CBC) was obtained. Blood indices were calculated and compared between the two groups.

**Results:** The values of total WBC count, Platelet, Neutrophil and Lymphocyte counts varied much in overweight and obese individuals compared to the controls. SIII showed significant correlation with BMI, thus indicating systemic inflammation in obesity.

**Conclusion:** SIII can be used as a potential marker and prognostic factor in obesity related complications. Hence CBC can be routinely used in practice as an alternative to costlier biomarkers like high sensitive C-reactive protein.

**Keywords:** Obesity, Systemic Immune Inflammatory Index, Metainflammation

### Introduction

Inflammation is a physiological response necessary to restore homeostasis. Obesity is well-known to be a state of low grade inflammation otherwise called 'metainflammation or 'parainflammation'. [1,2] Chronic low grade inflammation has been implicated in the association of obesity and metabolic complications like atherosclerosis and hypertension. Obesity and inflammation are also causative in a wide range of diseases like Diabetes Mellitus,

Cardiovascular diseases, Stroke, Gall bladder disease, Cancer, Chronic liver disease and Osteoarthritis. [3]

Evaluation of Complete blood count (CBC) is simple and feasible. Lymphocytes and Neutrophils play an important role in chronic inflammation. Systemic Immune Inflammatory Index (SIII) can be calculated from CBC that is useful in diagnosis and follow-up of obesity-related disorders.

### Aims And Objectives:

1. To study the association of BMI with SIII.

2. To assess the usefulness of SIII as a predictor of metainflammation.

**Materials And Methods:**

This is a case-control study done at the Non-communicable diseases Outpatient Department of Thanjavur Medical College, Thanjavur. 80 subjects participated in the study of whom 40 were controls and 40 were cases either obese or overweight. Subjects were of both sexes and in the age group of 25-45 years. Informed written consent was obtained from all the participants. Institutional Ethics Committee approval was obtained for the study.

Subjects who were overweight or obese were included as cases. Subjects with Diabetes Mellitus, Hypertension, Cardiac, Pulmonary and Renal diseases, Pregnancy, Infections, Hematological disorders and Smoking history were excluded.

Height was measured using a stadiometer and weight by using a digital weighing scale. Body mass index was calculated using Quetelet index ( $BMI = \text{Weight in kg} / \text{Height in metre}^2$ ) and graded using WHO criteria.

2 ml of venous blood was drawn from the antecubital vein of the participants after 8 hours of fasting. A complete blood count was obtained. Systemic Immune Inflammatory Index ( $\text{Neutrophil count} \times \text{Platelet count} / \text{Lymphocyte count}$ ) was calculated and compared between the two groups.

Statistical analysis was done using the Statistical Package for Social Sciences (SPSS) 16 version. The results were analysed by using student ‘t’ test. Correlation of SIII with BMI was analysed by

Pearson’s Correlation test. p value <0.05 was considered as statistically significant.

**Results:**

In the present study, the following hematological parameters like Platelet count, Neutrophil count, Lymphocyte count were significantly increased in cases compared to controls. SIII also showed a statistically significant increase in cases compared to controls.

Table-1 shows the correlation of various parameters with Body Mass Index. Significant positive correlation was found between BMI and WBC count (p-0.000), Platelet count (p-0.000), Lymphocyte count (p-0.000), Neutrophil count (p-0.004) and SIII (p-0.020).

Figure-1 shows a scatter diagram depicting the correlation between BMI and SIII. Note that the curve increases from lower BMI to higher BMI.

Table-2 shows comparison of hematological parameters in different grades of obesity. As the BMI increases, a variety of parameters (WBC, platelet, neutrophil and lymphocyte counts and SIII) increase.

Figure-2 shows a boxplot showing SIII in controls and cases. Note that the SIII of overweight and obese individuals is significantly higher than the controls. Also, there is a gradual elevation in the levels of SIII as the grades of obesity increase.

In addition to these, it was also found that Hemoglobin, Haematocrit and MCH levels were higher in males compared to females. But these RBC parameters did not differ between cases and controls.

**Table-1 : Pearson Correlation Of BMI With Blood Parameters**

PARAMETERS	r VALUE	p VALUE
AGE	0.007	0.948
WBC	0.449	<b>0.00*</b>
PLATELET COUNT	0.568	<b>0.00*</b>
LYMPHOCYTE COUNT	0.475	<b>0.00*</b>
NEUTROPHIL COUNT	0.321	<b>0.004*</b>
SIII	0.26	<b>0.02*</b>

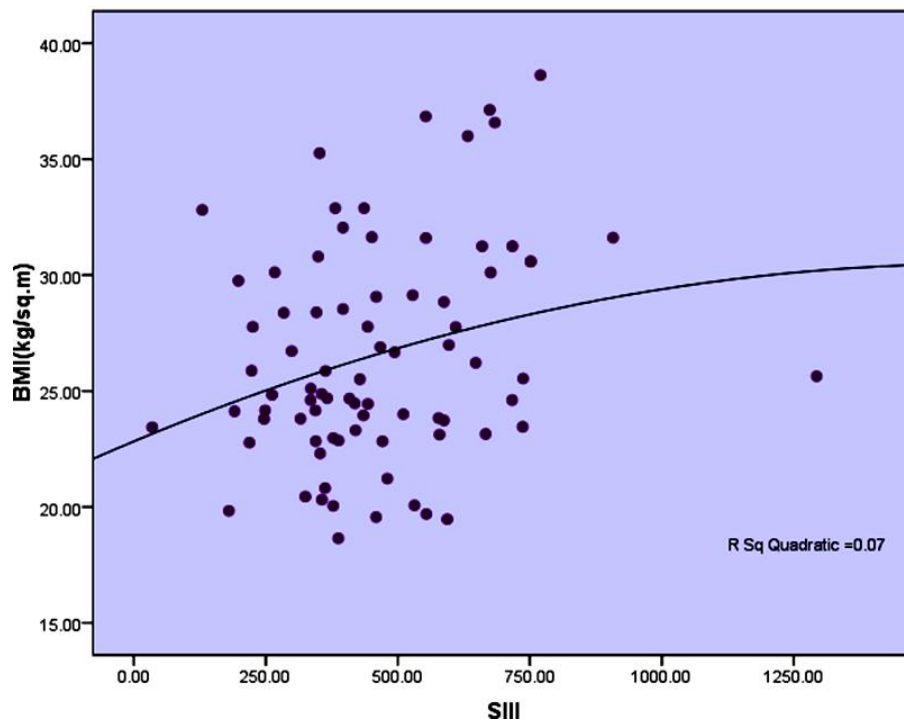
\*statistically significant

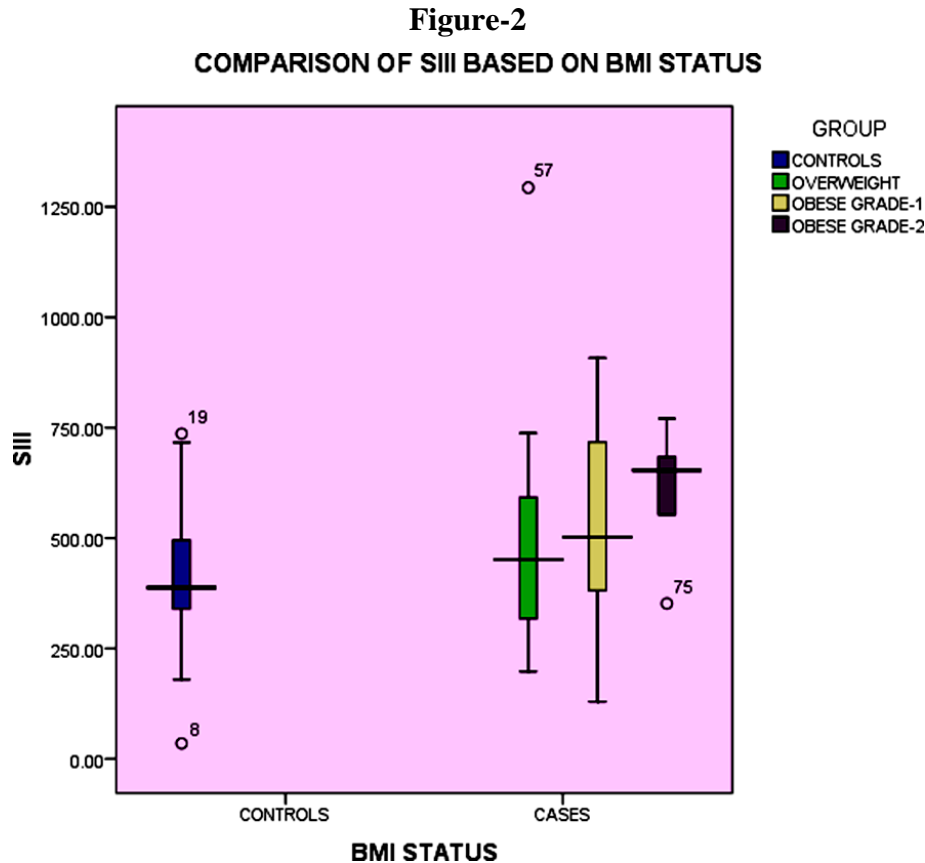
**Table-2: Comparison Of Haematological Parameters In Different Grades Of Obesity Using One Way ANOVA**

	<b>NORMAL BMI</b>	<b>OVER -WEIGHT</b>	<b>OBESE GRADE-I</b>	<b>OBESE GRADE-2</b>	<b>p VALUE</b>
	<b>Mean+SD</b>	<b>Mean+SD</b>	<b>Mean+SD</b>	<b>Mean+SD</b>	
<b>WBC count</b> $10^2/mm^3$	71.70±13.92	76.67±11.51	83.60±9.99	95.50±12.62	<b>0.000*</b>
<b>Platelet count</b> $10^3/mm^3$	214±42.87	253.7±67.29	291±75.74	361.50±63.17	<b>0.000*</b>
<b>Lympho -cyte count</b> $10^2/mm^3$	22.91±5.6	25.77±4.81	29.98±10.9	33.58±5.40	<b>0.000*</b>
<b>Neutro -phil count</b> $10^2/mm^3$	42.20±11.8	45.38±9.84	49.25±7.2	55.67±8.14	<b>0.014*</b>
<b>SIII</b>	409.6±147.3	476.6±245.3	530.5±220.4	610.9±145.3	<b>0.040*</b>

\*p value <0.05 – significant

**Figure-1**  
**CORRELATION OF BMI AND SIII**





### Discussion:

Adipose tissue plays an important role as a key mediator of low grade systemic inflammation in obesity. It is characterised by expression of inflammatory factors and immune cell infiltration without changes structurally or functionally. These changes establish a vicious cycle leading to pathological processes like insulin resistance and endothelial dysfunction. This obesity induced inflammation plays a major role in the development of metabolic diseases such as Dyslipidemia, Hypertension, Atherosclerosis and type-2 Diabetes Mellitus and hence the term 'meta-inflammation' is being widely used.[4]

In our study, we found that blood parameters like WBC count, Platelet count, Neutrophil and Lymphocyte count were significantly higher in the cases than controls. Systemic immune inflammatory index was also very high in the cases (515.62) thus strongly suggesting inflammatory changes. The association between Body Mass Index and WBC count, Platelet count, Neutrophil count, Lymphocyte count and SIII was found to be very strong implicating obesity induced inflammation.

**Fadini et al** observed a significant association between elevated WBC count and components of metabolic syndrome in the general population. In our study also, WBC count increased proportionately as the BMI increases.[5]

**Furuncuoglu et al** studied the effect of obesity on blood parameters in European population. They found significant differences between the groups for WBC and Platelet counts, Neutrophil and Lymphocyte counts and also SIII and platelet indices.[6]

Systemic immune inflammatory index is a novel biomarker used to denote severity and outcome of cancer patients. Since obesity leads to metabolic derangement including cancer, it may have a potential to reflect inflammatory status in obesity also. **Donma and Donma** evaluated SIII in obese children in Turkey and found that progressive increase in SIII values from normal weight to morbid obese group denoting a statistically significant relationship between obesity and inflammation.[7,8]

Hence, SIII can also be used as a novel inflammatory biomarker of obesity among other blood-based markers.[9]

## Conclusion:

Obesity is characterised by chronic low grade inflammation which is associated with many metabolic complications. Systemic Immune Inflammatory index (SIII) used generally to predict outcome of cancers and other chronic inflammatory conditions was also highly elevated in the study group. This suggests that it can be used as a potential biomarker for obesity-induced inflammation. It can be easily calculated which is advantageous over other indicators of inflammation like hs-CRP which is very costly. SIII can be used as a reliable inflammatory marker and prognostic factor in obesity.

## References:

1. Monteiro R, Azevedo I. Chronic inflammation in obesity and the metabolic syndrome. *Mediators of inflammation*. 2010 Oct;2010.
2. Rodríguez-Hernández H, Simental-Mendía LE, Rodríguez-Ramírez G, Reyes-Romero MA. Obesity and inflammation: epidemiology, risk factors, and markers of inflammation. *International journal of endocrinology*. 2013 Oct;2013.
3. Chovatiya R, Medzhitov R. Stress, inflammation, and defense of homeostasis. *Molecular cell*. 2014 Apr 24;54(2):281-8.
4. Furuncuoğlu Y, Tulgar S, Dogan AN, Cakar S, Tulgar YK, Cakiroglu B. How obesity affects the neutrophil/lymphocyte and platelet/lymphocyte ratio, systemic immune-inflammatory index and platelet indices: a retrospective study. *European review for medical and pharmacological sciences*. 2016 Apr 1;20(7):1300-6.
5. León-Pedroza JI, González-Tapia LA, del Olmo-Gil E, Castellanos-Rodríguez D, Escobedo G, González-Chávez A. Low-grade systemic inflammation and the development of metabolic diseases: from the molecular evidence to the clinical practice. *Cirugía y Cirujanos (English Edition)*. 2015 Nov 1;83(6):543-51.
6. Fadini GP, Marcuzzo G, Marescotti MC, de Kreutzenberg SV, Avogaro A. Elevated white blood cell count is associated with prevalence and development of the metabolic syndrome and its components in the general population. *Acta diabetologica*. 2012 Dec;49(6):445-51.
7. Donma O, Donma MM, Nalbantoglu B, Topcu B, Tulubas F, Aydin M, Gokkus T, Gurel A. The importance of erythrocyte parameters in obese children. *International Journal of Medical and Health Sciences*. 2015 Apr 3;9(5):361-4.
8. Donma MM, Donma O. Evaluation of systemic immune-inflammation index in obese children. *International Journal of Medical and Health Sciences*. 2018 Aug 5;12(9):362-5.
9. Osadnik T, Bujak K, Osadnik K, Czarnecka H, Pawlas N, Reguła R, Fronczek M, Lejawa M, Gawlita M, Gonera M, Góral M. Novel inflammatory biomarkers may reflect subclinical inflammation in young healthy adults with obesity. *Endokrynologia Polska*. 2019;70(2):135-42