

## Prevalence of Anemia among Preschool Age Children

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**Objective:** To evaluate the prevalence of anemia in general and microcytic hypochromic anemia among preschool-age children.

**Design:** A Retrospective Cohort Study.

**Setting:** Three government hospitals and two private hospitals, Abha and Khamis Mushait, Kingdom of Saudi Arabia.

**Method:** The study population included all children aged 6 months to 59 months seen in the emergency room (ER) and had a complete blood count. Hemoglobin level (Hb), mean corpuscular volume (MCV) and mean corpuscular hemoglobin (MCH) were estimated.

**Result:** The study included 2,415 children aged 6 to 59 months with a mean of 29.7 and a standard deviation of  $\pm 17.9$  months. More than half of them were males, 1,446 (59.9%), and the majority were Saudis, 1,921 (79.5%). The prevalence of anemia was 26.4%; mostly mild, 387 (16%), or moderate, 232 (9.6%). Severe anemia was found in 19 (0.8%) children. Microcytic hypochromic anemia was found in 679 (26.9%).

**Conclusion:** Anemia is still a public health problem among preschool children in Southwest Saudi Arabia, despite the improvement in socio-economic status. Further research is recommended to evaluate the underlying factors, particularly nutritional habits.

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WHO report (1993-2005) revealed that children of preschool age represent 47.4% of anemic patients worldwide, which represents a major public health problem all over the world and in particular developing countries<sup>1-3</sup>.

The most common cause of anemia is nutritional, due to deficiency of micronutrients such as iron, folate, vitamin B12, and protein<sup>4</sup>.

Preschoolers have the highest risks of anemia as a result of their physiological vulnerability and liability to infection<sup>2</sup>. Iron deficiency is the main type of anemia among preschoolers and is primarily due to the increased iron requirement as they grow<sup>5-6</sup>. Moreover, iron is likely to be inadequate in children's diets, particularly if parents were unaware<sup>2,7</sup>. Anemia affects cognitive development, physical growth, immunity and school performance<sup>8-9</sup>.

The aim of this study is to determine the prevalence of anemia and microcytic hypochromic anemia among preschoolers and to compare the prevalence according to age, gender and nationality.

### METHOD

The study included all children aged 6 to 59 months seen in the emergency room (ER) from 1 January 2017 to 31 December 2017 and had a complete blood count. Patients with sickle cell anemia, thalassemia, those with acute blood loss or hemolysis, chronic diseases, such as chronic kidney, liver diseases or chronic cyanosis were excluded.

Data on child age, sex and area of living, personal data and diagnosis were documented. Hemoglobin level (Hb), mean corpuscular volume (MCV) and mean corpuscular hemoglobin (MCH) were evaluated. Hb of patients from the high altitude area was subtracted by 0.8 mg as per WHO recommendation<sup>10</sup>.

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Normal values for Hb was  $\geq 11$  gm/dl (-0.8); 10-10.9 gm/dl was considered as mild anemia, 9.9- 7 gm/dl was considered moderate anemia and  $<7$  gm/dl was regarded as severe anemia. MCV low level was defined as the following: 6-23 months  $<70$ , 24-48 months  $<73$  and 49-59 months  $<75$ . MCH low level was defined as the following: 6-23 months  $<24$  and 24-59 months  $<25$ <sup>10</sup>. Using the WHO manual for sample size calculation in health sciences, with an estimate of 50% of anemia absolute required the precision of 2% and 95% confidence interval, the calculated minimal sample size was 2,401 children<sup>11</sup>.

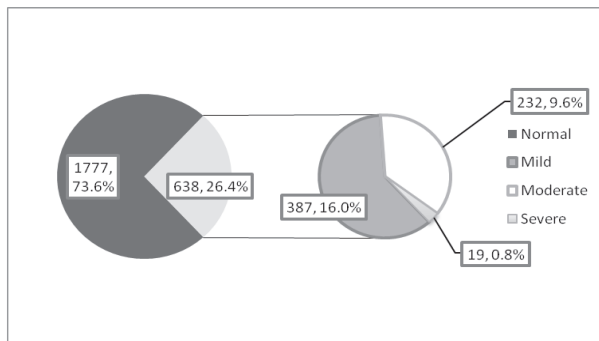
**RESULT**

The study included 2,415 children aged 6 to 59 months with a mean of 29.7 and a standard deviation of  $\pm 17.9$  months. One thousand two hundred fifty-three (51.9%) were aged 6 to 24 months. Table 1 summarizes other personal characteristics. One thousand four hundred forty-six (59.9%) were males and 1,921 (79.5%) were Saudis.

**Table 1: Personal Characteristics of the Participants**

| Variables            | Frequency    | Percentage |
|----------------------|--------------|------------|
| <b>Age in months</b> |              |            |
| 6-24                 | 1,253        | 51.9       |
| 25-48                | 779          | 32.3       |
| >48                  | 383          | 15.8       |
| <b>Total</b>         | <b>2,415</b> | <b>100</b> |
| <b>Gender</b>        |              |            |
| Males                | 1,446        | 59.9       |
| Females              | 969          | 40.1       |
| <b>Total</b>         | <b>2,415</b> | <b>100</b> |
| <b>Nationality</b>   |              |            |
| Saudi                | 1,921        | 79.5       |
| Non-Saudi            | 494          | 20.5       |
| <b>Total</b>         | <b>2,415</b> | <b>100</b> |

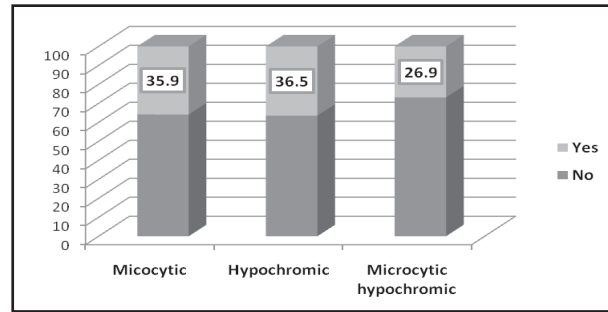
The prevalence of anemia was 26.4%; most were mild, 387 (16%) and moderate, 232 (9.6%). Severe anemia was found in 19 (0.8%) children, see figure 1.



**Figure 1: Anemia among Children 6-59 months of Southwestern Saudi Arabia**

Microcytic hypochromic anemia was seen in 679 (26.9%), based on the WHO cut off levels of MCV and MCH, see figure 2.

Moderate anemia among children aged 6 to 24 months was reported in 147/1,253 (11.7%) compared to 26/383 (6.8%) among those aged over 48 months. Severe anemia in children aged 25-48 months was reported in 9/779 (1.2%) compared



**Figure 2: Microcytic Hypochromic Anemia among Children 6-59 Months**

to 6/1,253 (0.5%) in aged 6-24 months, P-value $<0.001$ . There was no significant association between anemia and its severity and children gender and nationality, see table 2.

**Table 2: Personal Factors Associated with Anemia the Severity in Children 6-59 Months**

|                      | Anemia*                |                        |                            |                         | $\chi^2$<br>(p-value) |
|----------------------|------------------------|------------------------|----------------------------|-------------------------|-----------------------|
|                      | No<br>N=1,777<br>N (%) | Mild<br>N=387<br>N (%) | Moderate<br>N=232<br>N (%) | Severe<br>N=19<br>N (%) |                       |
| <b>Age in months</b> |                        |                        |                            |                         |                       |
| 6-24 (n=1,253)       | 874 (69.8%)            | 226 (18.0%)            | 147 (11.7%)                | 6 (0.5%)                | 32.75<br>( $<0.001$ ) |
| 25-48 (n=779)        | 590 (75.7%)            | 121 (15.5%)            | 59 (7.6%)                  | 9 (1.2%)                |                       |
| >48 (n=383)          | 313 (81.7%)            | 40 (10.4%)             | 26 (6.8%)                  | 4 (1.0%)                |                       |
| <b>Total</b>         | <b>2,415</b>           |                        |                            |                         |                       |
| <b>Gender</b>        |                        |                        |                            |                         |                       |
| Males (n=1446)       | 1059 (73.2%)           | 227 (15.7%)            | 149 (10.3%)                | 11 (0.8%)               | 2.16<br>(0.541)       |
| Females (n=969)      | 718 (74.1%)            | 160 (16.5%)            | 83 (8.6%)                  | 8 (0.8%)                |                       |
| <b>Total</b>         | <b>2,415</b>           |                        |                            |                         |                       |
| <b>Nationality</b>   |                        |                        |                            |                         |                       |
| Saudi (n=1921)       | 1396 (72.7%)           | 324 (16.9%)            | 188 (9.8%)                 | 13 (0.7%)               | 6.97<br>(0.073)       |
| Non-Saudi (494)      | 381 (77.1%)            | 63 (12.8%)             | 44 (8.9%)                  | 6 (1.2%)                |                       |
| <b>Total</b>         | <b>2,415</b>           |                        |                            |                         |                       |

\*Based on WHO hemoglobin concentration cut off levels

**Table 3: Personal Characteristics Factors associated with Microcytic Hypochromic Anemia among Children 6-59 Months**

|                      | Microcytic hypochromic anemia* |                       | $\chi^2$<br>(p-value) |
|----------------------|--------------------------------|-----------------------|-----------------------|
|                      | No<br>N=1,777<br>N (%)         | Yes<br>N=638<br>N (%) |                       |
| <b>Age in months</b> |                                |                       |                       |
| 6-24 (n=1253)        | 954 (76.1)                     | 299 (23.9)            | 12.58<br>(0.002)      |
| 25-48 (n=779)        | 539 (69.2)                     | 240 (30.8)            |                       |
| >48 (n=383)          | 273 (71.3)                     | 110 (28.7)            |                       |
| <b>Total</b>         | <b>2,415</b>                   |                       |                       |
| <b>Gender</b>        |                                |                       |                       |
| Males (n=1446)       | 1437 (74.8)                    | 484 (25.2)            | 13.64<br>( $<0.001$ ) |
| Females (n=969)      | 329 (66.6)                     | 165 (33.4)            |                       |
| <b>Total</b>         | <b>2,415</b>                   |                       |                       |
| <b>Nationality</b>   |                                |                       |                       |
| Saudi (n=1921)       | 1035 (71.6)                    | 411 (28.4)            | 4.40<br>(0.036)       |
| Non-Saudi (494)      | 731 (75.4)                     | 238 (24.6)            |                       |
| <b>Total</b>         | <b>2,415</b>                   |                       |                       |

\*Based on WHO MCV and MCH cut off levels

Microcytic hypochromic anemia among children aged 25-48 months was reported in 240/779 (30.8%) compared to 299/1,253 (23.9%) aged 6-24 months, P=0.002. It was more significantly reported among female than male children, 165 (33.4%) versus 484 (25.2%), P $<0.001$ . Similarly, it was more

significantly reported among Saudi compared to non-Saudi children, 411 (28.4%) versus 238 (24.6%),  $P=0.036$ , table 3. MCV result was summarized in table 4.

**Table 4: Results of MCV for Different Age Group**

|                       | Number | %     |
|-----------------------|--------|-------|
| <b>6 – 23 Months</b>  |        |       |
| Less than 70          | 586    | 24.4  |
| 70 and higher         | 1846   | 75.6  |
| Total                 | 2,442  | 100.0 |
| <b>24 – 48 Months</b> |        |       |
| Less than 73          | 986    | 40.4  |
| 73 and higher         | 1456   | 59.6  |
| Total                 | 2442   | 100.0 |
| <b>49 – 60 Months</b> |        |       |
| Less than 75          | 1340   | 54.9  |
| 75 and higher         | 1102   | 45.1  |
| Total                 | 2442   | 100.0 |

Data entry and statistical analysis were performed utilizing the SSPS version 22. Chi-square test was applied to test for the association between anemia and its related factors (age, gender and nationality). A P-value of less than 0.05 was considered significant.

## DISCUSSION

Relatively, few studies have been performed in Saudi Arabia regarding the epidemiology of anemia among children<sup>1,12</sup>.

In the present study, the prevalence of anemia was 26.4%; the majority were mild (16%) or moderate (9.6%). Severe anemia was found in 0.8%. In a study from Gaza, the prevalence of anemia was 59.7%, and 40% of them were severe<sup>13</sup>. They attributed the high rate to the high prevalence of malnutrition among children as a result of increasing unemployment and poverty. In Sudan, a very high prevalence of anemia was reported (80.4%) in a rural community<sup>14</sup>. Similarly, very high rates (70-80%) were reported in other studies<sup>15-20</sup>. On the other hand, the prevalence of anemia among preschoolers in the United States of America was only 16%<sup>1</sup>.

This difference between countries in the prevalence of anemia among children could be attributed to the variation in the characteristics of the study population, particularly age range as well as variation in the socio-economic status, as it is documented that the prevalence of anemia increases with increasing poverty<sup>21</sup>.

In this study, microcytic hypochromic anemia was found in 26.9%. It may be due to a defect in heme or globin synthesis. Among children, the differential diagnosis of hypochromic anemia is generally limited to one of four diagnoses: iron deficiency, lead poisoning, thalassemia, and anemia of inflammation<sup>22</sup>. Iron deficiency anemia is the most common nutritional deficiency in the world as WHO indicated that up to 80% of the world's population is iron deficient and 30% are anemic as a consequence of iron deficiency<sup>1</sup>. In a similar study, microcytic hypochromic anemia was detected in 37.5 % of the children under five years<sup>20</sup>.

In the present study, the age of children was significantly associated with the prevalence of anemia as anemia, in general, was highest among children aged between 6 and 24 months whereas severe anemia was highest among those aged between 25 and 48 months. In a study, age also was a significant predictor

of anemia<sup>13</sup>. An association between age and hemoglobin level was observed in another study<sup>23</sup>.

In this study, microcytic hypochromic anemia was more significantly found in female than male children. This finding is dissimilar to some studies<sup>13,24</sup>. This finding needs further detailed analysis of the pattern of feeding of those children.

The most important limitation of this study is its cross-sectional design that did not determine exactly the impact of risk factors of anemia. Another important limitation is the inclusion of possible risk factors, particularly nutritional and infections.

## CONCLUSION

**Anemia is still a public health problem among preschoolers in Saudi Arabia despite the improvement in socio-economic status. Further research is recommended to evaluate the underlying factors, particularly nutritional habits.**

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**Competing Interest:** None.

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