



Correlation of Malaria Infection With Nutritional Assessment of School-Going Children In The Rural Area of Nowshera, Pakistan

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ABSTRACT

This study evaluated the prevalence and risk factors of malaria infection, anemia, and malnutrition among school-going children of Nowshera (a city of Khyber, Pakistan). **Subjects and methods:** A total of 800 children of aged 5-10 years were included in the study in 2023. Malaria infection was confirmed by rapid diagnostic tests. Hematocrit level was obtained using a centrifuge microhematocrit, and converted to hemoglobin using standard conversion. Nutritional status was determined by the anthropometric measurements, and demographic characteristics were obtained by questionnaire. Anemia and malnutrition were defined according to the World Health Organization standards. Logistic regression analysis was used to determine association between the predictor variables and primary outcomes.

Some studies have reported that children with previous exposure to malaria have a higher risk of becoming malnourished, as characterised by either stunting, underweight or wasting.)In current research work 800 children were selected for the assessment of malaria and nutritional status, malaria infection was found more frequent among the students 240(12%). In addition, high prevalence of anemia 210(10.5%), malnutrition 180(9%), and stunting 140(7%) was observed, while wasting 4(0.2%) and underweight 40(2%) had very low frequency. Anemia and malnutrition were observed in 12%, 10.5% and 9% of the children population, respectively. To the best of our knowledge, this is the first study showing the current health problems among the school-going children of district Nowshera the prevalence of Anemia and malnutrition and their co-existence in children 5-10 years.

KEY WORDS: Anemia, Malaria, Malnutrition, Stunting, Underweight

INTRODUCTION

Rate of malaria infection declined from 22% (146 million individuals) in 2005 to 13% (114 million individuals) in 2015 in sub-Saharan Africa (**Apinjoh et al 2015**). In Cameroon, malaria burden and transmission intensity are heterogeneous with spatial and temporal variations between altitudes and geographical areas, with varied prevalence rates from one area to another (**Akiyama et al 2016**). Like many sub-Saharan countries, prevalence of malaria has dropped in Cameroon by using insecticide-treated nets (ITN) in 2007 (**Ebai et al 2016**). According to the follow-up study, prevalence of malaria parasitemia dropped from 85.4% in 2006 to 36.6% in 2013 with a relative risk reduction of 57.2% in the Mount Cameroon area. Nevertheless, malaria still remains a major killer of children in this country and is estimated to take the life of a child every two minutes (**Apinjoh et al 2015**).

Malaria, anemia, and undernutrition are associated with morbidity and mortality, with higher rates among children, particularly in sub-Saharan Africa. Anemia is defined as a condition in which the oxygen-carrying capacity of red blood cells is insufficient to meet the body's physiologic needs due to low blood hemoglobin concentration (**Eyong et al 2016**). This condition affects individuals and has significant adverse health consequences, as well as adverse impacts on social and economic development (**Kimbi et al 2014**).

Childhood anemia is considered a severe public health problem in Sub-Saharan Africa (62.5%) and in particular Cameroon, where a prevalence of 63.2% was reported in 2011 (**Apinjoh et al 2015**). Malaria causes a substantial proportion of anemia in malaria-endemic settings (**Sumbele et al 2014**). Notwithstanding, updating the role of malaria parasitemia in anemia prevalence when coverage of insecticide-treated nets is above 75% in Cameroon (**Stevens et al 2014**), will help the National Malaria Control Programs to plan proper management strategies by considering the heterogeneities in different localities. However, association of anemia burden with malaria, relative to other causes such as malnutrition, and its variation across different altitudes of Cameroon has not been established. On the other hand, nutritional status is closely associated with immune response to the infections, is an important determinant of risk and prognosis of infectious diseases, and is directly influenced by the infections (**Sumbele et al 2016**). Nonetheless, association of malnutrition with malaria has been contradictory. reported that malnutrition is associated with a higher risk of Plasmodium infection, and infectious episodes contribute to deterioration of nutritional status. In contrast, some studies found no association between nutrition and subsequent mortality from malaria (**UNICEF 2018**). In agreement, malnutrition and Plasmodium falciparum malaria frequently co-exist in Sahelian countries, and are accounted for a large part of under-five morbidity and mortality during their concomitant peak seasons . Based on the report of the United Nations Children's Fund in 2013, 38% of children below the age of 5 years suffer from chronic malnutrition or stunting in sub-Saharan Africa. Unfortunately, malaria and undernutrition are two major causes of childhood mortality in the region (**WHO 2016**). Anemia has also been reported as a significant determinant of stunting, which is the main type of malnutrition in young children. Stunting is associated with impaired cognitive development, reduced academic achievement, and decreased physical work capacity in adulthood, with a financial burden on societies. While the global stunting prevalence fell from 39.6 to 23.8% between 1990 and 2014, scenario is quite different in Africa, where an increasing trend is observed. Nevertheless, prevalence of stunting fell from 49.9% (**Wanzira et al 2017**) to 17.1% in some localities in the Mount Cameroon area.

Impact of nutritional status on malaria may differ due to the heterogeneity of populations, species of the parasite, and other factors involved in the host and parasite relationship. This study aimed at determining the prevalence and intensity of malaria parasitemia, anemia, and malnutrition as well as identifying the risk factors for these public health concerns among children living in Charsadda (a city of Khyber, Pakistan). Anemia and malnutrition were defined according to the

World Health Organization standards. Logistic regression analysis was used to determine associations between the predictor variables and primary outcome

MATERIALS AND METHODS

This observational cross-sectional study was conducted in Nowshera city from April to September 2023. It was approved by ethical committee of the Takht Bhai Institute of Health and Management Sciences and the Takht Bhai THQ Hospital (Pakistan). Informed consent was obtained from the teachers and participants. Verbal consent was obtained from the parent/caregivers after explaining the purpose, risks, and benefits of the study. Sample size was determined by a single population formula. Accordingly, 800 students of aged 5-10 years were selected from the Govt schools. Demographic information together with weight and height of the children were obtained by a questionnaire (Table 1), and plotted to gender specific, growth charts. School Health Program was carried out on a systematic basis in the Rural Block. Ages of the children were determined using school records. For nutritional status assessment, weight was measured by a floor type weighing scale, height was taken using a measuring tape applied to the wall from their back of heels to the head touching the wall. Malaria infection was confirmed by rapid diagnostic tests. The hematocrit level was obtained using a centrifuge microhematocrit and converted to hemoglobin using standard conversion. Nutritional status was determined from the anthropometric measurements collected. Anemia and malnutrition were defined according to the World Health Organization standards.

RESULTS AND DISCUSSION

Table 1- Indicators and cutoffs for assessment of malnutrition in the school-going children

| Demographic information | General information | Dietary Habits |
|------------------------------------|---|--|
| Name: | Do you have breakfast every day before going to school? (Yes/No) | What is your favorite healthy food? |
| Age: | How many meals do you typically eat a day? | How often do you drink water a day? |
| Gender: | Do you eat fruits and vegetables daily? (Yes/No) | <input type="radio"/> Less than 3 glasses <input type="radio"/> 3-5 glasses <input type="radio"/> 6-8 glasses <input type="radio"/> More than 8 glasses |
| Grade/Class: | How often do you consume fast food? (Yes/No) | Are you aware of the importance of a balanced diet? (Yes/No) |
| School Name: | | Do you receive any nutrition education at school? (Yes/No) |
| Anthropometric Measurements | | |
| Height (cm): | | |
| Weight (kg): | | |
| BMI (Body Mass Index): | | |

RESULTS

In current research work 800 children were selected for the assessment of malaria and nutritional status, malaria infection was found more frequent among the students 240(12%). In addition, high prevalence of anemia 210(10.5%), malnutrition 180(9%), and stunting 140(7%) was observed, while wasting 4(0.2%) and underweight 40(2%) had very low frequency. Malaria infection, anemia, and malnutrition were observed in 12%, 10.5% and 9% of the children population, respectively (Figure 1).

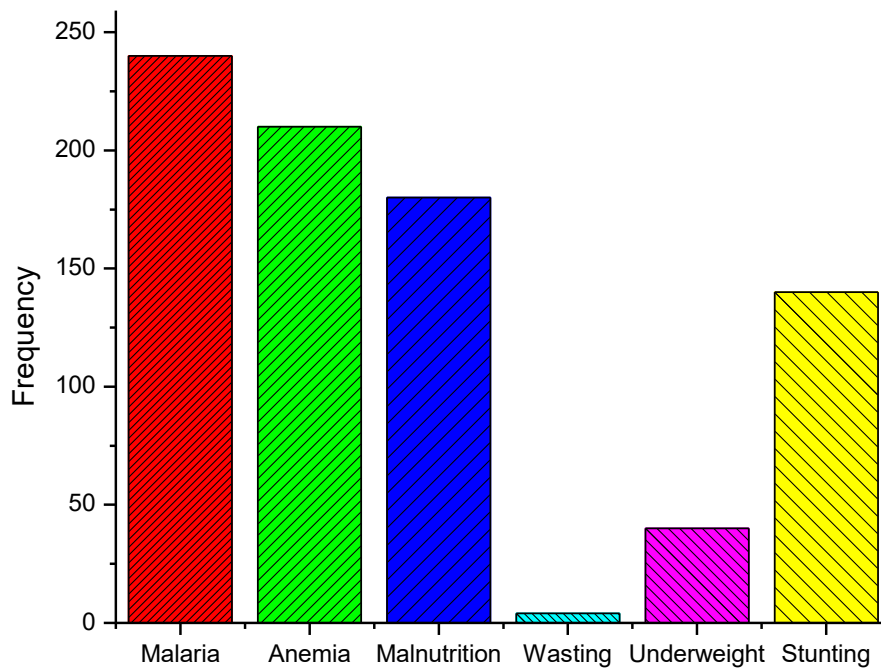


Figure1. Clinical characteristics of the study population

In age wise incidence of Malaria the lower age group were more infect by Malaria as compare to higher age group students 6.5% and 5.5% respectively (Table.1). While gender wise incidence of Malaria shows that the more boys were infected by Malaria as compare to girls. Boys 70(7%) and girls 50(5%) Table.1

Table 1- Malaria infection prevalence with respect to sex and age

| Parameter | Number | Prevalence (%) |
|-----------|--------|----------------|
| Age | | |
| 0-5 | 130 | 6.5% |
| 6-10 | 110 | 5.5% |
| Sex | | |
| Girls | 100 | 5% |
| Boys | 140 | 7% |

Overall assessment of nutritional status was found more frequent, malnutrition 180(9%), and stunting 140(7%) was observed, while wasting 4(0.2%) and underweight 40(2%) had very low frequency. malnutrition were observed in 12%, 10.5% and 9% of the school-going children respectively (Figure 2).

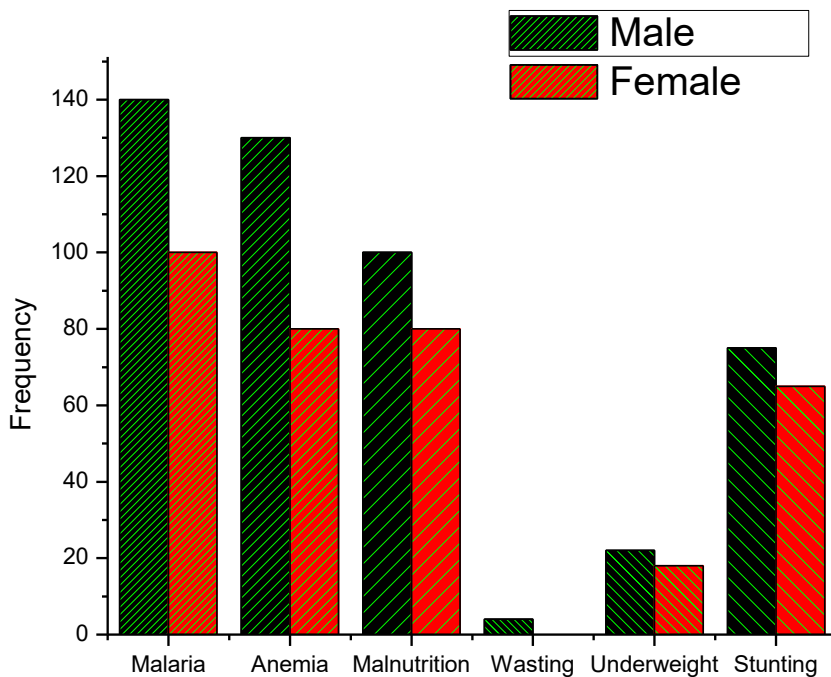


Figure2. Gender wise overall Clinical characteristics

Table 2- Food frequency questionnaires for assessment of nutrition status of school going children

| Food frequency questionnaire for Nutritional Assessment Of School-Going children In the Rural Area of Nowshera, Pakistan | | | | |
|--|------------------|------------------|----------------------|--------------|
| food frequency questionnaire (ffq) | | | | |
| MEAL TIMINGS | | | | |
| Do You Take | Always | Sometimes | Rarely | Never |
| Breakfast | 120 | 180 | 200 | 400 |
| Lunch | 400 | 160 | 140 | 100 |
| Tea time | 350 | 150 | 150 | 150 |
| Dinner | 440 | 160 | 170 | 130 |
| FOOD RESPONSE AND REACTIONS | | | | |
| Cravings | Aversions | | Unsuitability | |
| 250 | 300 | | 250 | |
| WATER INTAKE (1Glass=250ml) | | | | |

DISCUSSION

In current research work 800 children were selected for the assessment of malaria and nutritional status, malaria infection was found more frequent among the students 240(12%). In addition, high prevalence of anemia 210(10.5%), malnutrition 180(9%), and stunting 140(7%) was observed, while wasting 4(0.2%) and underweight 40(2%) had very low frequency. Malaria infection, anemia, and malnutrition were observed in 12%, 10.5% and 9% of the children population, respectively. In age wise incidence of Malaria the lower age group were more infect by Malaria as compare to higher age group students 6.5% and 5.5% respectively. While gender wise incidence of Malaria shows that the more boys were infected by Malaria as compare to girls. Boys 70(7%) and girls 50(5%). Overall assessment of nutritional status was found more frequent, malnutrition 180(9%), and stunting 140(7%) was observed, while wasting 4(0.2%) and underweight 40(2%) had very low frequency. malnutrition were observed in 12%, 10.5% and 9% of the school-going children. More males were malnourished (43.6%), underweight (18.1%) and stunted (42.6%) when compared with females (39.7%), (7.1%) and (37.2%) respectively. The difference in prevalence of underweight among the sexes was significant ($P = 0.025$) with the males having a higher prevalence. Bivariate analysis revealed children of the 0–5 years age group ($P < 0.001$) were significantly at odds of being malnourished. Anaemia has also been testified as a important cause of stunting, which is the main type of malnutrition in young children (Nyaaba 2017). Stunting is associated with impaired cognitive development, reduced academic achievement, and decreased physical work capacity in adulthood, with a negative cost on the economic development of societies (UNICEF 2014). While the global stunting prevalence fell from 39.6 to 23.8% between 1990 and 2014, the scenario is quite different in Africa, with an increase (WHO 2016). Nevertheless, in some localities in the Mount Cameroon area, the prevalence of stunting fell from 49.9% to 17.1% (WHO 2014). The impact of nutritional status on malaria may differ due to the heterogeneity of the population under study, species of the parasite, and other factors involved in the host and parasite relationship. The study aimed at significant the prevalence and intensity of malaria parasitaemia, anaemia and malnutrition as well as identifying the risk factors for these public health concerns among children living in low versus high altitude settings in the Mount Cameroon area. deficiency in School Children

CONCLUSION

The available data indicate that malnutrition is a public health problem among the school-going children of the local area of District Nowshera, Pakistan. However, the available data, on micronutrient status, are limited. These findings highlight the need for nutrition involvements in school-going children and more high-quality research to assess nutritional status in this age group. Anemia and malnutrition control should be integrated with existing malaria control and should include children above five years of age. In the current research work among the all malarial infection were found more frequent (240), leading by Anemia (210), similarly malnutrition also with high prevalence rate(180) while wasting and underweight with very low frequency of (4) and (30) respectively, stunting were also having frequency of (130)

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DECLARATION OF COMPETING INTEREST

The authors declare that they have no competing interests

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