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Intervention On Nutrition Education in The Management of School Aged Children (2-10 Years) Affected by Malaria in Bamenda

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Abstract

The objective of this study was therefore to manage the nutritional status of school aged children affected by malaria in Bamenda. This was conducted using a population of 397 for children whose parents consented. The data collected was analysed using SPSS version 23 and findings revealed that majority (52.4%) were females, 26.4% aged between 8-9years, 40.8% had occupations not specified, 64% were Christians, 70.8% were of the grass field, 65.2% earned less than 50.000frs per month and 49.9% had attained secondary education. And the BMI (Body Mass Index) classification, majority (19.1%) and (11.5%) for girls and boys respectively, were classified as moderately malnourished. Then, clinical data revealed that majority (81.1%) had pallor nails, 58.9% had scaly skin, 50.6% had week extremities, 40.8% had pale eyes, 40.1% had pale and dry eyes, 51.4% had temperature >37.5 while a few (24.7%) had brittle hair and mouth sore (29.7%). Majority (70.5%) consumed cereals, 12.6% ate legumes, 5.5% ate meat/fish/eggs, 4.5% ate milk/dairy, 3.8% ate vegetables and 3% ate fruits. Majority (60.7%) did not sleep under mosquito net, 58.4% accepted there is stagnant water and bushes around their house, 65.7% had monthly incomes <50.000frs, 59.2% did not eat green leafy vegetables, bananas, apples, meat, beans, chicken, 75.8% did not eat okro, meat, poultry, guavas, mushroom, pumkin seeds, pork, beans, yoghurt.

For nutritional interventions, 87.9% accepted nutrition education, 92.4% accepted advice be given to pupils to consume food containing vitamin A, iron, zinc and 90.2% accepted gardening be encouraged. The study concluded shown that nutritional interventions made has improve the nutritional status of school aged children affected by malaria in Bamenda.

Keywords: *Nutritional status, nutritional intervention, school aged children, malaria*

Introduction

Globally, 212 million new cases of malaria were reported in 2015 and in this same year, 429,000 lives were lost mainly young children from Africa. The disease results to the death of a child every 2 minutes. The WHO estimates that 90% of malaria cases and 92% of death associated with malaria were reported in Africa. In Sub-Saharan Africa, it is estimated that 114 million people are infected with the disease. The highest proportion being children aged 2-10years. Malaria is associated with malnutrition in children which eventually leads to about 50% deaths among children below 5years [1]. Worldwide, malaria incidence has significantly decreased between 2010 and 2017, from 71 to 57 cases per 1000 of the population at risk. In 2018, worldwide, there were approximately 405,000 deaths from malaria, a decrease from 416,000 deaths in 2017. Children were more vulnerable compared to other age groups where they accounted for 67% of all global deaths (272000) in 2018 [2].

Malaria, anaemia and undernutrition are each associated with significant morbidity and mortality, with higher rates among children particularly in the Sub-Saharan Africa and malaria causes a substantial proportion of anaemia observed in malaria endemic settings [3]. Anaemia is a condition where due to low blood haemoglobin concentration the oxygen carrying capacity of red cells is insufficient to meet the person's physiologic needs [3]. Childhood anaemia is considered a severe public health problem in Sub-Saharan Africa (62%) and in Cameroon in particular where prevalence of 63% was reported in 2011 [3]. Anaemia affects more than half of all pregnant women and children <5years and has serious consequences since severe anaemia (Hb level <5g/dl) is associated with an increased risk of death, while iron deficiency and anaemia may impair cognitive and motor development, growth, immune function and physical work capacity [4].

Nutritional status is closely tied to the immune response to infections being on one hand an important determinant of the risk and prognosis of infectious diseases and on the other and being influenced by infection. This is a double synergistic association in which a poor nutritional status contributes to the development and evolution of diseases like malaria, whereas diseases lead to a worsening nutritional status [5]. However, a recent systematic review found no consistent association between malaria risk and malnutrition, although chronic malnutrition was associated with malaria severity [6]. Another systematic review which reviewed nutritional status based on anthropometry and malaria infection concluded that malnutrition does not have a large impact on malaria morbidity, but might negatively affect malaria mortality and severity [6].

High level of poverty which has a define effect on nutritional status has been linked to the endemicity of malaria in the Sub-Saharan Africa [7]. Several studies have shown associations between malaria and protein energy malnutrition, poor growth and certain micronutrient deficiencies among children [8]. Malnutrition has a negative effect on the body's defence mechanism; the lack of certain essential nutrients which help the body to boost its immune system can make it susceptible to malaria infection. Micronutrient deficiencies are bi-directionally associated with several infections due to specific micronutrients playing key roles in the immune system and certain deficiencies may also predispose to malaria incidence [9]. Data from a study prompted several authors to propose micronutrient supplementation, i.e. Vitamin A and Zinc to prevent malaria incidence, severity, mortality, an approach that was shown to be generally successful [9]. While some studies still show a controversial association between iron deficiency and malaria incidence, other studies have shown that iron supplementation may increase the risk of malaria incidence.

In sub-Saharan Africa particularly, 39% of children less than 5 years suffer from stunting, 15% underweight and 6% of preschool children are suffering from wasting. Different diseases of adults are considered to have a close relationship with malnutrition and improper nutrition in childhood. The association between childhood diet and being underweight or overweight as children or even as adults have been shown in numerous studies [10]. Global evidence indicates increase of obesity, diabetes, cardiovascular diseases, and other chronic non-communicable diseases, especially in developing and transitional countries. This evidence also indicates that disease processes begin early in life, and it is expected that the epidemic will continue to increase due to a lifetime of exposure to poor diet and the influence of different factors [11]. Proper nutrition in childhood is considered to play a crucial role in the physical, mental, and emotional development of children through to their later adult age. Children are therefore considered the priority population for intervention strategies [12]. Nutritional assessment in children is needed to determine their nutritional status and problems in their food regimes and if identified, to treat such problems in order to prevent them from becoming larger and threatening to children's health.

In malaria-endemic areas, the manifestation of malaria cases is a function of immunity with respect to age and exposure to the parasite; reasons why asymptomatic malaria is common among older children [13]. A study reported that in high malaria transmission settings, symptomatic malaria is often in children below 5years of age as they have little exposure hence weak or low immunity to the parasites (Sumari *et al.,* 2017). On the other hand, asymptomatic infections usually occur in older children and at sub-microscopic densities, challenging their diagnosis in the population [14]. There are many potential factors that could contribute to differences in measures of malaria between males and females [15]. Social, cultural, and behavioural differences may influence ones risk of exposure to mosquito vectors, perception of illness and health seekingbehaviour [15]. Associations between gender and malaria are likely to be modified by local epidemiological factors, demographics such as age, and malaria outcomes being assessed that is, infection versus disease [15]. Prevalence of asymptomatic malaria infection among primary school children was reported as 14.3% in North Western Tanzania. This same study reported that school age children are the age group most commonly infected with malaria parasites and their infections are usually asymptomatic, go unnoticed and thus never get treated, resulting in anaemia, reduced ability to concentrate and learn in school, and if sick lead to school absenteeism. Aside from being a reservoir for malaria transmission, asymptomatic carriage causes challenges including but not limited to anaemia, stunting, and cognitive impairment in school children [16]. Children's susceptibility to diarrheal, respiratory infections and other illnesses increases when they develop repeated malaria infections and an estimated 2% of children who recover from cerebral malaria develop learning impairments and disabilities, including epilepsy resulting from brain

Undernutrition in children occurs when children do not consume enough calories, protein, or micronutrients to maintain good health. Malnutrition is common globally, and may result in both short and long term irreversible adverse health outcomes if not resolved at the early ages. Malaria, anaemia and under nutrition are each associated with significant morbidity and mortality, with higher rates among children particularly in the Sub-Saharan Africa and malaria causes a substantial proportion of anaemia observed in malaria endemic settings [3].

Despite sufficient quantity and diversity of food resources in Cameroon, especially in the North West Region, where many foods are produced, malnutrition rates among children under 5 years persist and are at rise; and malaria is the main cause of morbidity and mortality, accounting for 40 – 50% of hospital consultations and 23% of hospitalisations [17]. It was therefore, due to the negative health impacts of under nutrition and malaria infection in school aged children that this study was conceived.

It was therefore against this background that this study was aimed to propose possible nutritional interventions for children affected by malaria in Bamenda, North West region of Cameroon.

Material and methods

Study design

A cross-sectional study design looks at a population at a single point in time, using a cross section of a group and variables are recorded for each participant. They are relevant when assessing the prevalence of disease, attitudes and knowledge among patients or health personnel. This allow researchers to compare many different variables at the time, it's cheap and quick but requires a larger sample size as well as allow bias to affect results when there is a non-response during data collection. A cross sectional study design was therefore used to assess and manage the nutritional status of school aged children affected by malaria in Bamenda.

Study Area

The study was carried out in two selected hospitals; Regional Hospital Bamenda and District Hospital Nkwen formally known as CMA Nkwen. The Regional Hospital Bamenda is a Referral hospital found in Mankon, precisely in Bamenda II, in Mezam Division of the North West Region of Cameroon. It is subdivided into departments which include: Hemodialysis, opthamology, intensive care unit, emergency unit, pharmacy, internal medicine, maternity (post and antenatal units), treatment centre, theatre, social services, radiology, surgery, nephrology, outpatient department, paediatric unit which is the area of study.

The District Hospital Nkwen is located in mile2 directly opposite Amour Mezam travelling agency in Bamenda, North West Region of Cameroon. It's headed by a Medical Doctor and has Assistant General Supervisor. It is subdivided into wards (female, male, paediatric), maternity, ANC, infant welfare clinic and family planning, theatre, laboratory and casualty.

Study population and Study Procedure

The populations of this study included all children aged 2-10 years attending nursery and primary schools in Bamenda. Children aged 2-10 years who lived and attended schools in nursery and primary schools in Bamenda whose teachers and parents gave consent were included in the study while children who were seriously ill and those whose parents did not give consent were excluded.

Nutritional status was evaluated using anthropometric, dietary, and clinical assessment of school aged children affected by malaria.

Determination of Malaria Status

Rapid diagnostic tests were done to determine the children's malaria status. This was done using the P. falciparum Antigen rapid kit according to the manufacturer's instructions. The thumb was cleaned with swabs provided and pricked with the lancet to obtain capillary blood. The blood sample was collected using the loop and blotted into a small hole on the rapid test kit labeled the sample part A. Two drops of buffer were added to the buffer part B. The test result was read after 15minutes [5].

Measurement of Body Temperature

The children's body temperature was measured with Omron digital thermometer. The thermometer was placed in the armpits of the children; the body temperature appeared on the screen after 5-10 seconds and was documented for every child. Fever was characterised as an axillary temperature >37.5C [5].

Inclusion and exclusion criteria

Inclusion criteria: - children aged 2-10 years, their caretakers/teachers/ parents who gave consent, lived and schooled in Bamenda

Exclusion criteria: -Children aged 2-10 years, their caretakers/parents/teachers who were seriously ill, did not give consent, and were not available in Bamenda during the time of the survey were not included in the study.

Sampling Techniques

Systemic sampling and Random sampling technique was used to select children aged

2-10 years who lived and schooled in Bamenda.

Study Variable

Dependent variable: - Malnutrition was indicated by stunting, wasting, underweight and obesity.

Independent variable: -

- Child characteristics; age, gender, tribe, religion.
- Maternal characteristics; education level, occupation, income.
- Environmental health condition; water supply, sanitation and housing condition.

Sample Size

The sample size was determined by using the Taro Yamane Formula:

$n = N/(1+Ne^2)$; where n = corrected sample size**;** N = population size**;** e = margin of error (MoE)

The number of children aged 2-10years who lived and schooled in Bamenda= 50,000

Margin of error= 5%; $n=50,000/(1+50,000(0.05^2)=50,000/126= 396.8$ which is approximately **397**.

Therefore, per Taro Yamane formula a sample size of 397 was used.

Pre-Testing

The questionnaire was pretested among few selected children and their caretakers/ teachers/parents for accuracy and clarity of questionnaire after which any wrongly asked questions or unnecessary material was eliminated and the questionnaire adjusted to complete the study.

Validity and Reliability of Instrument

The researcher submitted her questionnaire to her supervisor for examination and correction. The questionnaire was pre-tested prior to data collection for validity among few selected children and their parents in Bamenda.

The questionnaires were checked on a daily basis to identify corrections, and to verify if it was completed or well understood by respondents.

Data collection Techniques

Data was collected using a structured questionnaire which was developed and designed to suit all children aged 2-10years who lived and schooled in Bamenda. The structured questionnaire was self- administered to respondents by the researcher. The questionnaire was divided into parts to cover all the specific objectives of the study. It constituted both closed and open-ended questions.

Data analysis

The collected data was reviewed and entered into Excel sheets for analysis for computing for means, and standard deviation (SD). Statistical analysis was accomplished using Statistical Package for Social Science (SPSS), version 20 for unpaired *t*-test. Data was used to calculate Z-scores of anthropometric measurements, height for age, and weight for height and weight for age as compared with the National Center of Health Statistics (NCHS/WHO) reference values. Z scores (standard deviation scores): The Z-score represents how far the data are distributed (higher or lower) around the reference median.

Following the classification of WHO database on child growth: Stunted child is defined as one whose height for age (HAZ) is less than -2 SD of the reference median, reflecting a long-term growth faltering. Wasted child is defined as one with weight for height (WHZ) less than -2 SD below the reference median, which reflects acute or recent growth disturbances. Underweight child is defined as one with weight for age (WAZ) less than -2 SD of the reference median, reflecting a combination of disturbances in linear growth and body proportion.

Ethical Consideration

Authorization was obtained from the following hierarchies:

- College of Technology (The University of Bamenda).
- Regional Delegation of Public Health.
- Study site.
- Informed consent from participants.

Consent was documented and validated by signing.

Issues surrounding confidentiality, privacy and the purpose of the study were explained.

Results and discussion

The results from Nutritional interventions revealed that 349/397 (87.9%) of the respondents accepted that children affected by malaria can be supplemented with Vitamin A while only 48/397 (12.1%) of the respondents disagreed.

Also, 340/397 (85.6%) of the respondents accepted that supplementation with Zinc will help children affected by malaria while 57/397 (14.4%) of the respondents disagreed.

To add, 130/397 (32.7%) of the respondents accepted that supplementation with Iron will help children affected by malaria frequency while 267/397 (67.3%) of the respondents refused.

Furthermore, the results showed that while 324/397(81.6%) of the respondents accepted that fortification of food with zinc will improve on the health status of children affected by malaria, only 73/397(18.4%) of the respondents refused.

The results also revealed that 311/397(78.3%) of the respondents accepted that fortification of food with Vitamin A will help children affected by malaria while 86/397(21.7%) of the respondents disagreed.

A total of 357/397 (89.9%) of the respondents accepted that Nutrition education to both children & their parents will help children affected by malaria while, 40/397 (10.1%) of the respondents refused.

More so, 367/397 (92.4%) of the respondents accepted that if pupils affected by malaria are advised to eat food containing Zinc/Iron/Vitamin A it will improve on their health status while 30/397 (7.6%) of the respondents disagreed.

Lastly, 358/397 (90.2%) of the respondents accepted that if parents & children are encouraged to do gardening, it will improve on the health status of children affected by malaria while, 39/397 (9.8%) of the respondents disagreed.

Table 1. Nutritional interventions

	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	340	85.6	85.6	85.6
No	57	14.4	100.0	100.0
Total	397	100.0	100.0	
Supplementation with Vitamin A				
Yes	349	87.9	87.9	87.9
No	48	12.1	12.1	100.0
Total	397	100.0	100.0	
Supplementation with Zinc				
Yes	340	85.6	85.6	85.6
No	57	14.4	14.4	100.0
Total	397	100.0	100.0	
Supplementation with Iron				
Yes	130	32.7	32.7	32.7
No	267	67.3	67.3	100.0
Total	397	100.0	100.0	
Fortification of food with Zinc				
Yes	324	81.6	81.6	81.6
No	73	18.4	18.4	100.0
Total	397	100.0	100.0	
Fortification of food with Vitamin A				
Yes	311	78.3	78.3	78.3
No	86	21.7	21.7	100.0
Total	397	100.0	100.0	
Nutrition Education to parents and Children				
Yes	357	89.9	89.9	89.9
No	40	10.1	10.1	100.0
Total	397	100.0	100.0	
Advice pupils to eat food containing Zinc, iron and Vitamin A				
Yes	367	92.4	92.4	92.4
No	30	7.6	7.6	100.0
Total	397	100.0	100.0	
Encourage gardening				
Yes	358	90.2	90.2	90.2
No	39	9.8	9.8	100.0
Total	397	100.0	100.0	

From the table below, the P value (>0.05) shows that there was no significant association between Nutritional interventions and malaria status of respondents.

Table 2: Correlation between Nutritional interventions and malaria status

Factors		Nutritional intervention and malaria status			
		Malaria Status			
		Frequency	Percentage (%)	Regression	p-values
Deworming?	Yes	300	85.5	0.36	2.37
	No	51	14.5		
Supplementation with Vitamin A?	Yes	301	85.8	0.14	3.94
	No	50	14.2		
Supplementation with Zinc?	Yes	130	37.0	-0.54	-0.54
	No	221	63.0		
Supplementation with Iron?	Yes	120	34.2	0.32	2.59
	No	231	65.8		
Fortification of food with Zinc?	Yes	318	90.6	0.57	1.30
	No	33	9.4		
Fortification of food with Vitamin A?	Yes	298	84.9	0.09	4.27
	No	53	15.11		
Nutrition Education to parents and Children?	Yes	261	74.4	-1.21	0.08
	No	90	25.6		
Advice pupils to eat food containing Zinc, iron and Vitamin?	Yes	243	69.2	1.04	0.20
	No	108	30.8		
Encourage gardening?	Yes	233	66.4	-0.39	2.18
	No	118	33.6		

The findings revealed that majority (87.9%) of the respondents accepted that supplementation with vitamin A can help school aged children affected by malaria. This is in line with a study which reported that the Vitamin A metabolite, 9 cis retinoic acid, decreased the malaria induced production of inflammatory cytokines especially the TNF alpha, increasing the clearance of P falciparum infected RBCs through up regulation of CD36 expression on human monocytes and macrophages [18].

Also, majority (85.6%) accepted that supplementation with zinc can help improve on the health status of children affected by malaria. These statistics support the work of [11], who reported that a 46-week period of supplemental zinc provided to school children in Papua New Guinea significantly reduced P falciparum attributable health center attendance by 38%.

More than half (67.3%) of the respondents refused that supplementation with iron will not be beneficial to children affected by malaria. This statistics tie with a study which reported that in a large randomized placebo trial (n=8000/group), routine supplementation with iron and folic acid in children aged 1-35months with high rates of malaria was associated with increased risk of illness and death [20]. According to [21], iron tablets will increase iron levels in the blood and this will promote the growth of the plasmodium parasite.

Furthermore, majority (81.6%) of the respondents accepted that zinc fortification can improve on the health status of school aged children affected by malaria. This finding ties with the results from a study which reported that Zinc fortification of centrally processed staple foods has the potential to increase zinc intake, and absorption although there are no data to demonstrate the efficacy and effectiveness in improving zinc status of young children [22].

Statistics revealed that 78.3% of the respondents accepted that fortification of food with vitamin A can help improve on the nutritional status of school aged children affected by malaria. Fortification with preformed Vitamin A has achieved better results than carotene rich diets [23].

Lastly, 89.9% of respondents accepted that Nutrition education be given to children affected by malaria, 92.4% accepted that children be advised to eat foods containing vitamin A, iron and Zinc, 90.2% accepted that children should be encouraged to do home gardening. Behavioural change communication for changing the attitudes of the public towards vitamin A rich foods is mandatory through Nutrition education, home gardening, and promotion of consumption of locally available vitamin A friendly foods [23].

Conclusion

The main objective of this study was to manage the nutritional status of school aged children affected by malaria in Bamenda. The factors that predisposed children to malaria were; - absence of carrots, fish, eggs, milk, - not sleep under a mosquito net, - presence of stagnant water or bushes around your house, -presence or no of parents monthly income, - Not eat foods like green leafy vegetables, bananas, apples, meat, beans, chicken, - Not often eat foods like okra, pear, red meat, milk, yoghurt, pork, pumpkin seeds, poultry, peanuts, mushrooms, guavas.

Nutritional interventions that could help improve on the nutritional status of school aged children affected by malaria included; supplementation with vitamin A, Supplementation with zinc, fortification with vitamin A, fortification with zinc, Nutrition education, advice pupils to eat foods containing vitamin A, iron, zinc and to encourage home gardening.

Conflict of interest

The authors have not declared any conflicts of interest.

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