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Prevalence of Anaemia and Associated Risk Factors among Children Under Five Years in Hohoe Municipality, Ghana

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Authors' contributions

This work was carried out in collaboration among all authors. Authors PAP and MK conceived the study. Authors PAP, MK, WT and GKD performed the statistical analysis and wrote the methods section. Authors PAP, MK, GKD, EA, MT and ET were responsible for the initial draft of the manuscript. Author ET critically reviewed the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Background: The global estimate of anaemia in children indicates that 293.1 million children under five years (43%) are anaemic, of whom 28.5% are residing in sub-Saharan Africa (SSA). This study was set out to determine the prevalence of anaemia and its associated risk factors among children under five in Hohoe municipality, Ghana.
Methods: A descriptive cross-sectional study was carried in March 2016 at various Child Welfare Clinics (CWCs) using convenient and systematic sampling methods. Interviews with semi-structured questionnaires were used to obtain information on demographic, socio-economic, dietary and feeding practices of the children. Axillary temperature was measured using electronic

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thermometer and anthropometric measurements were done using bathroom weighing scale and Infantometer. Finger-prick blood samples were collected for blood film for malaria parasites, and haemoglobin level was measured using an automated Haemocue. Binary logistic regression was used to identify associated factors, odds ratio was used to access the strength of the association and t-test was used for means.

Results: A total of 400 children were sampled from ten CWCs**.** Insecticide Treated Net (ITN) usage was high, 69.0%; SP-IPTp and iron supplements coverage among pregnant women was very high, 83.5% and 86.8% respectively. The overall prevalence of anaemia **(**Hb <11.0 g/dl) was 47.5 %, anaemia requiring treatment (Hb <8.0 g/dl) was 10.0% with mean haemoglobin of 10.64 ±2.29. Children aged 24-35, 36-47 and 48-59 are less likely to have anaemia [OR=0.39(95% CI: 0.19-0.80); p=0.011], [OR=0.21(95% CI: 0.09-0.45); p<0.001] and [OR=0.29(95% CI: 0.14-0.58); p<0.001] respectively. Children with malaria parasitaemia were 7.8 times more likely to develop anaemia [OR=3.8(95% CI: 1.12-2.97); p=0.027].

Conclusion: Anaemia prevalence among children less than five years in the Hohoe municipality was lower than that of the national surveys. The presence of malaria parasitaemia could result in anaemia. Clearing malaria parasites from the blood, and use of SP-IPTp and iron supplements by mothers during pregnancy could reduce anaemia in children under five.

Keywords: Anaemia prevalence; malaria parasitaemia; child welfare clinic; Hohoe municipality; Ghana.

1. BACKGROUND

Anaemia is defined as a decrease in the concentration of circulatory red blood cells or in the haemoglobin concentration, which impairs oxygen transport [1], and it is the second leading cause of nutritional disability [2]. In both developing and developed countries, the most prevalent nutritional disorder is iron-deficiency anaemia.

The World Health Organisation (WHO) has estimated that approximately 1.6 billion people (i.e. one fourth of the world's population have anaemia [3]. The global estimate of anaemia among children indicates that 293.1 million children under five years (approximately 43%) are anaemic, and 28.5% of these children are residing in sub-Saharan Africa (SSA) (Mclean et al., 2008). One in four people are affected by anaemia worldwide, with pregnant women and preschool-age children having the greatest risk [3]. There is also increased risk of morbidity and mortality from mild and moderate anaemia as well as infectious diseases, [2,4].

Low content of iron in diet and malaria are commonly known to be associated with anaemia [5]. The other commonly known factors to be associated with anaemia include parasitic infections (hookworm and tapeworm), acute or chronic inflammations, inherited or acquired disorders that affect haemoglobin synthesis, red blood cell production or red blood cell survival and nutritional deficiencies. Socio-economic factors may also affect the risk of anaemia by affecting the nutritional status, family size and birth interval, as well as intensifying problems of affordability and accessibility of preventive and curative measures [6]. Other factors such as early weaning, poor health of pregnant women, unsafe drinking water, inadequate hygiene and sanitary conditions, and poverty may contribute to the development of anaemia [7].

Common symptoms of anaemia in children include dizziness, fatigue and body tension, general body weakness, loss of appetite, low body weight, paleness of the skin, eyes and palms, and under severe conditions, unconsciousness and finally death. Anaemia in children is of particular interest since it impairs their mental, physical and social development; it causes low immunity, negative behavioural and cognitive effects, resulting in poor performance at school and later at working environment in life, thereby reducing earning potentials and damaging national economic growth [5].

According to the under five child health policy 2007-2015, the primary approach for preventing anaemia in children in Ghana is to promote diet adequate in iron, regular deworming and prompt treatment of malaria. This child health program is to promote the survival, growth and development of all children in Ghana. Anaemia in mothers can be a risk factor for anaemia in the child. Therefore, in Ghana the policy for antenatal care (ANC), deliveries and postnatal care (PNC) services are free of charge. Pregnant women are

encouraged to attend ANC, receive supervised deliveries and PNC. Throughout the ANC period, pregnant women are tested for haemoglobin levels and malaria. Women found to have anaemia and malaria are treated. Pregnant women are given long lasting insecticide treated nets (LLIN), folic acid and iron supplements. SP for intermittent preventive treatment in pregnancy (SP-IPTp) is also given every four weeks starting from 20 weeks up to 36 weeks gestation. Reports have shown that ANC (4+) visits was 87.3% and in Volta Region 77.3%. Postnatal care coverage in Ghana was 78.2% and in Volta Region 67.2% [8].

Despite the above efforts, there is still high prevalence of anaemia in children under five years. In Volta Region, the prevalence of anaemia among children below five was 69.9% [8]. Studies have shown that mothers aged below 20 years, mothers with anaemia during pregnancy, children (below 24 months of age) with recent episodes of diarrhoea are some of the risk factors associated with childhood anaemia [7].

It has also been shown that there is a relationship between anaemia and the following: maternal education, mothers with children less than five years, maternal age and maternal anaemia during pregnancy [9]. Childhood anaemia has been reported to be more prevalent in children below the age of 24 months [7,9].

Studies in Burma have found that childhood anaemia was more prevalent in males than females [10]. Reports have shown that risk factors associated with anaemia include children from families with lower income, children drinking from spring and river water, complementary feeding for children older than 8 months and mother's educational levels as well as positive malaria parasites in the blood [5]. In Tanzania it was also found that malaria parasitaemia, presence of haemoglobin S and unemployment were associated with anaemia among children below five years [11].

A report from Ghana indicates that the prevalence of anaemia in urban areas was much lower as compared to that in the rural areas, and that children between 6 to 11 months and from low income households were most affected [8].

Other reports have shown that, poor economic status, mothers with low educational level, malaria prone environment are factors associated with anaemia [6,12]. This study therefore reports on the prevalence of anaemia and associated risk factors among children under five years in Hohoe Municipality.

2. METHODS

2.1 Study Site

The study area is Hohoe municipality, which is one of the twenty-five administrative districts of the Volta Region. The municipality is located in the central part of the region with a total land surface area of 1,172 km square. The municipality consist of 102 communities with a total population of 167,016 people (projected from 2010 population census). It is located within longitude 0 degree 15 East and 0 degree 45 East and latitude 6 degrees 45 North and 7 degrees 15 North and lies almost in the heart of the Volta Region. It is bounded by Jasikan District to the North, Northwest by Biakoya District, South by Afadjato South District, West and South West by Kpando Municipality and East by the Republic of Togo. There are two main seasons, the wet and dry seasons. The major wet season lasts from April to July and the minor one from September to November. The rest of the year is relatively dry. The average recorded annual rainfall in the district is 1,592 mm with approximately 1,296 mm rain falling between April and October. Malaria is hyper endemic but with seasonal peaks. The Municipality has been divided into seven (7) Health Sub-municipalities namely: Akpafu/Santrokofi, Alavanyo, Agumatsa, Lolobi, Gbi-Rural, Hohoe-sub and Likpe. Hohoe Municipality has a total of Twenty-one (21) health facilities including Municipal Hospital (1) Health centres (14) and CHPS compounds (5). There are 57 EPI outreach clinics.

2.1.1 Study population

The population of the study included children between ages of 6 and 59 months and their mothers attending the selected Child Welfare Clinics (CWCs) who were eligible, and the mothers consented to participate.

2.2 Study Design

A descriptive cross-sectional study was carried out in March 2016 involving 400 children under five years. Data were collected in the form of face-to-face interviewer administered questionnaires using semi structured

questionnaires and collection of biological samples. It involved asking mothers of the children questions and collecting finger-prick blood from the children for analysis. During the survey, temperature and weight were measured and a fingerpick blood sample collected for determination of malaria parasitaemia and haemoglobin (Hb) levels. Information was obtained on ITN ownership and usage. Information was also collected on child breast-feeding practices, and on where mothers delivered their children, whether they attended ANC and whether they received IPTp and iron supplements, as well as their haemoglobin concentration measurement during pregnancy.

2.3 Sampling and Sample Size Determination

A descriptive cross-sectional study was carried out in March 2016 involving 400 children under five years.

2.3.1 Sample size determination

The sample size was calculated using the formula by Degu and Tessema [13]. Reliability co-efficient (z score) of 1.96 at 95% confidence level, margin of error (e) of 5 prevalence of anaemia in children under five in the urban areas (p) of 57.3% [8] were substituted into the formula to determine a minimum sample size of 376. Adjusting for non-response rate of 5% gives the total sample size of 395, which was approximated to 400 children aged 6 to 59 months.

2.3.2 Sampling method

2.3.2.1 Selection of child welfare clinics and study participants

A sampling frame of all the Child Welfare Clinics within the municipality was obtained. A simple random sampling method was used to select 10 Child Welfare Clinics (CWC) which were located within three sub municipalities namely Lipke, Lolobi and Hohoe. The participants were proportionately distributed to the CWC based on 2015 clinic attendants. A probability (simple random) sampling technique was used for the selection of participants in each clinic. The balloting method specifically, non-replacement type was used. With this, the expected number of children under-five (participants) needed for each clinic was estimated. This was done by counting the number of under-five children that reported at the CWC in the same period of the previous year (2015) for each clinic. Once the sampling frame for each clinic was obtained and the number of respondents to be interviewed for each clinic known, ‘‘yes’’ and ‘‘no’’ was written on pieces of papers and then folded. The number of ‘‘yes’’ was equal to the number of respondents required per clinic and the number of ‘‘no’’ was equal to the number remaining after subtracting the required number of children from the total number for each clinic. Parents of all children who were eligible, randomly picked one paper. Those who picked ‘‘yes’’ and consented were interviewed. In a situation where the number of children were less than or equal to the number of children required, all those who visited the CWC were enrolled and interviewed.

2.4 Data Collection

Pre-tested semi-structured questionnaires were used to collect the data. The questionnaires were administered to mothers of eligible children below five years immediately after they have completed the CWC activities and were exiting the clinic. The exit interview was conducted in a convenient and conducive place, in English language, and in Ewe for respondents who did not understand or speak English.

Mothers were asked where they delivered the child, whether they attended ANC and if they received IPTp and iron supplements, whether their haemoglobin concentration was measured and the outcome. Information was obtained on the demographic characteristics, socio-economic status, and child feeding practices, morbidity and health characteristics and dietary diversity in children under five years. The Seca hanging scale and the bathroom scale were used for the weight measurement. The Stadiometer and Infantometer were used for the height and length measurement respectively. A tape was used for Mid Upper Arm Circumference (MUAC) measurement. An electronic thermometer was used to measure the temperature. Finger-prick blood was used to measure haemoglobin level and malaria parasitaemia. An automated URIT-12 Hemoglobin Meter (URIT Medical Electronic Co., Ltd, UK) was used to measure haemoglobin level.

2.5 Laboratory Procedure

2.5.1 Malaria blood films

The blood films were stained with 3% Giemsa for 25 minutes and used for identification and

quantification of malaria parasites. The prepared slides were examined under oil immersion with a light microscope (ocular magnification x 100). The thick films were used for quantifying malaria parasites while the thin films were used for identifying the malaria species. Parasite densities were estimated by counting the number of parasites per 200 white blood cells (WBCs) in a thick film by two Microscopists.

A sample was considered negative only if no parasites were found after 200 high power fields had been read. Parasite counts were converted to parasites per micro liter (ml), assuming a white blood cell count of 8000 leukocytes per ml of blood. If there was a discrepancy in the findings in a slide between the two initial technicians (positive or negative or a 50% or more difference in parasite density), a third more senior Microscopist read the slide and his reading was deemed to be correct. A senior Microscopist from the University of Health and Allied Science UHAS, Ghana) examined all the positive blood films and a 20% random sample of negative blood slides for quality control.

2.5.2 Haemoglobin

Haemoglobin was measured using URIT-12 Hemoglobin Meter (URIT Medical Electronic Co., Ltd, UK). This system consists of a battery-operated photometer and a disposable microcuvette coated with a dried reagent that serves as the blood collection device. Finger-prick blood samples were collected from all study subjects for measurement of Hb concentration. For the test, a drop of capillary blood from finger-prick was drawn into the microcuvette. The blood in the microcuvette was analysed using the photometer, which displays the haemoglobin concentration.

2.5.3 Measurement of dietary diversity score

Dietary diversity scores of a child were determined by using WHO and "indicators for assessing infant and young child feeding practices" minimum dietary diversity for children age 6–59 months and by employing 24 hour recall method. Mothers or female caretakers were asked to report all food items and beverages given to the child during the previous day of the survey. Then, all food items and beverages consumed by the child were categorized into seven food groups as (1) grains, roots, and tubers, (2) legumes and nuts, (3) dairy products, (4) flesh foods, (5) eggs, (6) vitamin-A rich fruits and vegetables, and (7) other fruits and vegetables [14]. Using dietary diversity score 4 (minimum dietary diversity score) as cut-off point, a child was defined as having "poor dietary diversity" if he/she consumed less than 4 food groups while having "good dietary diversity" if he/she had 4 or more food groups.

2.6 Statistical Analysis

After entry, data were cleaned and validated to ensure quality before they were analysed. Data were entered in Epi Data software. Cleaned was then exported to Stata version for analysis. Simple frequency and percentages were used to determine the prevalence of categorical variables and t test was used for means. Binary logistic regressions (CI of 95% and p-value) were used to determine the association between anaemia (dependent) and independent variables. Statistical significance was considered based on p-value <0.05. Dietary diversity was classified into good and poor had good dietary diversity (consumed 4 or more food items from the categorized food groups).

2.7 Ethical Issues

Ethical approval for the study was sought from the Ghana Health Service Ethical Review committee with approval number GHS-ERC: 02/2016. In addition, permission was obtained from the Hohoe Municipal Health Directorate. The risks and benefits and the right to participate or not were explained to mothers\caregivers of the child before a written informed consent was obtained. Also, participants were also made to understand that, participation was voluntary and can decide not to participate any more with any harm. The respondents were assured that the findings from the study and its dissemination would not have their names or any information that can be used to trace them. By this, confidentiality was assured. Special codes were assigned to the participants; this was to ensure that individuals were not identified by their names.

3. RESULTS

3.1 Background Characteristics of Children

The results are based on the analysis of data from 400 children aged 6 to 59 months with mean age of 34.9±1.07, from ten CWCs. Of the

total of 400 children surveyed, 201(50.3%) were males. Approximately a quarter (27%) of the children were delivered at home while the rest 73% were delivered at a health facility. Sixty nine percent (69.0%) of the children slept under insecticide treated nets the night before the survey. The mean MUAC of the children was 14.28 ±1.48 and majority (94.0%) of the children had normal MUAC. Of the 400 children surveyed, 7.0% were stunted, 14.0% were wasted and 26.0% were underweight (Table 1).

Table 1. Background characteristics of children (N=400)

Characteristics	Frequency n (%)
Mean age (SD)	34.9(1.07)
Age (Months)	
6- 11	61(15.3)
12-23	79 (19.8)
24-35	83 (20.6)
36-47	74(18.5)
48-59	103 (25.8)
Gender	
Male	201(50.3)
Female	199 (49.7)
Place of delivery	
Health facility	292 (73.0)
Home	108 (27.0)
ITN usage	
Yes	276 (69.0
No	124 (31.0)
MUAC (cm)	
Mean(SD	14.28(1.84)
<11.5	6 (1.5)
11.5-12.5	18 (4.5)
12.6-18.4	376 (94.0)
Length-for-age	
Stunted (<-2-Z-score)	28 (7.0)
Normal (>-2-Z-score)	372 (93.0)
Weight-for-height	
Wasted (<-2-Z-score)	56 (14.0)
Normal (>-2-Z-score)	344 (86.0)
Weight-for-age	
Underweight (<-2-Z-score)	104 (26.0)
Normal (>-2-Z-score)	296 (74.0)

3.2 Background Characteristics of Mothers

The mean age of mothers of the children was 27.9±9.67. Most mothers were aged between 17 and 27 (45.5%), followed by 28 and 38 (44.5%). Only few were aged between 39 and 49 (9.0%), and between 50 and 60 (1.0%). Majority (83.1%) of the mothers were married, 13.5% were single while 5.3% were divorced. Most, (83.7%) were Christians, while (15.5%) were Muslims and (0.75%) were practicing traditional religion. Number of children of mothers of the children ranged between 1 and 5 or more. Only 18.2% of the mothers had one child, 27.2% had two, 21.6% had three, 15.5% had four and 17.5% had five and above children.

More than half of the mothers (57.0%) had Primary/JHS education, followed by those with Secondary education (21.5%), and only 5.0% had tertiary education; while the rest (16.5%) did not have any formal education. Unemployment was very high, 81.0% with only 19.0% of the mothers in gainful employment. Approximately a third (32.3%) of the mothers suffered from anaemia during pregnancy. Coverage of Sulphadoxine Pyrimethamine (SP) for prevention of malaria in pregnancy (SP-IPTp) and iron supplementation during pregnancy at Antenatal Clinic (ANC) were high, 83.5% and 86.8% respectively (Table 2).

3.3 Prevalence of Anaemia, Malaria and Fever among Children between 6 and 59 Months

Table 3 shows that the mean Hb was 10.6± 2.29, and the prevalence of anaemia (Hb <11.0 g/dl) was 47.5%. Of the 400 children enrolled, 150 (37.5) had mild anaemia (8.0-10.9), 40 (10.0%) had anaemia, which required treatment (Hb<8.0 g/dl) out of which 31(7.8) had moderate anaemia (5.0-7.9), 9 (2.3%) had severe anaemia and were referred to the hospital for treatment.

Prevalence of anaemia (Hb<11.0 g/dl) was higher in children between 6 and 11 months and between 12 and 23 months, (10.5%) and (12.8%) respectively, compared to children aged 24 months and above (Table 3).

Prevalence of malaria parasitaemia by microscopy among the children was 22 (5.5%). Twenty-four 24 (6.0%) had fever (Temperature ≥37.5℃) as shown in Table 3.

3.4 Feeding Practices and Dietary Diversity of Mothers

3.4.1 Exclusive breast-feeding and complementary feeding

Feeding practices of mothers were explored and it was found that majority of the mothers, (84.5%)

initiated their babies to the breast milk within one hour after birth. Only 230 (57.5%) of mothers answered they practiced exclusive breastfeeding (breast milk only without water for six months). Approximately, a third of mothers (31.5%) answered they started complementary feeding before six months while 68.5% did not. Half (50.3%) of the mothers bottle-fed their children within the first six months (Table 4).

Table 2. Background characteristics of mother N=400

Characteristics	Frequency n (%)
Mean age (SD)	**27.9(9.67)**
Age group	
17-27	182 (45.5)
28-38	178 (44.5)
39-49	36 (9.0)
50-60	4(1.0)
Marital status	
Single	54 (13.5)
Married	325 (81.3)
Divorced	21 (5.3
Religion	
Christianity	335 (83.7)
Islam	62 (15.5)
Traditional	3 (0.8)
Number of children	
1	72 (18.2)
2	107 (27.2)
3	85 (21.6)
4	61 (15.5)
5 and above	69 (17.5)
Educational level	
No formal education	66 (16.5)
Primary education/ JHS	228 (57.0)
Secondary education	86 (21.5)
Tertiary education	20 (5.0)
Employment status	
Employed	76 (19.0)
Unemployed	324 (81.0
Iron supplementation during pregnancy	
Yes	347 (86.8)
No	47 (11.8)
Don't know	6 (1.5)

3.4.2 Dietary diversity

Table 4 shows that only 70 (17.5%) of 400 children had good dietary diversity (consumed 4 or more food items from the categorized food groups). Majority of children (82.5%) had poor dietary diversity by consuming less than 3 food items from the categorized food groups.

Table 3. Prevalence of Anaemia, Malaria and Fever in Children 6 to 59 months (N=400)

Anaemia status	Frequency N (%)
Anaemia (Hb <11.0 g/dl)	190 (47.5)
No anaemia	210 (52.5)
Anemia by Age groups	
6-11	42 (10.5)
12-23	51 (12.8)
24-35	36 (9.0)
36-47	22 (5.5)
48-59	39 (9.7)
Haemoglobin level (Hb) (g/dl)	
Mean Hb (SD)	10.6 (2.29)
Anaemia (Hb <8.0 g/dl)	40 (10.0)
Severe anaemia (<5.0)	9 (2.3)
Moderate anaemia (5.0-7.9)	31(7.8)
Mild anaemia (8.0-10.9)	150 (37.5)
Normal (≥11.0)	210 (52.5)
Malaria parasitaemia	
Positive	22 (5.5)
Negative	378 (94.5)
Axillary temperature (℃)	
Mean(SD)	35.9(2.08)
Normal (<37.5℃)	376 (94.0)
Fever (≥37.5℃)	24 (6.0)

3.5 Socio-economic Status of Mothers

The parents/guardians were asked about their educational background and whether they owned a television set, refrigerator, cellular phone, motorbike or bicycle. The scoring ranged between 0 and 4 depending on the number of assets owned by the respondents. Ownership of an asset attracted a score of 1. For instance, one who owned a refrigerator and a cellular phone scored 2.

Educational level was also grouped into four categories: no education, primary education/ JHS, secondary and tertiary education with the scores 0, 1, 2, 3 and 4 respectively (Table 2). Respondents were scored low socio-economic status if they scored 0 to 3 and high socio-economic status with scores of 4 to 8. Majority of the respondents had low socioeconomic status with 75%,

Table 4. Feeding practices and dietary diversity of children

Feeding practices	Frequency (%)
Early initiation of breast milk	
Yes	338 (84.5)
No	62(15.5)
Exclusively breastfed	
Yes	230(57.5)
No	170 (42.5)
***Early complementary feeding (started before six months)**	
Yes	126 (31.5)
No	274 (68.5)
Child bottle fed	
Yes	201 (50.3)
No	199 (49.7)
Dietary diversity	
Good dietary diversity	70 (17.5)
Poor dietary diversity	330 (82.5)

**(started complementary feeding before six months)*

3.6 Binary Logistic Regression of the Effect of the Independent Variable of the Child on Anaemia Prevalence

Children aged 12 to 23 months, when compare to those aged 6 to 11 months were similar in terms of developing anaemia OR=0.84(95% CI: 0.40-1.75); p= 0.638]. Children with age between 24 and 35 months, 36 and 47 months and 48 and 59 months were less likely to develop anaemia compared to those aged 6 and 11 months, [OR=0.84(95% CI: 0.40-1.75); p=0.011], [OR=0.21(95% CI: 0.09-0.45); p<0.001)] and [OR=0.29 (95% CI: 0.14-0.58);p<0.001] respectively.

Developing anaemia was slightly lower among females compared to males but the difference was not statistically significant OR=0.67(95% CI: 0.44-1.03); p= 0.073]. Children who tested positive for malaria parasitaemia were 7.76 times more likely to develop anaemia when compared with those who tested negative [OR=7.76 (95% CI: 2.07-29.06); p=0.002]. Children who had fever were less likely to have anaemia compared to those with normal temperature [OR=0.29(95% CI: 0.10-0.87); p=0.028].

ITN usage, exclusively Breast-fed and Bottle-fed children were similar to those who did not practise these in developing anaemia OR=0.74(95% CI: 0.46-1.17) p=0.207] OR=1.07(95% CI: 0.62-1.87); p=0.793] and OR=0.94(95% CI: 0.58-1.52); p=0.810] respectively (Table 5).

3.7 Binary Logistic Regression of the Effect of the Independent Variables of the Mother on Anaemia Prevalence

From Table 6, when older age group was compared with the younger age group (17-27 years), there was no association between maternal age and anaemia; 28-38 years [OR=0.92(95% CI: 0.57-1.47)); p= 0.725], 39-49 years [OR=1.21(95% CI: 0.55-2.68); p=0.633]. There was no association between married and single women and the development of anaemia [OR=1.43(95% CI: 0.73-2.78); p=0.289]. Although children of divorced women were 1.86 times more likely to develop anaemia compared to single-mother children, the difference was not statistically significant. [OR=1.86 (0.61-5.66); p= 0.273].

There was also no association between number of children a parent had (2, 3 and 4 children) and anaemia when compared with one child [OR=0.55(95% CI: 0.28-1.08); p=0.154], [OR=0.49(95% CI: 0.24-1.00); p=0.051] and [OR=0.51(95% CI: 0.25-1.06); p=0.070] respectively. Low socio-economic status when compared with high was not associated with anaemia [OR=1.30(95% CI: 0.71-2.39); p=0.394] (Table 6).

Table 6 shows that there was an association between primary educational level attainment by a parent and anaemia when compared with no formal education [OR=0.57(95% CI: 0.33-0.98); p=0. 0.042]. However, there was no association between JHS and SHS educational level attainment by a parent and anaemia when compared with no formal education [OR=0.91(95% CI: 0.44-1.85); p=0.791] and [OR=0.67(95% CI: 0.31-1.46); p=0.316] respectively.

There was also no association between a parent employed and anaemia when compared with no employment [OR=0.58(95% CI: 0.33- 1.03); p=0.061].

4. DISCUSSION

The results of this study revealed that the prevalence of anaemia (Hb<11.0g/dl) was 47.5% with mean Hb (10.6±2.29). This was lower than what was reported by Ghana Demographic and Health Survey (GDHS) in 2014 for Volta Region

(66.9%) [8]. This could be due to district variations or the time the survey was carried out. This study also reported lower anaemia prevalence compared to what was reported by GDHS (2014) in Ghana (65.7%), and Volta Region 66.1% [8]. The difference in results may be as a result of geographical variations within the country where there is variation between urban 57.3% and rural 73.6%. The children in our study might have had good iron stores, which may be due to the mother's good iron status while pregnant and practice of exclusive breastfeeding for six months. Data from this study revealed that majority of the mothers visited antenatal clinic, took SP-IPTp and iron supplements while pregnant and this might have protected mothers from malaria infections and boosted the production of more red blood cells.

The results from this study showed a decline in the prevalence of anaemia 47% as compared to the prevalence of anaemia 66% for Volta region in the GDHS (2014) report [8]. This could be due to the introduction of ACTs and high utilization of ITNs, high coverage of iron supplementation and SP-IPTp during pregnancy and good practice of exclusive breastfeeding among children aged 6 to 59 months in Hohoe Municipality. Another reason could be due to the fact that, the data was collected in low transmission season (March) therefore, low prevalence of malaria may have contributed to the reduction in anaemia in the Hohoe municipality.

In our study, anaemia (Hb<8.0 g/dl) was 10.0%. This is similar to what GDHS (2014), 8.4% for Volta Region and 8.3% for Ghana (urban 4.1% and rural 12.2%) [8]. This finding is also similar to what was found in the study area in 2015 by Kweku (unpublished), which found between 8.9% and 11.1% among children under five years in the same study area. Most of the children were mildly anaemic (37.5%) (Hb 8-10.9 g/dl). Similar results were also reported in Cuba, which showed that most children had mild anaemia (Hb 10.0-10.9 g/dl) [15]. It was found in this study that anaemia was high among children of ages between 6 and 11, and12 and 23 months and that children aged 24 to 59 months were less likely to develop anaemia. This is similar to the findings from Cape Verde, West Africa where the prevalence was higher among children below 24 months [8]. Similarly, according to GDHS report (2014), the prevalence of anaemia in Volta

Table 5. Binary logistic regression of the effect of the independent variable of the child on anaemia

Independent variable	Anaemia status of children		OR (95% CI)	p-value
	Yes	No		
Age groups				
6-11	42(22.1)	19(9.1)		
12-23	51(26.8)	28(13.3)	0.84(0.40-1.75)	0.638
24-35	36(19.0)	47(22.4)	0.39(0.19-0.80)	0.011
36-47	22(11.6)	52(24.8)	0.21(0.09-0.45)	<0.001
48-59	39(20.5)	64(30.5)	0.29(0.14-0.58)	<0.001
Sex of child				
Male	108(56.8)	93(44.3)		
Female	82(43.2)	117(55.7)	0.67(0.44-1.03)	0.073
Malaria tested				
Negative	171(90.0)	207(98.6)		
Positive	19(10.0)	3(1.4)	7.76(2.07-29.06)	0.002
ITN usage				
Yes	136(71.6)	140(66.7)		
No	54(28.4)	70(33.3)	0.74(0.46-1.17)	0.207
Temperature (°C)				
Normal	184(96.8)	192(91.4)		
Fever	6(3.2)	18(8.6)	0.29(0.10-0.87)	0.028
Exclusively breastfed				
Yes	139(73.2)	151(71.9)		
No	51(26.8)	59(28.1)	1.07(0.62-1.87)	0.793
Bottle fed				
No	109(51.9)	101(48.1)		
Yes	92(48.4)	98(51.6)	0.94(0.58-1.52)	0.810

Table 6. Binary logistic regression of the effect of independent variable of the mother on anaemia

Independent variable	Anaemia status of children [N=400] n(%)		OR (95% CI)	p-value
	Yes	No		
Maternal age				
17-27	87(45.8)	95(45.2)		
28-38	80(42.1)	98(46.7)	0.92(0.57-1.47)	0.725
39-49	19(10.0)	17(8.1)	1.21(0.55-2.68)	0.633
50-60	4(2.1)	0(0.0)	1	
Marital status				
Single	24(12.6)	30(14.3)		
Married	154(81.1)	171(81.4)	1.43(0.73-2.78)	0.289
Divorced	12(6.3)	9(4.3)	1.86 (0.61-5.66)	0.273
Number of children				
1	40(21.4)	32(15.5)		
2	49(26.2)	58(28.0)	0.55(0.28-1.08)	0.084
3	35(18.7)	50(24.2)	0.49(0.24-1.00)	0.051
4 and above	63(33.7)	67(32.4)	0.51(0.25-1.06)	0.070
Socio economic				
High	51(26.8)	61(29.1)		
Low	139(73.2)	149(71.0)	1.30(0.71-2.39)	0.394
Educational level				
No formal education	48 (25.3)	38 (18.1)		
Primary education/ JHS	74 (39.0)	100 (47.6)	0.57 (0.33- 0.98)	0.042
JHS	29 (15.3)	25 (11.9)	0.91 (0.44- 1.85)	0.791
SHS	39 (20.5)	47 (22.4)	0.67 (0.31- 1.46)	0.316
Employment status				
Employed	160 (84.2)	164 (78.1)		
Unemployed	30 (15.8)	46 (22.0)	0.58 (0.33- 1.03)	0.061

region was high among the age group 6 to 11 months [8]. Other studies in Cuba and Ghana revealed that, those in the age group of 6 to 23 months had a higher prevalence as compared to the age group of 24 to 59 months [15].

Childhood anaemia has been reported to be more prevalent in children below the age of 24 months and this may be due to inadequate feeding practices such as weaning and poor complementary feeding (low diversity, low frequency) [7,9].

A study in Cuba showed that children who were not exclusively breastfed were at risk of developing anaemia [15]. Children who were exclusively breast-fed within the first six months have good iron stores. Hence this might explain why there was no significant difference between anaemia and children who were exclusively breastfed in this study.

It is however, expected that in the early stage of growth, both males and females have the same rapid growth. During this period, more micronutrients such as iron are needed. When this physiological demand is not compensated with appropriate iron and iron rich complementary foods at this critical stage then the child begin to develop anaemia.

Even though not statistically significant difference was observed between males and females, females were less likely to develop anaemia when compared to males [OR= 0.67(95% CI: 0.44-1.03); p=0.073). This is similar to other findings, which indicated that males were more likely to develop anaemia than females [2].

The study also found that though the numbers were small, children with malaria parasitaemia when compared with those without parasitaemia were 7.8 times more likely to develop anaemia [OR=7.8 (95% CI: 2.07-29.06); p=0.002).

Although the current study did not indicate any association between ITN usage and anaemia, the use of the ITNs might

have served as a protection against malaria infections.

5. CONCLUSIONS AND RECOMMENDATIONS

The result from this study shows the prevalence of anaemia in children under-five in Hohoe Municipality to be 47.5%, with the highest prevalence falling within age group of 6 to 23 months. The associated risk factors, which are attributed to the prevalence of anaemia, were children aged 6 to 23 months, and testing positive for malaria parasitaemia. Therefore, appropriate and targeted measures such as increase use of ITNs, high coverage of iron supplements and SP IPTp during pregnancy and good practice of exclusive breastfeeding among children aged 0 to 6 months, provision of good dietary diversity among children 6 to 59 months and availability of portable water, will help reduce further anaemia in children under-five years in Hohoe Municipality.

It is therefore recommended that further research be conducted to rule out worm infestation as a risk factor. Also, the use of another study method such as case control, to determine causal relationship between exclusive and complementary feeding and ITN usage and anaemia is also highly recommended.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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