

## Original Research Article

# Burden of anemia in hospital attendees in Tayma general hospital, Tabuk, Saudi Arabia

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## ABSTRACT

**Background:** Anemia, a low hemoglobin (Hb) status in the body is a serious nutritional public health problem in the world. It causes divergent morbidity and mortality in the affected population. Prevalence of anemia among women of reproductive age (women ages 15-49 years) in Saudi Arabia was 40.30% in 2011. In this study, we attempted to explore the burden of anemia in Hospital attendees in Saudi Arabia.

**Methods:** A cross sectional study was conducted with the laboratory hematological values of walk-in clients from January 2016 and February 2016. Client's sex, Hb, HCT, MCV, MCH, MCHC values were collected. Hb values categorized as mild anemia: Male: 11-12.9 gm/dl; Female: 11-11.9 g/dl., moderate anemia 8-11 gm/dl and severe anemia <8 g/dl. Data entry done was using Microsoft Excel and data analysis by STATA 15.

**Results:** Out of total 2805 client's data, 49% (n=1377) were male and 51% (n=1428) were females. The mean Hb% was 12.31 g/dl (SD=2.54), 11.50 g/dl in females and 13.13 g/dl in males. The overall prevalence of anemia was 48.73% (CI: 46.87%-50.6%) as per WHO criteria and it was higher in females (45.53%, CI: 42.88-48.21) in men and 51.82% (CI: 49.19-54.44) in women). Severe anemia was also higher in women (Male: 2.76% vs. Females: 7.49%) while mild anemia was high in men (Male: 28.61% vs. Female: 17.79%). Prevalence of anemia was 25.6% and 40.7% if lower margin of Hb kept at 11 g/dl and 12 g/dl respectively.

**Conclusions:** The prevalence of anemia in Tayma region was high which needs integrated intervention at different levels to improve Hb status in the community.

**Keywords:** Hemoglobin, Anemia, Saudi Arabia, Hematology, Nutrition, MCV, MCH

## INTRODUCTION

Anemia is a global public health problem that affects both developing and developed countries with major consequences for human health as well as social and economic development.<sup>1</sup> It is an indicator of both poor nutrition and poor health and linked with major development goals.<sup>2</sup> It is a condition in which the number and size of red blood cells, or the hemoglobin concentration, falls below an established cut-off value

usually hemoglobin (Hb) concentration 2 SDs below the mean Hb concentration for a normal population of the same gender and age range, consequently impairing the capacity of the blood to transport oxygen around the body.<sup>3,4</sup>

The Micronutrients Database in the WHO Vitamin and Mineral Nutrition Information System (VMNIS) estimates approximately 800 million children and women affected by anemia with 38.2% of global prevalence of

anemia among pregnant women, 29.4% among women of reproductive age group and 43% among children in 2011.<sup>5</sup> There were 496 million (409–595 million) estimated anemia cases among non-pregnant women, 32 million (28–36 million) cases among pregnant women, and 273 million (242–304 million) cases among children in the world in 2011. The estimated anemia prevalence was 47.4% (95% CI: 45.7–49.1%) in preschool-aged children, 41.8% (95% CI: 39.9–43.8%) in pregnant women and 30.2% (95% CI: 28.7–31.6%) in non-pregnant women in 2011.<sup>6</sup> Iron deficiency anemia amounts to 841000 deaths and 35057000 DALYs.<sup>7</sup>

Anemia is the most common nutritional disorder in the world, as it is in the Eastern Mediterranean Region (EMR).<sup>8</sup> The anemia prevalence in Bahrain reached 48.3% among children under 5 years of age and 41.6% among children between 5 and 14 years. In women of childbearing age the prevalence of anemia was also reported to be approximately 40% in both Oman and Bahrain.<sup>9</sup> Prevalence of anemia among women of reproductive age (% of women ages 15–49) in Saudi Arabia was 40.30% in 2011.<sup>10</sup>

In order to find out the character and etiology of anemia, physical examination and laboratory test like Hb%, hematocrit and certain red cell parameters MCV, mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC) and red cell distribution width (RDW) are important.<sup>11</sup> However, Hb% estimation is the most widely used test for anemia while the MCV value—the mean size of the red cells used with the RDW for interpretation of the red cell size.<sup>12</sup> Hb estimation is done using various methods such as hemoglobin color scale, Sahli technique, Lovibond-Drabkin technique, Tallqvist technique, copper-sulfate method, HemoCue and automated haematology analyzers etc. HemoCue is the method of choice for initial screening of anemia because it is reliable, portable. Now a day's automated analyzers are used in high level settings.<sup>13</sup>

Low hemoglobin concentration is associated with iron deficiency, infectious and inflammatory disorders, the prevalence of genes for thalassemia, vitamin A deficiency, deficiencies of folic acid and vitamin B12, chronic diseases, and autoimmune diseases etc.<sup>14,15</sup> Hence advanced investigations and follow-up is required to identify the nutritional, physiological or pathological types of anemia and etiology causing anemia.

As anemia causes high morbidity and mortality, global and local level actions have been initiated. The World Health Assembly endorsed a Comprehensive implementation plan on maternal, infant and young child nutrition which specified second target, a 50% reduction of anemia in women of reproductive age out of six global nutrition targets for 2025.<sup>16</sup>

Hence, in our study, we attempted to identify the burden of anemia among the hospital attendees in Tayma General Hospital, Tabuk, Saudi Arabia during January and February 2016.

## METHODS

### *Study design and setting*

The current study was a cross sectional study using retrospective data of General Laboratory, Tayma General Hospital

### *Participants*

Hospital attendees sent from different departments of hospital to laboratory from 1<sup>st</sup> January 2016 to 28<sup>th</sup> February 2016 were taken for this study.

### *Method of data collection*

Information on date of test, patient's name, sex, OP department, and ward, WBC, RBC, Hb, HCT, MCV, MCH, MGHC and PCT etc were collected from hematology register in the laboratory. Except patient name, WBC and PCT other variables were taken for this study.

### *Method of hematology test used*

Sysmex- KX-21N™ Automated Hematology Analyzer from Sysmex Corporation was used to test the blood samples. Hb tested by Non-cyanide method and hematocrit by Cumulative pulse height detection method.

### *Sample Size*

Sample size of 2805 was arrived using anemia prevalence of 32%, precision of 0.02 and confidence interval of 0.98 for the 30411 population of Tayma for Anemia prevalence.<sup>17</sup> Sample size of 150 taken conveniently for other hematological indices due to time factor for data entry.

### *Types of sampling*

Consecutive sampling method for Hb and random sampling for other variables.

### *Variables*

Anemia definition was adopted using WHO criteria (Table 1).

### *Data management*

Data entries done using Microsoft Excel and analyzed using STATA version 15, Stata Corp LLC. Frequency,

mean, proportions and chi-square test were performed depending upon the type of data. Used tables, histogram,

normal distribution curve, bar diagram to present the data.

**Table 1: Hemoglobin levels to diagnose anemia at sea level (g/dl).<sup>1</sup>**

Population	Non-Anemia*	Anemia*		
		Mild <sup>#</sup>	Moderate	Severe
<b>Women</b>	12.0 or higher	11.0-11.9	8.0-10.9	lower than 8.0
<b>Men</b>	13.0 or higher	11.0-12.9	8.0-10.9	lower than 8.0

\*Hemoglobin in grams per dl <sup>#</sup>"Mild" is a misnomer: iron deficiency is already advanced by the time anemia is detected. The deficiency has consequences even when no anemia is clinically apparent.

## RESULTS

Out of total 2805 client's data on hematology considered for the study, 1377 (49.09%) were male and 1428 (50.90%) were females (Table 2). There were 1390 and 1415 hematology tests had been performed in our hospital in January 2016 and February 2016 respectively.

The overall mean Hb was 12.31 g/dl (SD: 2.54). It was less in women with 11.51 g/dl (SD:2.26) compared to men, 13.13 g/dl (SD:2.54). The lowest level of hemoglobin was 2.4 g/dl in men and 2.6g/dl in women and highest 24.2 g/dl in men and 19.4g/dl in women (Table 2). The Hb values fit in to a normal curve as the sample was normally distributed. And it was evident that more Hb values centered lower in women than men (Figure 1).

The hematological values depicted in Table 3. The mean value of HCT was 35.38%, MCV 92.11 fL, MCH 29.97 pg and MCHC 31.82 g/dl. More than 18.5g/dl of Hb values was seen in 18 males (1.3%) and more than 16.5 seen in 27 females (1.89%). Hematocrit values more than 52% seen in 6.5% of males and more than 48% seen in 2.7% of females. MCV values less than 80fl seen in 15% of samples and more than 94fl seen in 40.0% of individuals. And 34% of samples were having MCH values more than 31 pg (Table 3).

Prevalence of anemia was 25.6% if lower margin of Hb kept 11 g/dl. The prevalence was higher in females (67.59%) and lower in males (32.01%). The difference was statistically significant ( $p<0.001$ ). And prevalence of anemia was 40.7% if lower margin of Hb kept 12 g/dl. The prevalence was higher in females (64.80%) and lower in males (35.20%). The difference was statistically significant ( $p<0.001$ ) (Table 4).

Prevalence of anemia as per WHO criteria was 48.73% (46.87%-50.6%). It was 45.53% (CI:42.88%-48.21) in males and 51.82% (CI:49.19%-54.44%) in females. Severe anemia was also high in females (Male: 2.76%; Females: 7.49%). But mild anemia was high in males (Male: 28.61%; Female: 17.79%) (Table 5).

Figures 2 denote the Hb grades in the study samples. Among females, 379 (26.54%) were having the Hb values 8 to 10.9 g/dl next to  $\geq 13$  g/dl category. But 750 (26.73%) males having  $\geq 13$  g/dl than females 399 (14.22) and female having larger number of  $<8$  g/dl Hb than males. The Hb band of 12 to 12.9 g/dl was almost equal number in both sexes (male: 8.02%; females: 10.30%). The overall trend of Hb was rising from lowest to highest values.

HCT, MCV, MCH, MCHC values are categorized with the grading of anemia in Table 6. Though some pattern had been observed with the grading of anemia, it has no diagnostic value of grading of anemia rather than type and nature of anemia (Table 6).

**Table 2: Hemoglobin (g/dl) status and sex of participants (n=2805).**

Sex	Mean	Median	Max	Min	SD
<b>Male (n=1377)</b>	13.13	13	24.2	2.4	2.54
<b>Female (n=1428)</b>	11.51	11.75	19.4	2.6	2.26
<b>Overall (n=2805)</b>	12.31	12.2	24.2	2.4	2.54

**Table 3: Descriptive statistics of all hematology values of study participants.**

Variable	Minimum	Maximum	Mean	Std. deviation
<b>MCV(fL)</b>	31.0	124.0	92.11	13.65
<b>MCH (pg)</b>	9.0	78.0	29.97	6.84
<b>Hematocrit (HCT)(%)</b>	6.0	66.2	35.38	11.41
<b>MCHC (g/dL)</b>	15.9	42.4	31.82	4.10
<b>Hemoglobin (g/dl)</b>	2.4	24.2	12.31	2.54

**Table 4: Anemia prevalence among study participants using Hb less than 11 g/dl and 12 g/dl (n=2805).**

Sex	Hb <11 g/dl	%	Hb ≥11 g/dl	%	P-Value
Male	233	32.41	1144	54.84	p<0001; Pearson Chi-Square:107.69;df:1
Female	486	67.59	942	45.16	
Total	719	100	2086	100	
	<b>Hb &lt;12 g/dl</b>		<b>Hb ≥12 g/dl</b>		
Male	402	35.2	975	58.63	p<0001; Pearson Chi-Square:148.69;df:1
Female	740	64.8	688	41.37	
Total	1142	100	1663	100	

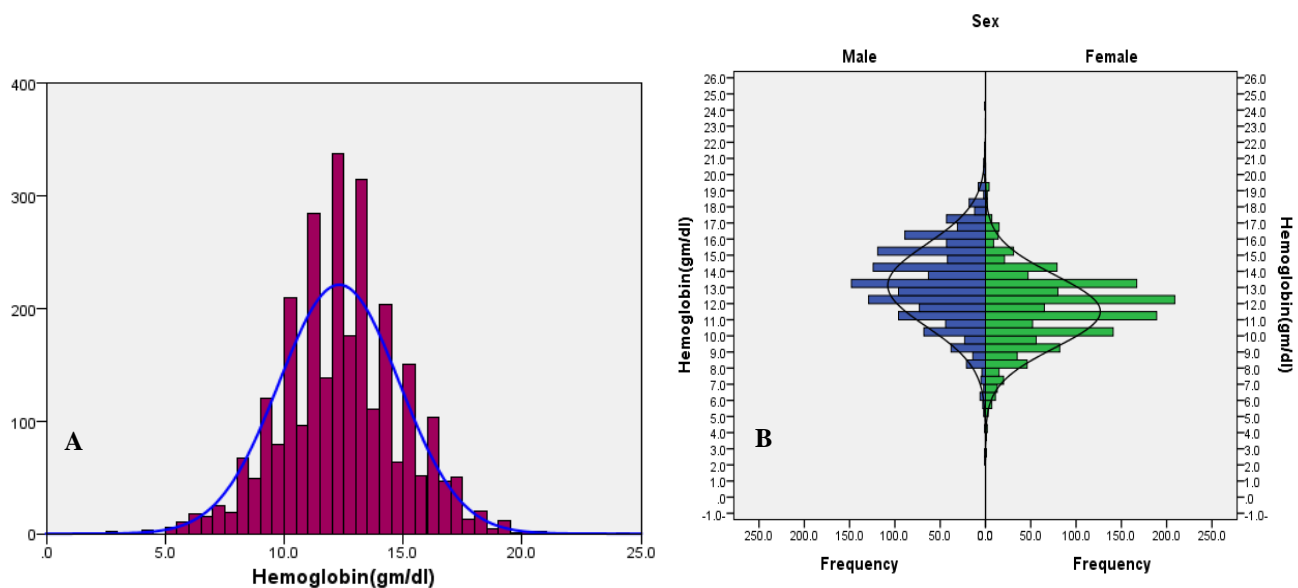
**Table 5: Grades of anemia in male and female population as per WHO criteria (n=2805).**

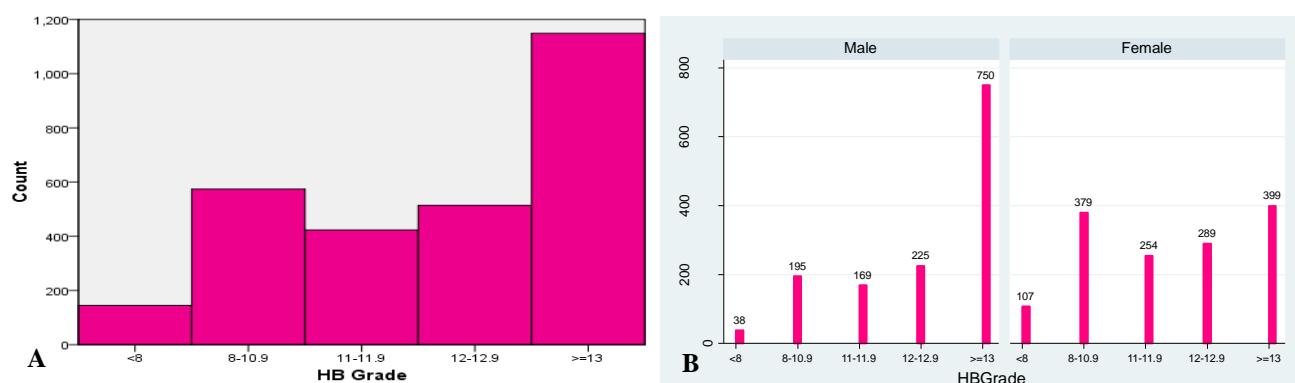
Anemia	Male	%	Female	%	Total	%	P value
Severe (<8 g/dl)	38	2.76	107	7.49	145	5.17	p<0001; Pearson Chi-Square: 123.85; df:3
Moderate (8-10.9 g/dl)	195	14.16	379	26.54	574	20.46	
Mild	394	28.61	254	17.79	648	23.10	
Normal	750	54.47	688	48.18	1438	51.27	
Total	1377	100.00	1428	100.00	2805	100.00	

Mild anemia: Male: 11-12.9 g/dl; Female: 11-11.9 g/dl. Normal: Male ≥13 g/dl; Female ≥12 g/dl.

**Table 6: Grades of anemia and other hematological indices (n=150).**

Anemia grade	Statistics	Hematocrit (HCT)(%)	MCV (fL)	MCH (pg)	MCHC (g/dL)
Severe	Mean	20.729	85.003	24.914	28.514
	Std. deviation	7.2874	18.3401	6.4888	3.8484
Moderate	Mean	32.000	90.110	28.035	31.090
	Std. deviation	3.7497	11.7735	4.8109	3.1818
Mild	Mean	35.807	93.607	31.350	31.432
	Std. deviation	2.8087	10.2135	9.7122	3.0399
Normal	Mean	43.992	95.855	32.641	33.961
	Std. deviation	8.1712	10.9868	3.9402	3.5877
Total	Mean	35.380	92.112	29.965	31.821
	Std. deviation	11.4101	13.6483	6.8383	4.0950

**Figure 1: Hemoglobin depicted in a normal curve in the study populations (n=2805). A=Normal curve of study samples; B=Sex wise normal curve of study samples.**



**Figure 2: Grading of HB in study subjects (n=2805). A= hemoglobin grades in the study samples; B= sex wise hemoglobin grades in the study samples.**

## DISCUSSION

The overall prevalence of anemia in this study was 48.73% with female predominance. As per WHO, it will be severe public health problem, when the prevalence of anemia above  $\geq 40.0$  g/dl.<sup>24</sup> The study clearly shows the highest anemia burden in the region. A study conducted in Egypt shows the highest prevalence of anemia (45.26%) in non-pregnant females and in young children (52-54%).<sup>18</sup> A wide variation of anemia prevalence in pregnant women was reported from 20% to 40% in Riyadh, Saudi Arabia and 54.8% of women reported have anemia in Al-Asha region.<sup>19-21</sup> Hence country wide detailed study can be conducted to understand the diverse burden of anemia in the region.

Anemia prevalence in the world over the time period decreased from 40.2% in 1990 to 32.9% in 2010. It accounts for 68.4 million Years Lost due to Disability (YLD) in 2010 (8.8% of all).<sup>22</sup> The YLD fell by 12% between 1995 and 2011 from 33% to 29% in non-pregnant women and from 43% to 38% in pregnant women, and from 47% (43–51) to 43% (38–47) in children indicating that progress is possible but presently insufficient to meet this goals.<sup>16</sup>

Mean Hb values in our study was 12.31 g/dl, Male 13.13 g/dl and females 11.51 g/dl. Globally, the mean blood hemoglobin concentration was 11.1 g/dl (95% CI: 11.0–11.3 g/dl) in children, 12.6 g/dl (95% CI: 12.4–12.8 g/dl) in non-pregnant women, and 11.4 g/dl (95% CI: 11.2–11.6 g/dl) in pregnant women.<sup>5</sup> One study conducted in Riyadh reported higher mean value with males 13.5% and females 12.3 g/dl. And values for MCV, mean cell Hb, MCHC and red cell distribution width in males were 77.8  $\mu\text{m}^3$ , 26.1 pg, 32.7 g/dl and 13.9%, respectively.<sup>23</sup> These indices are helpful to find out the types anemia either microcytic or megaloblastic anemia; in first type the indices (MCV, MCH, MCHC) are low and second type elevated except MCHC which will be normal or slightly elevated. Extreme high (24.2 g/dl) and low values of Hb (2.4 g/dl) in the current study needs more research and follow-up.

Important risk factors for iron deficiency anemia among Saudi women of childbearing age are dietary habits, menorrhagia and history of ingestion of non-steroidal anti-inflammatory drugs or antacids. Hence action to be undertaken to minimize the risk factor through wide modalities of health interventions.<sup>24</sup> WHO-TRS denote various approaches namely improvement of dietary habits, control of parasites associated with blood loss, fortification of food, use of prophylactic iron and screening of associated diseases.<sup>25</sup> Health education at primary health care centers should be given importance especially for pregnant women.

Anemia is a serious outcome of iron deficiency nearly half of the cases. The overall iron supply is particularly limiting in Sub-Saharan Africa, South Asia, and South East Asia. In these three regions animal sources are low, the average diet is likely to be of low bioavailability, and for many people the supply probably does not reach even the minimum average requirement. Hence higher trend of anemia is expected in this region. Their two strategies used in controlling iron deficiency are through dietary improvement and by food supplementation and fortification.<sup>26</sup>

Iron supplementation should start in one month of age for pre-term babies fed with human milk and from four months for term exclusive breast fed babies and iron fortification to be given to non-breast fed babies. Universal screening for anemia should be performed at approximately 12 months of age with determination of Hb concentration.<sup>27</sup> Menstruating adult women and adolescent girls (non-pregnant females in the reproductive age of group) should be given 30–60 mg elemental iron (150–300 mg of ferrous sulfate heptahydrate, 90–180 mg of ferrous fumarate or 250–500 mg of ferrous gluconate) daily for three consecutive month in a year. All women, from the moment they begin trying to conceive until 12 weeks of gestation, should take a folic acid supplement. Daily oral iron and folic acid supplementation should be part of routine antenatal



care, begun as early as possible and continued throughout pregnancy.<sup>28</sup>

As per sustainable development goals, by 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons.<sup>29</sup> Regions with high anemia prevalence tended to have higher mean severity of anemia and a higher proportion of their anemia burden due to infectious and iron-related etiologies.<sup>30</sup> The regional strategy on nutrition 2010–2019 is the first nutrition strategy to be developed in the Eastern Mediterranean (EM) Region. Prevalence of iron deficiency anemia among preschool-aged and school-aged children, women of reproductive age women and the elderly reduced by 30% is fixed as a target.<sup>31</sup>

### Limitations of this study

Samples were taken from the hospital laboratory but considering the major public sector laboratory offering in the locality apart from few private laboratories, the prevalence can be considered for generalizability. We have considered only 2 months data for analysis due to non-availability of digital version of data. Another limitation for the data was it not able to consider age range, elderly or pregnancy status because of non-availability of data at the lab.

### CONCLUSION

The prevalence of anemia in the region was 48.73% which was clearly states the burden in Tayma, Saudi Arabia. The study also guides us to improve our nutritional health education, periodic screening of anemia, iron and folic acid supplementation and management with proper follow-up. It needs integrated interventions and support from different level to improve people's nutritional status. A detailed country wide study in the Kingdom using different age groups, special population like pregnant women, having kidney diseases and other chronic diseases and types of anemia can be undertaken to understand the actual burden in the community and needed interventions.

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