

# Haemolytic Anaemia at Kavaratti Island, Lakshadweep: A Hospital Based Study

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## ABSTRACT

**Background:** 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 extreme paucity of data on the type of anaemia here. Objective of this study is to take an in depth look at the various etiologies of anaemia at Kavaratti island, Lakshadweep.

**Methods:** A total of 4526 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 aetiology of anaemia in these cases was further investigated.

**Result:** The prevalence of anaemia in adult males was 21.5% and in females 37%. 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 and even higher in elderly females (43%). However, the most significant finding was the high prevalence of haemolytic anaemias especially sickle cell anaemia.

**Conclusion:** Anaemia is not a major public health problem in Kavaratti island, Lakshadweep. However, there is high prevalence of haemolytic anaemias especially sickle cell anaemia. Nutritional anaemia is quite rare. This fact may have major implications for health policy makers.

**Keywords:** Anaemia; Haemolytic Anaemia; Kavaratti Island; Lakshadweep; Public Health

## Introduction

The assessment of human health status is very important parameter for general wellbeing of an individual. Anaemia is a global health problem whose burden is severe in developing countries like India because of poverty, poor dietary habits and lack of awareness of nutritional value of food items.<sup>[1]</sup> National family health survey (NFHS) <sup>[2]</sup> conducted in 2005-2006 showed that prevalence of anaemia was as high as 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. The situation is further compounded by the fact that a large number of cases of anaemia are asymptomatic and thus do not seek medical attention.<sup>[3]</sup> Therefore, analysis of laboratory data becomes extremely crucial in estimating the magnitude of this problem in different communities.

Lakshadweep is a remote group of 36 islands in the Arabian Sea with an area of 32 sq km. The literal meaning of the name of these islands in Malayalam and Sanskrit is 'a hundred thousand islands'. It is the smallest union territory of India and its capital is Kavaratti island. It is located between 10°32' and 10°35'N latitude and 72°35' and 72°40 S longitude, having an area of 4.22 sq km. Main

occupation of people of Lakshadweep is Fishing, coir twisting and coconut cultivation. Indira Gandhi Hospital is the main hospital located in Kavaratti island established in 1972. It has been upgraded to 150 beds from 50 beds in 1986. It also serves as referral hospital for other islands in Lakshadweep.

There is paucity of literature regarding type of anaemia in Kavaratti island, Lakshadweep. In a thorough search of literature, the authors could find only a single study<sup>[4]</sup> on this subject. However, the previous study did not take an in depth look at the various etiologies of anaemia at Kavaratti island, Lakshadweep. Thus, this study was undertaken to investigate the status of anaemia and the types of anaemia at Kavaratti island, Lakshadweep.

## Materials and Methods

The study was conducted from November 2016 to January 2017 at Indira Gandhi Hospital, Kavaratti island, Lakshadweep. An analysis of all patients referred for haematological workup was carried out. A total of 4526 patients were included in the study. The haematological analysis was carried out on a MEK-6420 haematology analyser (Nihon-Kohden).

The study population was quite heterogeneous which could lead to confounding results and difficulty in interpretation. Thus in order to facilitate data analysis the cases were subdivided into following groups –

1. Children (Age – 0-14 years).
2. Adults (Age > 14 but < 60 years)
3. Elderly (Age > 60 years).

The anaemia in each of the groups was assessed using the standard WHO criteria<sup>5</sup>. The haematological data and peripheral smear findings were correlated with other parameters and ancillary investigations like haemoglobin electrophoresis. Based on the peripheral smear findings and results of ancillary studies the type of anaemia was identified. The various types of anaemias in all the subjects included in the study were tabulated. Based on this compiled data the prevalence of various types of anaemias was calculated. Special attention was paid to the various haemolytic anaemias and their types were studied further. The data was also compared with other neighbouring island countries like Maldives which shares similar geography and socioeconomic circumstances.

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

## Result

The study included a total of 4526 subjects out of which there were 1674 males (37%) and 2852 (63%) females. The M:F ratio was 1:1.7. Amongst the males a total of 359 were found to be anaemic while in the females group 1055 were anaemic. Thus, the overall prevalence of anaemia in males was 21.5% and in females 37%. The mean haemoglobin in the male group was 10.3 g/dl and mean  $\pm$  2S.D. was 8.7-11.9 g/dl. On the other hand, amongst the females the mean haemoglobin was 10.1 g/dl and mean  $\pm$  2S.D. was 8.6-11.6 g/dl. When comparison was done between the two groups the difference was found to be statistically significant (P value <0.05). Overall the prevalence of anaemia was 30%.

The study comprised of 405 children. The mean haemoglobin in this group was 9.8 g/dl and mean  $\pm$  2S.D. was 8.4-11.2 g/dl. There were 275 male and 130 female children. The M:F ratio was 1:0.5. Overall among children 99 (24.6%) were anaemic. Female children showed a higher prevalence 35 (27.4%) as compared to males among which 64 (22.9) were anaemic. The mean Hb in male children was 9.8 g/dl and mean  $\pm$  2S.D. was 8.4-11.2 g/dl. While in the female children group the mean Hb was 9.3 g/dl and mean  $\pm$  2S.D. was 7.6-11 g/dl. On comparing the difference between two groups was found to be statistically significant (P-value<0.001).

The elderly group consisted of a total of 447 individuals. There were 259 males and 188 females. The M:F ratio was 1:0.7. The mean haemoglobin in elderly males was 10.4 g/dl and mean  $\pm$  2S.D. being 8.9-11.9 g/dl. Whereas, in the elderly females group the mean Hb was 10.5 g/dl and mean  $\pm$  2S.D. was 9.4-11.6 g/dl. The number of anaemic subjects in the elderly male group was 78 (30%) while amongst elderly females a total number of these cases was 81 (43%). The difference between the two groups was found to be quite significant statistically (P-value<0.05). The mean and mean  $\pm$  2S.D. Hb in the various groups is summarily presented in Table 1.

In all the cases of anaemia in the various groups as mentioned above peripheral smears were examined. The various types of anaemias identified on peripheral blood examination and their relative prevalence is summarized in Table 2. As can be seen in the table by far the most common type of anaemia that was seen was haemolytic anaemia followed by iron deficiency anaemia (Fig.1). The other types of anaemias observed were macrocytic anaemia (Fig.2), anaemia of chronic disease and dimorphic anaemia (Fig.3)

As mentioned previously the overall prevalence of anaemia was 30 %. However, there appeared to be high incidence of various haemolytic anaemias. These were then further categorized on the basis of peripheral blood and haemoglobin electrophoresis findings. The various types of haemolytic anaemias observed and their relative distribution is shown in Table 3. As can be seen in the table the most common type of haemolytic anaemia observed was sickle cell trait followed by sickle thalassemia.

The cases of sickle cell anaemia (Fig.4), sickle haemoglobin C and sickle thalassemia were further analyzed as these patients are at significantly higher risk for complications. These cases were subdivided on the bases of age and correlation was done with Hb, MCV, HbF and reticulocyte count. The results are shown in Table 4. Thus, in a total of 875 patients (92%) definite categorization of the haemolytic anaemia was possible. In the rest of the patients a definite work up could not be done as the patients were lost to follow up.

## Discussion

The present study is the first study to look at the types of anaemia occurring at Kavaratti island, Lakshadweep. In a previous study Yadav along with co-workers<sup>[4]</sup> studied the prevalence of anaemia at Kavaratti island, Lakshadweep. However, they did not look at the causes of anaemia in their study.

**Table 1: Mean and mean±2S.D. haemoglobin in the various groups.**

Group	Mean (g/dl)	Mean+2S.D. (g/dl)
Male	10.3	10.3+1.6
Female	10.1	10.1+1.5
Male children	9.8	9.8+1.4
Female children	9.3	9.3+1.7
Male elderly	10.4	10.4+1.5
Female elderly	10.5	10.5+1.1

**Table 2: Types of anaemias identified on peripheral smear examination.**

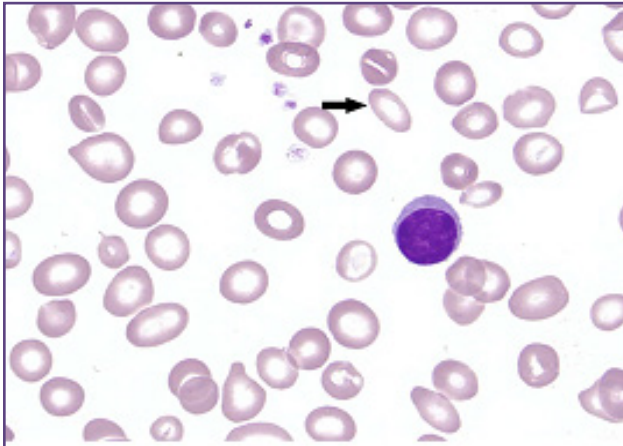
Type of anaemia	Number of cases	Percentage
Haemolytic anaemia	951	70%
Iron deficiency anaemia	217	16%
Macrocytic anaemia	41	3%
Anaemia of chronic disease	14	1%
Dimorphic anaemia	135	10%

**Table 3: Types of haemolytic anaemias observed and their relative distribution.**

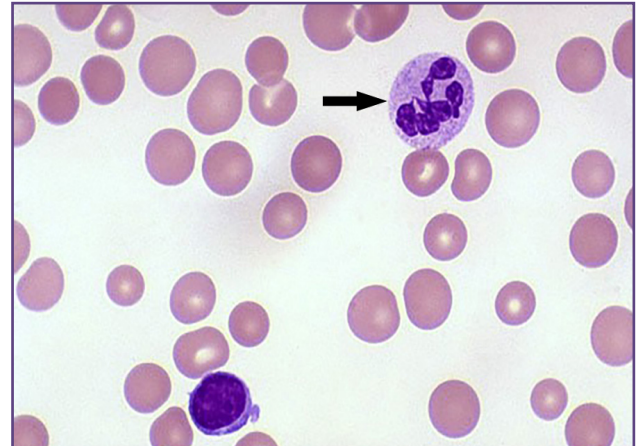
Type of haemolytic anaemia	Number of cases	Percentage
Sickle cell trait	599	63%
Sickle cell anaemia	19	0.2%
Sickle thalassaemia	209	22%
Sickle haemoglobin C	23	2.4%
Haemoglobin C	49	5.4%

**Table 4: Correlation with Hb, MCV, HbF and Retic. Count in cases of HbSC, SβThal and HbSS.**

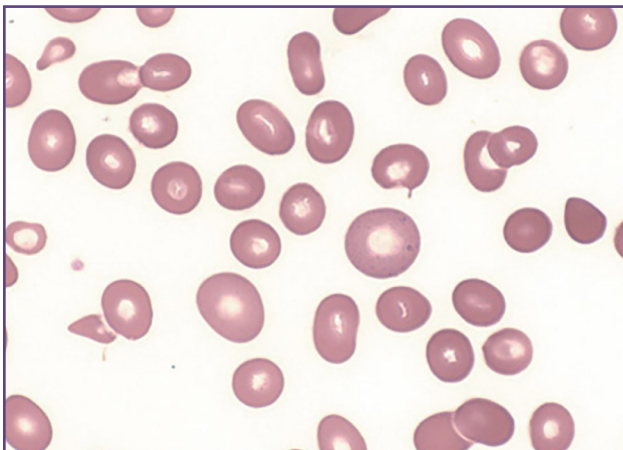
S.No.	Type of haemolytic anaemia	Age group (yrs)	Hb (g/dl) Mean±2S.D.	MCV (fl) Mean±2S.D.	HbF (%) Mean±2S.D.	Retic. Count (%) Mean±2S.D.
1	HbSC	0-14	11.6±2.5	81±10	11.6±3.5	5.8±2.0
		14-60	10.7±2.1	76±9	3.5±2.1	2.7±2.0
		>60	10.6±2.0	77±10	3.4±2.0	2.6±1.8
2	SβThal.	0-14	10.9±2.4	80±12	5.0±2.6	5.2±2.2
		14-60	10.5±2.6	84±10	3.1±2.1	2.8±1.8
		>60	10±2.5	80±10	3.0±1.6	2.4±1.6
3	HbSS	0-14	10.2±2.5	81±14	9.1±4.2	4.0±2.6
		14-60	12.1±2.5	79±20	6.7±4.2	3.6±3.0
		>60	10.4±2.5	80±15	4.9±3.2	3.2±3.0



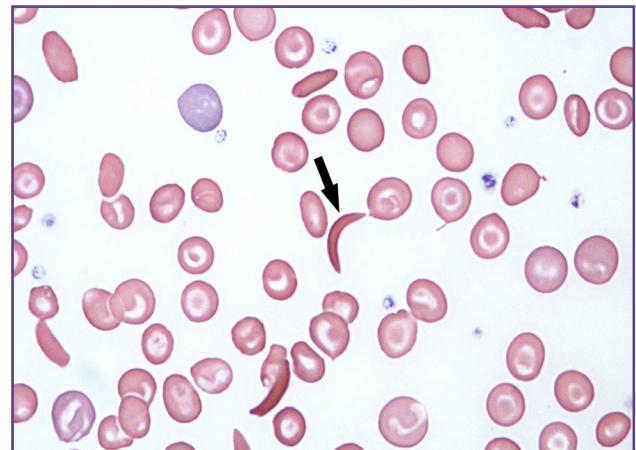
**Fig. 1: Iron deficiency anaemia showing microcytic hypochromic red cells and pencil cells (arrow).**



**Fig. 2: Macrocytic anaemia showing macrocytic red cells and a hypersegmented neutrophil (arrow).**



**Fig. 3: Dimorphic anaemia showing mixed population of small and large red cells.**



**Fig. 4: Peripheral smear from a patient of sickle cell anaemia showing sickle shaped RBC (arrow).**

The present study has a sample size of 4526 patients. The previous study by Yadav et al had 2000 subjects. Thus, the sample size in the present study is significantly larger. According to the 2011 census the population of Kavaratti island, Lakshadweep is 10113. Thus, a sample size of 4526 represents a highly representative sample. Also, Indira Gandhi Hospital Kavaratti island, Lakshadweep is a referral hospital and patients from all the other islands come here to get treatment. Thus, the sample in the present study not only reflects the situation in Kavaratti island but is an indicator of the situation in all Lakshadweep islands.

The overall anaemia indicators appear to be vastly superior as compared to the national figure and even that of Kerala. The incidence of iron deficiency anaemia is low at Kavaratti island, Lakshadweep. This is due to the consumption of fish as a staple diet which is a good source of haem iron. However, the prevalence of anaemia amongst adult females was found to be significantly higher

as compared to adult males ( $P=0.001$ ). Previous similar studies by various authors have reported similar findings.<sup>[4,6-8]</sup> The overall prevalence of anaemia in children was found to be significantly lower than the national figure. However, a slightly higher prevalence in female children points towards the fact that this group needs more attention.

The present study shows that anaemia is very common in the elderly group. Especially elderly females were shown to have high frequency of anaemia. There is very limited data available from India on anaemia in elderly. However, various studies<sup>[9-11]</sup> done previously have shown similar results.

The most striking finding in the present is the very high incidence of haemolytic anaemias especially Sickle cell trait at Kavaratti island. There is overall a paucity of literature on the prevalence of sickle cell anaemia in the remote islands of the world. An overview of published literature reveals that majority of published literature is

from the Caribbean region especially Jamaica. Asnani et al<sup>[12]</sup> in their study found that women with sickle cell anaemia experienced a significantly higher risk of dying in pregnancy and childbirth as compared to those without sickle cell anaemia. They recommended that tertiary services (e.g. ventilator support) are needed at regional centres to improve outcomes in this and other high-risk populations. Universal sickle cell anaemia screening in pregnancy in populations of African and Mediterranean descent is needed as are guidelines for managing sickle cell anaemia pregnancies and educating families with sickle cell anaemia.

The presence of high prevalence of sickle cell anaemia in a population demands concerted action especially in the setting up of specialized newborn screening centres. In their work from Jamaica King and coworkers<sup>[13]</sup> reported that island-wide newborn screening for sickle cell anaemia has yielded wonderful results has ensured continuous improvements in morbidity, mortality and quality of life. In a subsequent work King et al<sup>[14]</sup> found that by establishing comprehensive care centres mortality in children <5 years of age with sickle cell anaemia can be brought to the same level as that of the general population. Children with sickle cell anaemia, a highly vulnerable population, can be effectively managed, even in these resource-limited environments.

In another study carried out in Balearic Islands, Escribano et al<sup>[15]</sup> used blood spot specimen dried on filter paper and performed High-performance liquid chromatography (HPLC), using the VARIANTS (Biorad) automated system to detect haemoglobin variants. The overall incidence was 9.9 per 1000 specimens. The incidence of SCD was 1/6756 and the incidence of sickle cell traits was. They concluded that there is a need to include screening for sickle cell anaemia and other haemoglobinopathies in the neonatal screening program. Heyningen and coworkers<sup>[16]</sup> did a study on 368 cord blood samples from the islands of Aruba and St. Maarten. They found an incidence of 2.65% for HbAS and 1.86% for HbAC in Aruba and 6.80% for HbAS and 4.86% for HbAC in St. Maarten. Thus, a newborn rate of about 2 sickle cell anaemia patients per 3 years in Aruba and 2 sickle cell anaemia patients per year in St. Maarten. They recommended universal screening of newborns for sickle cell anaemia as a cost-effective measure in St. Maarten.

Tarer and co-workers<sup>[17]</sup> in their study on Guadeloupean children observed that the natural history of sickle cell anaemia in Guadeloupe is more similar to that in Jamaica with regard to those reported in Europe and the United States. This suggests a potential impact of environmental factors on the clinical course of the disease.

In a study carried out in Northern Haiti, Randolph<sup>[18]</sup> reported that the estimated prevalence of sickle haemoglobin was 15.1%. He has suggested the need to develop intervention programs among the people of northern Haiti.

The high incidence of haemolytic anaemia especially haemoglobinopathies is an extremely significant finding in the present study. It is significant not only because sickle cell anaemia is a haemolytic anaemia. It is also because there are many additional manifestations like depression and loneliness. In a study carried out by Asnani and co-workers<sup>[19]</sup> on 277 patients with sickle cell anaemia and 65 controls based on questionnaire method depression and loneliness were analyzed. It was found that depression was present in 21.6% of patients and 9.4% controls. Loneliness scores were also significantly higher in patients than in controls. Depression was also significantly associated with unemployment, whereas unemployment and lower educational attainment were significantly associated with loneliness. Thus, they concluded that health care workers need to actively look for and manage these problems to optimize their patients' total biopsychosocial care.

Another dimension to consider is the fact that sickle cell anaemia cell anaemia can combine with other tropical infectious diseases to form a lethal combination. Limonta et al<sup>[20]</sup> report two cases of fatal dengue from the 2001-2002 Havana dengue epidemic. Both these patients died due to dengue haemorrhagic syndrome/dengue shock syndrome. Both of these patients also suffered from sickle cell anaemia. It is hypothesized that activated monocytes in sickle cell anaemia, might activate endothelial cells through different cytokines that contribute to frequent microvascular occlusions,<sup>[21]</sup> altering endothelial cell apoptosis, immune responses and hemopoiesis.<sup>[22]</sup> However, further detailed investigations are needed to elucidate the association of apoptosis with sickle cell anaemia and severe dengue physiopathology.

Since the cause of sickle cell anaemia is genetic abnormalities leading to mutations in globin gene the situation demands a different kind of approach to the management on the part of health care professionals at Kavaratti island, Lakshadweep. They must be made aware of this fact, so as to accordingly manage these patients. Also, further molecular studies are required to elucidate the genesis of haemolytic anaemia in this population.

According to WHO<sup>5</sup> prevalence of anaemia >40% in a population makes it of severe public health importance. The overall prevalence of anaemia is quite low in Kavaratti island, Lakshadweep. Thus, it is not of a major public health importance. However, there is high prevalence of haemolytic anaemias especially sickle cell anaemia at

Kavaratti island, Lakshadweep. Nutritional anaemia is quite rare. This fact may have major implications for health policy makers.

### Conclusion

Thus, to conclude anaemia is not a major public health problem in Kavaratti island, Lakshadweep. However, there is high prevalence of haemolytic anaemias especially sickle cell anaemia. Nutritional anaemia is quite rare. This fact may have major implications for health policy makers.

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