INTRODUCTION

Anaemia is the most common nutritional disorder in young Indian girls.\(^1\) Deficiency of iron, zinc, folic acid, copper and vitamins can impair the immune responses and bactericidal activity of macrophages, monocytes and neutrophils.\(^2\) Anaemia is associated with hypoxia and ischaemia. It is possible that ischaemia associated with anaemia may alter the leucocyte count.\(^3,4\) Leucocyte count is regarded as an independent risk factor for coronary heart disease (CHD), stroke and vascular disease.\(^5,6\)

It has prognostic importance for both short term and long term survival. It is well established fact that many factors are associated with CHD and their measurement may allow the estimation of risk of ischaemic events.\(^7\) One such risk factor may be the role played by leucocyte\(^8\) particularly the neutrophils\(^6\) assessed most simply by leucocyte count in peripheral blood.\(^7\) Recently neutrophil to lymphocyte ratio (NLR) has emerged as a useful inflammatory index in critically ill patients and ischaemic heart diseases (IHDs).\(^9\) Also abnormal platelet counts are seen in anaemia which can be thrombocytosis or thrombocytopenia.\(^10\) So the current study was planned to estimate total and differential leucocyte count (TLC and DLC), neutrophil to lymphocyte ratio (N/L ratio) and platelet count in cases of anaemia.

MATERIALS AND METHODS

Female medical students of SBKS medical college, Piparia, Vadodara were invited to participate in the study after getting approval from the institutional ethics committee. Experimental protocol was explained to them and written informed consent was taken. History was taken and clinical
examination (general and systemic) was done for inclusion and exclusion criteria.

**Inclusion criteria:**

1) Age 18-23 years.
2) In pre-ovulatory phase of menstrual cycle.
3) Apparently healthy without any known disease.
4) No history of drug, blood transfusion or any condition that affect blood cell count.

**Exclusion criteria:**

1) Individual with any known general or systemic disease.
2) Any history of drug or medication that affect blood cell count.
3) Female with pregnancy and in post-ovulatory/menstrual period.
4) Any non co-operative individual.

Out of 206 students, 182 participants were selected for the study by using the above mentioned criteria. 10 non-cooperative students and 14 students in menstrual phase were excluded. Participants’ Hb, TLC, DLC and platelet count were estimated by electronic cell counter (Sysmex KX-10 haematology analyser) in the pathology laboratory of Dhiraj hospital, Piparia, Vadodara and then N/L ratio was estimated. 30 anaemic (haemoglobin (Hb) level less than 8 gm%) and 30 healthy (Hb level more than 12gm%) females were selected randomly from 46 anaemic and 136 healthy subjects respectively and their data were compared using unpaired t test. P value less than 0.05 was considered as significant and less than 0.01 was considered highly significant. Statistical analysis was done using Microsoft Office Excel 2007 and Epi Info 6.

**RESULTS**

Hb concentration in anaemic students was 6.65 ± 0.84 gm% compared to 13.34 ± 1.10 gm% in control subjects which was statistically highly significant (P < 0.01). TLC was high in anaemic students but it was not statistically significant (P > 0.05). On DLC, there was highly significant increase in neutrophils (P < 0.01) and basophils (P < 0.01), highly significant decrease in monocytes and eosinophils (P < 0.01) without much alteration in lymphocytes count. Platelet count was significantly decreased in anaemic group (P < 0.05). N/L ratio was significantly higher in anaemic group (P < 0.01).

### Table 1: Comparison of basic parameters in anaemic and control groups

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Anaemic students</th>
<th>Healthy students</th>
<th>P Value</th>
<th>Statistical significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>18.23 ± 1.30</td>
<td>18.42 ± 1.45</td>
<td>0.7</td>
<td>NS</td>
</tr>
<tr>
<td>Hb (gm%)</td>
<td>6.65 ± 0.84</td>
<td>13.34 ± 1.10</td>
<td>&lt; 0.01</td>
<td>HS</td>
</tr>
<tr>
<td>TLC (cells / cu mm of blood)</td>
<td>7738 ± 3212</td>
<td>6984 ± 1976</td>
<td>0.86</td>
<td>NS</td>
</tr>
<tr>
<td>Platelet count (lakhs / cu mm of blood)</td>
<td>1.58 ± 0.92</td>
<td>3.14 ± 1.56</td>
<td>0.02</td>
<td>S</td>
</tr>
</tbody>
</table>

Data are presented as Mean ± SD (standard deviation), NS : not significant (P > 0.05), S : significant (P < 0.05) HS : highly significant (P < 0.01)

**DISCUSSION**

We found insignificant increment in leucocyte count in anaemia in present study. This elevated leucocyte count (even within normal range) is associated with cardiovascular risk. Hypoxia induced by anaemia is a kind of stress, which increases vascular reactivity to catecholamine through glucocorticoids, thus helping in raising leucocyte count. So high leucocyte count might be seen as a manifestation of a haematological stress syndrome. Activated leucocyte particularly neutrophils release substances, i.e. cytotoxic material, protease, hydrolytic enzymes that could lead to vascular and ischaemic injury.
Neutrophil count is found significantly higher (P < 0.01) in present study in anaemic patients. It is reported that neutropenia rarely suffer from myocardial infarction (MI). Along with neutrophil, basophil count is also found to be more in anaemia. Role of basophil in vascular events is unknown.

Monocyte, eosinophil and platelet count are found to be reduced significantly in patients of anaemia. Exact reason for decrease count is not known.

Lymphocyte count is not more affected in both groups.

Anaemia is said to be involved in pathogenesis of heart failure (HF), chronic angina and acute coronary syndrome. Recently neutrophil to lymphocyte ratio (N/L ratio) has been described as significant inflammatory index in IHD, MI and in colorectal cancer. In current study N/L ratio is significantly more (P < 0.001) in anaemic subjects as compared to control subjects. Anaemia does not significantly increase leucocyte count but significantly increase neutrophil count thus N/L ratio significantly increases.

Akoy et al evaluated the effect of iron therapy on platelet function among women. They found iron deficiency anaemia in women caused arachidonic acid induced platelet dysfunction through iron-containing enzymes and may give rise to increased menstrual blood loss, which can be reversed through iron repletion. Kiem et al showed that iron is present in platelets in a concentration of approximately 12.28 μg/g, further supporting the hypothesis of Karpatkin and colleagues that iron may have a functional role in controlling platelet production. A 2-compartment model has been designed to study the role of iron in maintenance of platelet counts. At the time of initial presentation, iron stores of the essential component compartment were exhausted in the participants and thrombocytopenia ensued.

CONCLUSION
Anaemia is associated with increased N/L ratio & thrombocytopenia. Thus anaemia may increase risk of myocardial infarction (MI), ischaemic heart disease (IHD) and bleeding episodes.

REFERENCES