Anaemia in Kavaratti Island, Lakshadweep: Perspectives from a Hospital Based Study

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Abstract

Introduction- Anaemia is a major public health problem in developing countries like India. Kavaratti Island, Lakshadweep is a remote island located in Arabian sea. There is no data on anaemia available from here. Objectives of this study are to examine status of anaemia and compare the data with Indian, Kerala and Maldives figures.

Materials & Methods- A total of 2000 patients were studied. Data from the anaemic individuals was collected and analyzed. The study group was subsequently divided into smaller subgroups on the basis of age and sex for analysis. The anaemia was also correlated with other haematological parameters like TLC, DLC, platelet count and ESR.

Results- The prevalence of anaemia in adult males was 21.5% and in females 37.8%. In pregnant females anaemia was still more common (47.5%). Among children 24.6% were anaemic with female children showing higher percentage (27.4%) than males (22.9%). Anaemia was quite common in the elderly (36.6%) and even higher in elderly females (43.5%). Elderly males showed alterations in TLC and DLC while alteration in platelet count was most common in male children.

Discussion- The present study is the first study to examine anaemia at Kavaratti Island, Lakshadweep. On comparison the anaemia indicators were found to be vastly superior than those from India, Kerala and Maldives. However, in adult females and elderly females the situation demands urgent public health intervention.

Conclusion – Anaemia is significantly less common in Kavaratti island, Lakshadweep. The important lessons learnt can be implemented in other places to bring down the prevalence of anaemia.

ABBREVIATIONS


INTRODUCTION

The assessment of human health status can be carried out by using various biological parameters. Amongst these various parameters anaemia is one of the most important parameters as it has an immense impact on the general health and well being of an individual [1]. Anaemia is a global health problem whose burden is particularly severe in developing countries. In India, anaemia is a public health problem of epic proportions. National Family Health Survey (NFHS-3) conducted in 2005-2006 showed that the prevalence of anaemia was 70% in children in the age group of 6–59 months, 55% in females between 15–49 years, and 24% in males aged 15–49 years [2]. The situation is further compounded by the fact that in large number of cases anaemia does not lead to overt symptoms [3]. Therefore, analysis of laboratory data is necessary to estimate the magnitude of this problem.

Lakshadweep is an archipelago of 36 islands located in the Arabian Sea with an area of 32 sq km. The literal meaning of the name in Malayalam and Sanskrit is 'a hundred thousand islands'. It is India's smallest Union Territory. Kavaratti Island is the capital and the principal town of Lakshadweep. It is located between 10°32’ and 10°35’ N latitude and 72°35’ and 72°40’ E longitude, having an area of 4.22 sq km. The main occupation of the people is fishing, coconut cultivation and coir twisting. Indira Gandhi Hospital is the largest hospital in Lakshadweep. It was established in 1972. The hospital was upgraded to the present strength of 50 beds in 1986. The hospital also acts as a referral
institution and receives patients from other islands. Thus, the data in present study is partly reflective of the overall population of Lakshadweep.

The unique geographical location of Kavaratti Island and the socioeconomic pattern of the local population is likely to have an impact on the pattern of anaemia seen here. The present study is aimed at investigating status of anaemia at Kavaratti Island, Lakshadweep. An attempt will be made to correlate the data obtained in the present study with overall data of India and neighbouring island country Maldives which share similar geography and socio-economic parameters. To the best of our knowledge there is no study till date on anaemia in Kavaratti Island, Lakshadweep.

**MATERIALS AND METHODS**

The study was conducted in March to May 2015. An analysis of all patients referred for haematological investigations to the Pathology laboratory was carried out. The measurements were carried out on a three part haematology analyzer (MEK-6420, Nihon-Kohden). A total of 2000 patients were studied. Data from the anaemic individuals was collected and analyzed.

For the purpose of analysis the study population was subdivided into children (male/female), adults (male/female) and elderly (male/female). The subdivision was carried out according to the following age groups –

1) **Children** – Age 0-12 years.
2) **Adults** – Age > 12 years but < 60 years.
3) **Elderly** – Age > 60 years.

The children’s group was further subdivided into following groups for comparison –

1) **Young children** – Age > 6 months but < 5 years.
2) **Older children** – Age > 5 years but < 12 years.

The adults group was further subdivided into various groups as follows –

1) **Adolescents** – Age > 12 years but < 14 years.
2) **Adults** – Age > 14 years but < 60 years.

In each group the anaemia was defined and severity was graded into mild, moderate and severe. The criteria used for this are the WHO criteria [2011] [4]. The anaemia was also correlated with other parameters like TLC, DLC, platelet count and ESR in those cases where the results for these parameters were available. The rest of the cases were excluded from this correlation.

Statistical analysis was carried out using student t-test and chi square test. P < 0.05 was taken as significant.

**RESULTS AND DISCUSSION**

The study included a total of 2000 cases out of which there were 773 males (38.7%) and 1227 females (61.3%). The M:F ratio was 1:1.6. Amongst the males a total of 140 had anaemia out of 650 (21.5%). The mean haemoglobin (Hb) was 10.4 g/dl and mean+2S.D. was 8.9-11.9 g/dl. In females the number of anaemic individuals was 510 out of a total of 1350(37.8%). The mean Hb was 10.2 g/dl and mean+2S.D. was 8.7-11.7 g/dl. The difference between the two groups was statistically significant (P=0.0001).

In the children’s group a total of 48 were anaemic out of a total of 195 (24.6%). Among these anaemic children the overall mean Hb was 9.9 g/dl and mean+2S.D. was 8.6-11.2 g/dl. Amongst the children out of a total of 195 there were 122 males and 73 females. The M:F ratio was 1:7.1. Out of the 122 male children 28 were anaemic (22.9%). In these children the mean Hb was 9.7 g/dl and mean±2SD. 8.3-11.1 g/dl. While in the case of female children out of 73 a total number of 20 were anaemic (27.4%). In this group the mean Hb and mean±2SD. were 9.5 g/dl and 7.7-11.3 g/dl respectively. The difference between the male and female children was statistically significant (P=0.0001).

On subdividing the children’s group according to age it was found that amongst the group of young children (Age > 6 months but < 5 years) out of 85 a total number of 36 were anaemic (42.4%). In this subgroup the mean Hb was 9.7 g/dl and mean±2S.D. was 8.4-10.9 g/dl. In the older children group (Age > 5 years but < 12 years) amongst 110 children 12 were anaemic (10.9%). In these children the mean Hb was 10.9 g/dl and mean±2SD. was 10.1-11.7 g/dl. On comparing these two subgroups the difference between the two subgroups was statistically significant (P=0.0001).

Amongst the adults a total of 506 were anaemic out of 1548 subjects (32.7%). The overall mean Hb in these anaemic individuals was 10.1 g/dl and mean±2S.D. was 8.4-11.8 g/dl. This group consisted of 509 males and 1039 females. Out of the 509 males 68 were anaemic (13.3%). The mean Hb and mean±2SD. in these anaemic adult males were 10.5 g/dl and 8.7-12.3 g/dl respectively. In the adult female group a total of 438 were anaemic out of 1039 subjects (42.1%). The mean Hb was 10.1 g/dl and mean±2SD. 8.5-11.7 g/dl. When a comparison was done between the adult male and female group the difference was found to be strongly significant (P=0.0001).

The adult female group consisted of 480 pregnant and 559 non-pregnant females. In the pregnant female group a total number of 228 were anaemic out of 480 (47.5%). The mean Hb in this group was 9.4 g/dl and mean±2SD. 8.4-10.7 g/dl. The non pregnant group consisted of 210 females who were anaemic (37.6%). The mean Hb and mean±2SD. in this group were 10 g/dl and 8.2-11.8 g/dl respectively. The difference between the two groups was statistically significant (P=0.0001).

The adults group was further stratified according to age into adolescents (age > 12 years but < 14 years) and adults (age > 14 years but < 60 years). In the adolescents group out of a total of 66 individuals 26 (39.4%) were anaemic. In this group the mean Hb was 11.0 g/dl and mean±2SD. 10.3-11.7 g/dl. In the adults group the number of anaemic individuals was 480 out of a total of 1482 (32.4%). The mean Hb and mean±2SD. in this group were 10.1 g/dl and 8.5-11.7 g/dl respectively. On comparing the two groups the difference was statistically significant (P=0.0001).

The elderly group consisted of 257 individuals. Out of these a total number of 94 (36.6%) were anaemic. The overall mean Hb and mean±2SD. in these anaemic elderly individuals were 10.6 g/dl and 9.5-11.7 g/dl respectively. There were 142 males and 115 females. The M:F ratio was 1.2:1. Among the elderly males
out of a total of 142 the number of subjects who were anaemic was 44 (31%). The mean Hb in this group was 10.6 g/dl and mean±2S.D. was 9.4-11.8g/dl. As far as the elderly females are concerned 50 (43.5%) were anaemic out of a total of 115. The mean Hb and mean±2S.D. in this group were 9.6-11.8g/dl The difference between the two groups was not statistically significant (P=0.4).

The haemoglobin values (mean±2S.D) in the anaemic individuals in various groups are shown in Figure 1. The percentage of anaemic individuals in each group is depicted in Figure 2. The anaemia was graded in each group according to WHO criteria (2011) [2]. The results obtained are presented in Figure 3. It was seen that in all the groups except adult females and elderly males the commonest grade was mild anaemia. In these two groups the most common grade was moderate anaemia. The groups with highest frequency of severe anaemia were adult males (14.7%) followed by male children (14.3%).

The anaemia in each group was then correlated with TLC, DLC, platelet count and ESR. This correlation was done taking into account only those cases where the results for these parameters were available. The results of this correlation are shown in (Tables 1-3). The group which showed the highest frequency of cases with increased TLC (leukocytosis) was elderly males (19.4%) followed by elderly females (17.4%). Decreased TLC (leucopenia) was seen maximum in male children (25%) followed by elderly males (20%). On correlating with DLC it was seen that elderly females showed maximum proportion of individuals showing eosinophilia (28.6%) and lymphocytosis.

### Table 1: Correlation of anaemia with TLC in various groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>Low TLC (%)</th>
<th>Normal TLC (%)</th>
<th>High TLC (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male children</td>
<td>6(25%)</td>
<td>18(75%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Female children</td>
<td>2(10%)</td>
<td>18(90%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Adult Males</td>
<td>6(10.7%)</td>
<td>44(78.6%)</td>
<td>6(10.7%)</td>
</tr>
<tr>
<td>Adult females</td>
<td>6(2.5%)</td>
<td>192(80.7%)</td>
<td>40(16.8%)</td>
</tr>
<tr>
<td>Elderly males</td>
<td>6(20%)</td>
<td>20(60.6%)</td>
<td>4(19.4%)</td>
</tr>
<tr>
<td>Elderly females</td>
<td>0(0%)</td>
<td>38(82.6%)</td>
<td>8(17.4%)</td>
</tr>
</tbody>
</table>

TLC- Total leukocyte count

### Table 2: Correlation of anaemia with DLC in various groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>Normal DLC(%)</th>
<th>Neutrophilia(%)</th>
<th>Lymphocytosis(%)</th>
<th>Eosinophilia(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male children</td>
<td>16(66.7%)</td>
<td>4(16.7%)</td>
<td>0(0%)</td>
<td>4(16.6%)</td>
</tr>
<tr>
<td>Female children</td>
<td>18(90%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>2(10%)</td>
</tr>
<tr>
<td>Adult Males</td>
<td>28(56%)</td>
<td>6(12%)</td>
<td>6(12%)</td>
<td>10(20%)</td>
</tr>
<tr>
<td>Adult females</td>
<td>150(65.8%)</td>
<td>28(12.3%)</td>
<td>20(8.8%)</td>
<td>30(13.3%)</td>
</tr>
<tr>
<td>Elderly males</td>
<td>16(61.5%)</td>
<td>4(15.4%)</td>
<td>2(7.7%)</td>
<td>4(15.4%)</td>
</tr>
<tr>
<td>Elderly females</td>
<td>16(38.1%)</td>
<td>6(14.3%)</td>
<td>8(19%)</td>
<td>12(28.6%)</td>
</tr>
</tbody>
</table>

DLC- Differential leukocyte count

### Table 3: Correlation of anaemia with platelet count in various groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>Low platelet count (%)</th>
<th>Normal platelet count (%)</th>
<th>High platelet count (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male children</td>
<td>8(28.6%)</td>
<td>20(71.4%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Female children</td>
<td>4(22.2%)</td>
<td>14(77.8%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Adult Males</td>
<td>8(19%)</td>
<td>34(81%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Adult females</td>
<td>4(2.6%)</td>
<td>150(96.1%)</td>
<td>2(1.3%)</td>
</tr>
<tr>
<td>Elderly males</td>
<td>2(14.3%)</td>
<td>12(85.7%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Elderly females</td>
<td>0(0%)</td>
<td>26(100%)</td>
<td>0(0%)</td>
</tr>
</tbody>
</table>
Occurrence of neutrophilia on the other hand was seen highest in male children (16.7%) closely followed by elderly males (15.4%). The least disturbance in DLC was seen in the group of female children wherein 90% of the subjects showed a normal DLC. On the other extreme in elderly females as high as 61.9% cases had abnormal DLC.

On correlating the anaemia with platelet count it was seen that overall the large majority of patients had a normal platelet count with percentage ranging from 71.4% to 100% in the various groups. The highest incidence of thrombocytopenia was seen in male children (28.6%). Thrombocytosis was infrequent with only one group i.e. adult females (1.3%) showing it. ESR was seen to be increased in all the groups however the highest percentage was seen in elderly males (100%).

Anaemia is an extremely important condition of public health importance due to its wide spread occurrence. In India the burden of anaemia is gigantic as shown in the national family health survey-3 and WHO global database on anaemia for India [5]. However, there is no data available regarding anaemia from Kavaratti Island, Lakshadweep. To the best of our knowledge the present study is the first study to evaluate anaemia in Kavaratti Island, Lakshadweep.

The present study consisted of 2000 subjects. According to the 2011 census the population of Kavaratti Island, Lakshadweep is 10113. Thus a sample size of 2000 represents a highly representative sample. The study sample had a distinct female bias. This was due to the fact that Indira Gandhi Hospital receives a large number of obstetric patients. The prevalence of anaemia was more in females (37.8%) as compared to males (21.5%). Also the anaemic males had slightly higher haemoglobin levels than anaemic females. These findings are similar to previous studies [6-8].

In our study anaemia was seen to be more common in children, adult females and elderly people. This is similar to findings of previous studies [9-12]. Among children it was seen that anaemia was more common in female children (27.4%) as compared to male children (22.9%). It was also observed to be significantly more common in younger children as compared to older children (42.4% vs 10.9%). These differences could be attributed to difference in feeding patterns in these groups. Thus there is need for greater attention to be paid to young children.

Among the adults the females (42.1%) were significantly more commonly anaemic as compared to males (13.3%). Anaemic males also showed significantly higher haemoglobin as compared to anaemic females. Pregnant females (47.5%) had a higher frequency of anaemia as compared to non pregnant females (37.6%). Haemoglobin concentration was significantly higher in non pregnant females as compared to pregnant females. Bharati [13] and Aikawa [14] along with coworkers in their studies have reported similar findings. It was also observed that anaemia was more common in adolescents as compared to adults (39.4% vs 32.4%). Thus the adolescent group also deserves more attention.

The present study shows that anaemia is very common in the elderly. As a group they have the highest proportion of anaemic individuals (36.6%). Especially elderly females were shown to have high frequency of anaemia (43.5%). There is very limited data available from India on anaemia in elderly. However, various studies [15-17] done previously have shown similar results.

According to WHO [4] prevalence of anaemia >40% in a population makes it of severe public health importance. Based on the findings of present study it can be suggested that in adult females (especially pregnant) and elderly female anaemia is of severe public health importance. Thus any action in this regard must be targeted towards these groups.

The severity of anaemia was graded according to WHO criteria [4]. It was observed that adult males and male children had the highest frequency of severe anaemia. The likely reason could be that besides nutritional deficiency other causes like haemoglobinopathies, sepsis etc. are playing a role in these groups. The fact that in adult females and elderly males the commonest grade of anaemia is moderate is a further pointer to the gravity of problem in these groups. Carmel [18] and Beghe and co-workers [19] in their studies have pointed towards the fact that anaemia tends to be of more severe variety in elderly as compared to adults.

On correlating the haemoglobin concentration with TLC it was seen that the elderly group (both males and females) showed a relatively high frequency of cases showing leukocytosis. Leukopenia was seen most commonly in male children followed by elderly males. Alteration of leucocyte count in these groups suggests that additional pathologies particularly sepsis may be playing a role in these groups. When the relationship of anaemia with DLC was examined it was seen that certain groups showed disturbance in DLC more commonly as compared to other groups. Neutrophilia was commonest in male children, lymphocytosis and eosinophilia in elderly females. These findings point towards likely role of infection in male children. In case of elderly women aetiologies like allergic conditions, parasitic infestation and tuberculosis should be investigated for.

The status of platelet count in various groups was studied. It was observed that large majority of individuals had a normal platelet count. Thrombocytopenia was commonest in male children followed by female children. This again points towards role of sepsis in this group of patients as it is a well known fact that sepsis tends to worsen anaemia. Thrombocytosis was negligible in the study with only a couple of patients in the elderly female group showing it. The correlation of ESR with anaemia showed that expectedly majority of subjects had a raised ESR. The elderly males group showed highest prevalence (100%) followed by adult males (89.5%). The children's group showed elevation of ESR in less number of cases as compared to other groups.

The data obtained in the present study was also correlated with overall Indian data (NFHS-3) [2], Kerala state (as majority of people living in Lakshadweep are ethnically related to Kerala) and neighbouring country Maldives [20] (as it shares geography and socio-economic parameters). It was observed that in all the groups where information is available the indicators of Kavaratti, Lakshadweep are significantly better than national figures (Table 3). This despite the remote location is a very significant achievement. A very important factor is likely to be the high literacy rate (88.29% as per census 2011). Previous works of Akramipour [21] and Sadeghian [22] along with co-workers has
shown that high literacy rates are associated with good anaemia related indicators. However, as compared to Kerala the figures are inferior. This could be due to inaccessibility and non-availability of food stuff during rainy season as all the supplies come from Kerala via ships. The figures are on the other hand vastly better than the neighbouring country Maldives. A fact that deserves particular mention is that the prevalence of anaemia in children is particularly low in Kavaratti, Lakshadweep as compared to national figure. This is likely due to the practice of weaning of children with a diet containing fish here. Fish as is well known a good source of haem iron with good bioavailability.

Another group which deserves special attention is the elderly group. This is because that not only the prevalence of anaemia is high in this group the aetiology is complex. Thus a straightforward approach is unlikely to work. However examination of the gastrointestinal tract is strongly recommended in this group as recommended by various authors [23-24].

The author also looked at the available literature and found that there is very little known about anaemia at remote islands of the world. Only a few studies have been reported from Marshall Island [25], Fiji [26] and Papua New Guinea [27]. Thus, overall there is extreme paucity of data on anaemia occurring at these remote locations of the world.

**CONCLUSION**

Anaemia is an important condition with serious consequences. It is a major public health problem in developing countries like India. There is however no data available from Kavaratti, Lakshadweep. The present study shows that anaemia indicators in Kavaratti, Lakshadweep are vastly superior to national figures and neighbouring country Maldives. However, in adult females and elderly females its prevalence is unacceptably high and needs urgent intervention. The elderly males also have a high prevalence of anaemia but this group will be difficult to tackle as the underlying aetiology is multifactorial and complex. It is hoped that the data brought out by this study will help health policy makers to better frame strategy to face this major problem.

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