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THERAPEUTIC EFFECTS OF VITAMIN A ON UNCOMPLICATED CHILDHOOD MALARIA

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Abstract

Malaria is one of the leading causes of mortality in children worldwide. It is estimated that up to 40% of the world's population is at risk of contracting malaria. This study on therapeutic effects of malaria on uncomplicated childhood malaria was conducted at The Lagos University Teaching Hospital were to determine the incidence of malaria, assess the relationship between Vitamin A administration and malaria and identify factors that affect patient outcome. The study design was a prospective randomized cross sectional controlled clinical trial, employing the use of questionnaires' to obtain relevant data. Data entry and analysis were done using EPI-INFO 2002 and data were presented in frequency distribution tables and graphs. The association between Vitamin A administration and malaria was assessed using length of stay in the hospital. More than 50% of the patients were between 1 to 3 years of age reflecting the age range that is most vulnerable to malaria. Males represented 57.5% of respondents while 42.5% were female. 15.1% of patients received malaria prophylaxis while 84.9% did not. A total of 12.3% of children had malaria positive smears by Giemsa while 87.7% did not. Vitamin A was administered to 6 patients while 7 received placebo. The study show that if vitamin A is administered on a large scale it will reduces the signs and symptoms of malaria in children in our environment especially if combined with sleeping in insecticide treated nets and selective anti-malarial prophylaxis are instituted. It is recommended that Vitamin A supplementation be strengthened and advocated in childhood malaria so as to reduce morbidity and hasten recovery of patients.

Key Words: *Malaria, Mortality, Childhood, Vitamin A.*

INTRODUCTION

Malaria is an overwhelming problem in developing countries, accounting for up to 500 million febrile illnesses and several, million deaths annually. (Greenwood B 1999) (Snow RW et al 2001).

It is estimated that up to 40% of the world's population is at risk of acquiring malaria. The Sub-Sahara Africa, most severe cases and deaths occur in children younger than 5 years old and in pregnant women.

Malaria is a mosquito borne infections disease of humans and is cause of by eukaryotic protists that belong to the genus Plasmodium (Prothero et al 2001).

It is widespread in tropical and subtropical regions including but not limited to: Sub-Saharan Africa, Asia and the America's. Prevalence is high in these regions because of the high levels of annual rainfall and temperatures, high humidity and stagnant water which allow larvae to mature.

The disease commonly afflicts populations that are both impoverished and malnourished, and a large proportion of the burden of malaria falls upon children. There were more than 100 million malaria episodes among young children in Sub-Sahara Africa in the year 2000 (Roca Feltrer et al, 2008).

Malaria however is a preventable and easily treatable disease though 800,000 children die from it in Africa every year (Rowe et al 2006). In addition malaria is the commonest reason for hospitalization among children and is a leading cause of anemia in Africa (Carnew et al 2006).

In malarious parts of the world young children suffer more frequently and more seriously than any other section of the population (WHO 1985).

In the year 2000 there were more than 100 million episodes of malaria among children and these were caused by *Plasmodium falciparum* mainly. (World Health Organization: Roll back malaria 2002)

About 60% of the episodes of malaria and 80% of death occur in young children, south of the Sahara, where malaria is responsible for 25 to 35% of outpatient visits, 20–45% of Hospital admissions and 15–35% of hospital deaths (Bremer JG, 1999).

Despite the introduction in recent years of more rational anti-malarial regimes and the increasing use of the most rapidly parasitidal artemisinin derivatives the malaria risk and morality has not seen significant reductions yet (Hay et al 2004).

The number of malaria episodes young children in Sub-Sahara Africa experience ranges from 1.6 to 5.4 episodes annually (WHO, 2004).

Malaria causes anemia, as well as the decrease in blood level antioxidants including Vitamin A. Workers such as Shankar and colleagues demonstrated. considerable reduction in the frequency of malaria episodes in children under Vitamin A supplementation (Shankar *et al* 1999).

It has also been established that the retinol molecule can also directly inhibit the development of *Plasmodium* (Hamzah et al 2004). Few studies have however been done in our environment to elucidate the effects of Vitamin A supplementation on the incidence of malaria.

Vitamin A is essential for normal immune function and this suggest that it could play a role in protection against malaria. (Sensa et al 1998).

Studies on factors associated with increased risk of developing severe malaria and morbidity may provide additional understanding of the course of malaria and eventually lead to improved case management and the development of drugs and adjunctive treatment such as vitamin A.

This will require establishment of appropriate case definitions and meaningful trial endpoints for future testing in endemic site (Ballou et al 2004).

Unfortunately a lot of febrile episodes are clinically diagnosed as malaria and ultimate and therapy started. It will be ideal to achieve laboratory diagnosis and tailor treatment towards eradicating true malarial parasitemia.

It is pertinent to note that vitamin A deficiency and malaria are both highly prevalent in Sub Saharan Africa concomitantly. Vitamin A deficiency affects 30 million children most of whom are under the age of 5 years (who are also prone to malaria). Vitamin A deficiency increases all cause mortality in this age group. A low serum retinol concentration which is a marker of vitamin A deficiency is commonly found in children suffering from malaria, but it is not certain whether this represents pre-existing vitamin A deficiency, an acute effect of malaria on retinol metabolism or binding (San joaquim et al., 2009)..

MATERIALS AND METHODS

The study was carried out at the children emergency room of the Lagos University Teaching Hospital. The hospital is a 761 bed facility located in a urban cosmopolitan setting. The total bed space of the children emergency rooms 31. Samples shall also be obtained from children in wards D1,D2 and D3 which receive admissions from (CHER).

This was a descriptive prospective clinical intervention trial of inpatient intended at determining the relationship between Vitamin A deficiency and malaria.

Blood was obtained via phlebotomy from patients aseptically using standard and universal precaution. Aseptic collection entailed cleaning the venupuncture site with methylated spirit or alcohol; at least 2 to 3 mls of blood was withdrawn each into EDTA bottles and Lithium heparin respectively.

A structured questionnaire considering medical and other clinical history including immunizations taken in the part was recorded.

Ethical Issues

Approval was obtained from the ethics and research committee of the Lagos University Teaching Hospital informed consent will be obtained before the filling of questionnaire and collection of blood.

Sample Size

The average incidence rate for malaria is 10% using the prevalence figure in calculating the sample size.

$$N = \frac{Z^2 Pq}{D^2}$$

Where Z = critical value at 95% confidence level set at 1.96

Q is the precision at 5%

P is the proportion at the population that have malaria.

$$\text{Sample size} = \frac{1.96 \times 0.1 \times 0.9}{0.05 \times 0.05}$$

Sample size for the study was set at 140.

Inclusion Criteria

The study involved children aged 1 year to 16 years. It included children presenting to the children emergency room on account of fever, clinical features suggestive of malaria and \vitamin A deficiency.

Exclusion Criteria

The study excluded those beyond the above age range and those who refused to sign consent forms and who were not febrile or did not have features suggestive of malaria.

RESULTS and DISCUSSION

A total of 106 patients were recruited into the study over a 5 month period.

Data Presentation and Analysis of Results

Table 1 shows the distribution of age with the number of patients showing that patients aged 1-3 comprise half of respondents

Table 2 shows that majority of patients recruited into

Table 1: Age versus Frequency

Age	Frequency	Percentage
1	36	34
2	11	10.4
3	10	9.4
4	6	5.7
5	11	10.4
6	10	9.4
7	4	3.8
8	1	0.9
9	2	1.9
10	3	2.8
11	2	1.9
12	3	2.8
13	4	3.8
14	1	0.9
15	1	0.9
16	1	0.9
Total	106	100

Table 2: Sex distribution

Sex	Frequency	Percentage
Female	45	42.5
Male	61	57.5
Total	106	100

Table 3: Malaria Prophylaxis

Malaria prophylaxis	Frequency	Percentage
No	90	84.9
Yes	16	15.1
Total	106	100

Table 4: Malaria parasite

Malaria parasite	Number	Percentage
Negative	93	87.7
Positive	13	12.3
Total	106	100

Table 5: Vitamin A Administration

Vitamin A	Number	Percentage
Administered	6	5.7
Not administered	100	94.3
Total	106	100

the study were male representing 57.5% of participants There were more patients who did not receive malaria prophylaxis compared to those who did Table 3. A total of 13 patients were positive for malaria parasitemia with 6 receiving Vitamin A and 7 placebos Table 4.

A total 106 patients were sampled. 45 of them (42.5%) were female while 61 (47.5%) of them were male majority of the patients in the study were male and this is reflected in previous studies on the incidence of malaria by other workers (Hay et al 2009). The mean was age of children presenting with febrile episodes' was 4.4yrs with more than 34hrs of patients [who presented aged 1 years old.

The average temperature at the time of obtaining clinical data from malaria parasite negative patients was 38oc while for malaria parasite posture a patient was 37.62%. This lower temperature might be due to the fact that majority of patients were malaria parasite negative.

On the other hand the mean admission temperature for malaria parasite negative patients was 38.3% while for palavers parasite positive patients it was 38.7%. This represents a time association between their febrile episodes' and the presence of malaria parasites in their blood streams.

A remarkable finding is that for those patients who were administered Vitamin A their mean duration of admission was 2.15 days while for those who were not 3.55 days. this showed an immolating effect of Vitamin A or overall improvement of immunity in those who were administered the drug. This is also in line with discovery of other workers.

It was also seen from the study that the mean duration of admission in this who had recovered prophases for malaria was 3.25days while those who had received no prophylaxis, stayed an average at 3.56days.

In this study the older the child the longer the days of admission. This was particularly true for children aged 11 and 13 who spent 1 and 6days respectively on the wards. Through the exception were children aged 16 was spent don't 1 day admission.

In addition children who slept with mosquito treated nets spent an average of 2.82days on admission compared to 3.72 days for those who did not sleep with treated nets.

The male children spent less time on admission compared to the females. They spent an average of 3.02 days while the females stayed for 4.15 days. Children aged 1.3 represented 50 of participants of the study. This is the time when internal antibodies acquired in inter begin to fall in quantity, leading to increased susceptibility to malaria 80 (75.5%) of the participants slept with mosquitoes treated nets while 26 (24%) did not.

Children who had temperature of up to 40^0c spent a longer time on admission 19days. While those who had relatively lower temperature (36.5^0c) spent a shorter five on admission 21 days.

Correlating current temperature at the time of drawing samples from patients for the presence of malaria parasites those with negative smears had mean higher temperatures (38.05oc) while those with positive smears had mean temperature of (37.6^0c) Figure 2. consequently it proper malaria parasite diagnosis had

Figure 1: Total no of days on admission versus Vitamin A administration

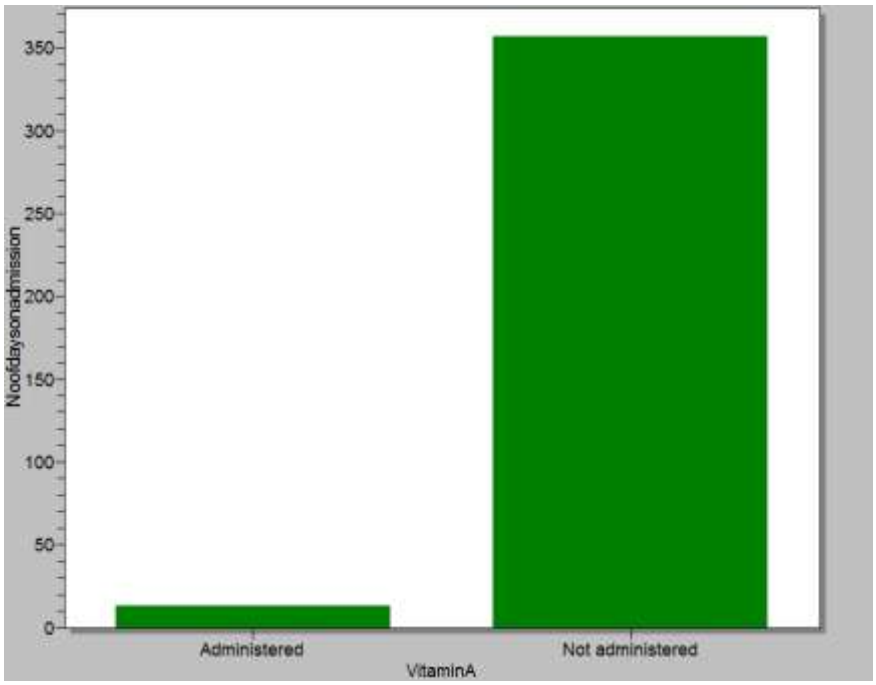
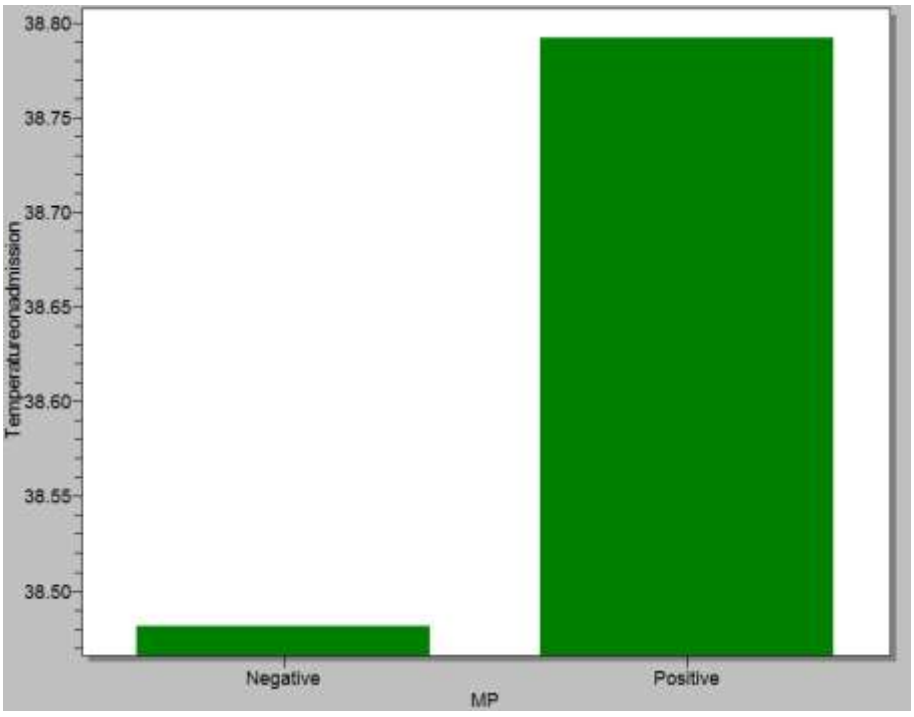


Figure 2: Malaria parasitemia versus admission temperature



not been done there would have been treatment for supposed febrile episodes' due to malaria.

For those who were administered Vitamin A they had a summation 12 number of admission days while who were not administered had a cumulative 350 days on the ward Figure 1. The incidence of malaria in the study was 12.73 percent. These fines in line with studies from similar series by other authors. A total of 3.5% of patients were administered Vitamin A while 96.5% were not Figure 4.

Figure 3: Malaria parasitemia versus Temperature at The Time of sample collection

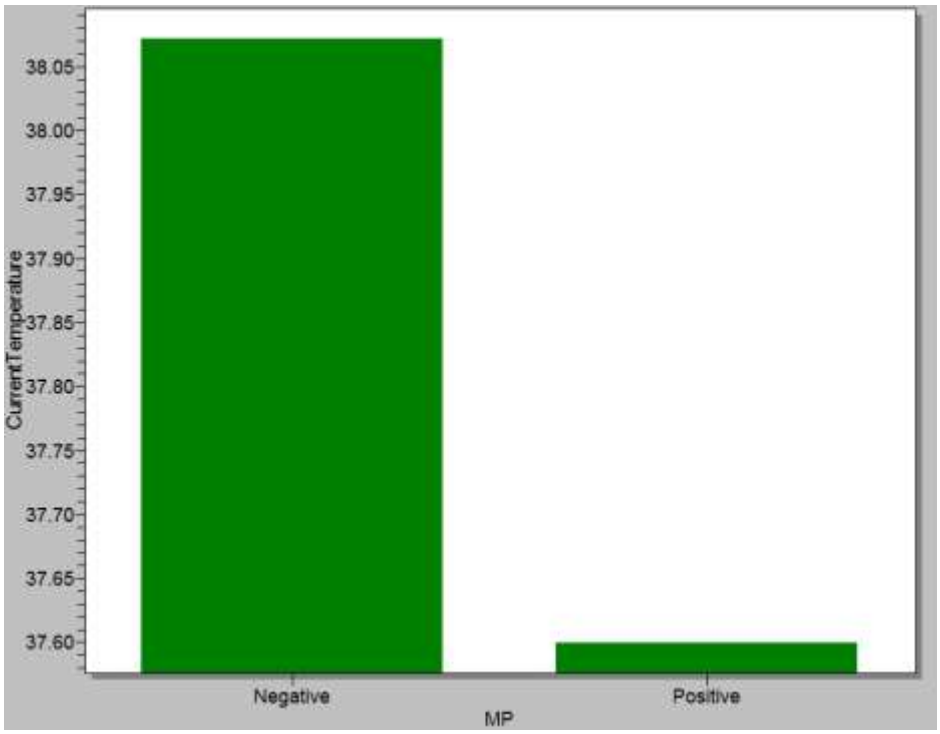
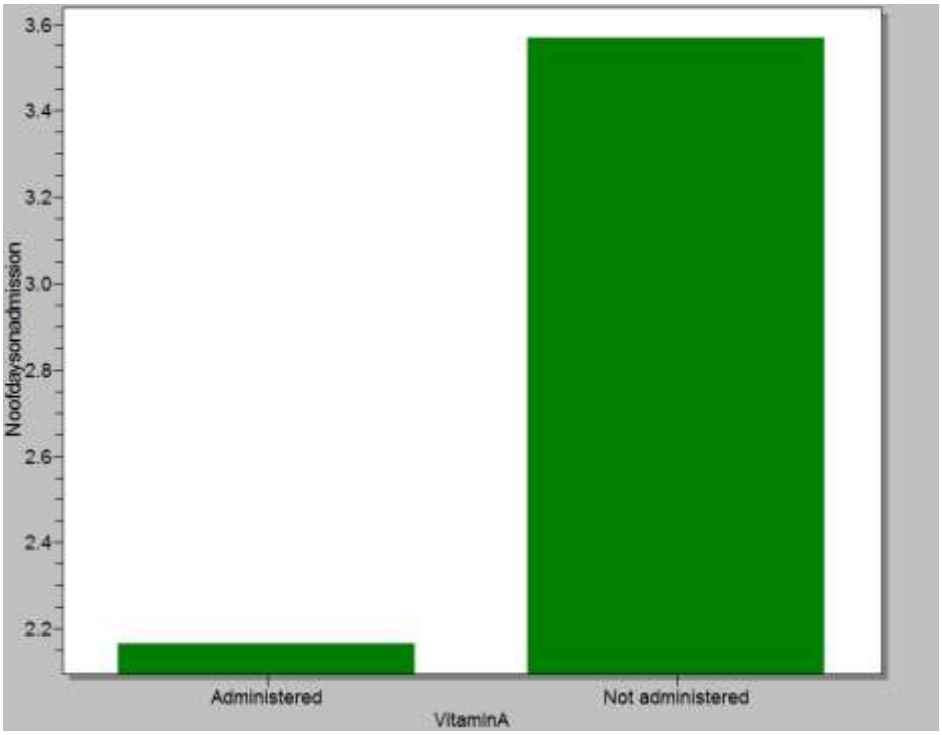


Figure 4: Number of days on admission versus Vitamin A Administration



Conversely temperature at admission for patients who were smear negative for malaria parasites was 38.3oc whilst it was 38.7oc for children with positive malaria parasite smears Figure 3. This was at a point where there had been no intervention therapeutically. This probably reflects the effects of true parasitemia.

Figure 5: No of days on admission versus use of ITN

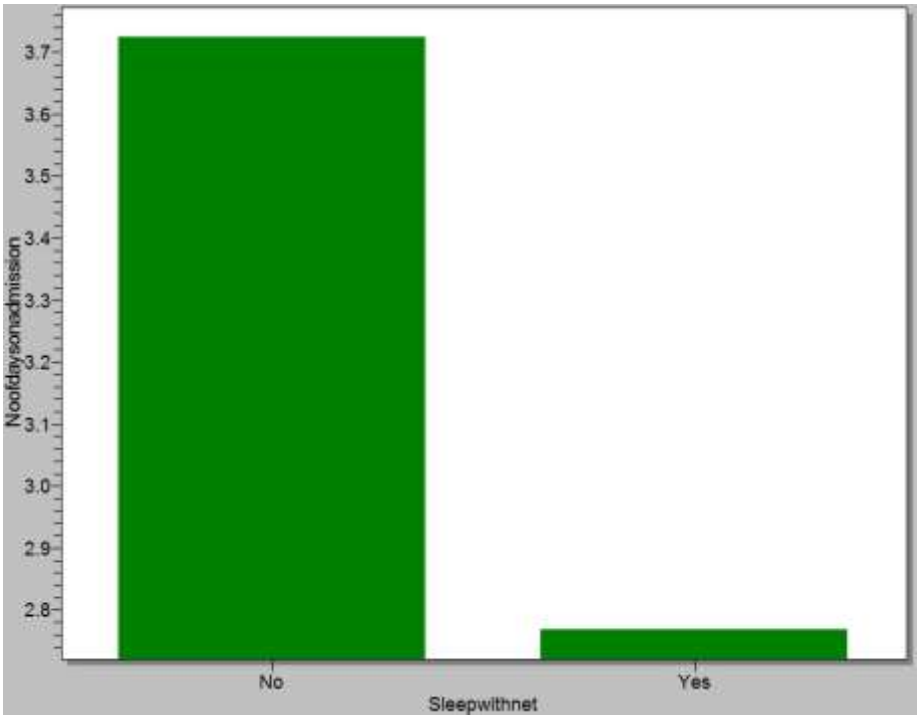
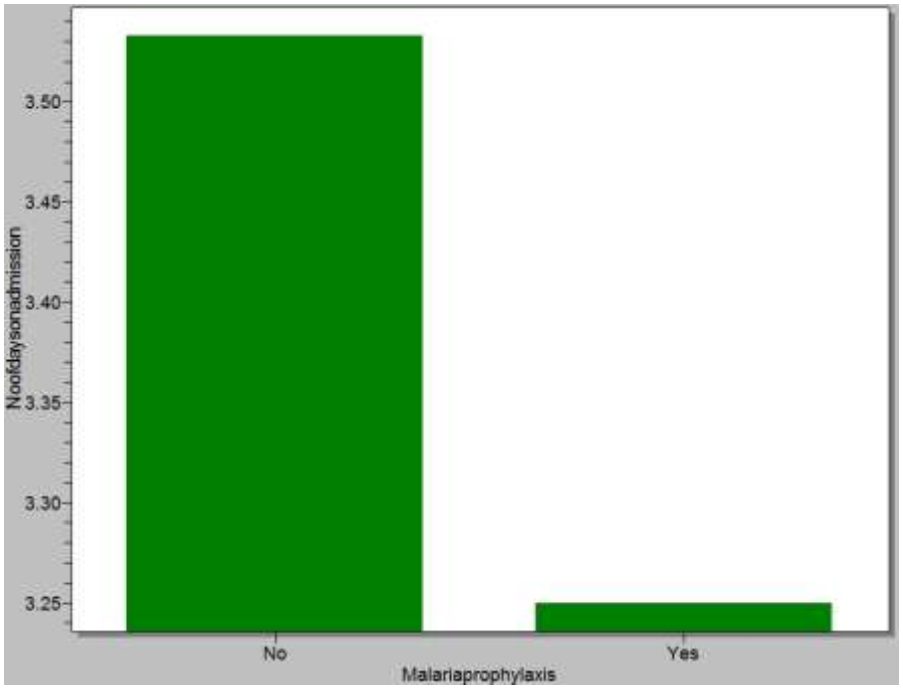


Figure 6: No of days on admission versus malaria prophylaxis



Male children spent on average lesser time on admission with an average of 30 days while females spent more time with an average of 4.15 days Figure 6. This might reflect some subtle difference in reposed malaria and consisting infection. For respondents who slept with mosquitoes net they had a shorter mean duration of hospital stay (2.7 days) while those who did not had a mean hospital stay of 3.75 days figure 5. This might be due to the protective effects from mosquitoe bites and attendant increase in hemoglobin levels.

Figure 7: No of days on admission versus anti-malarial administration

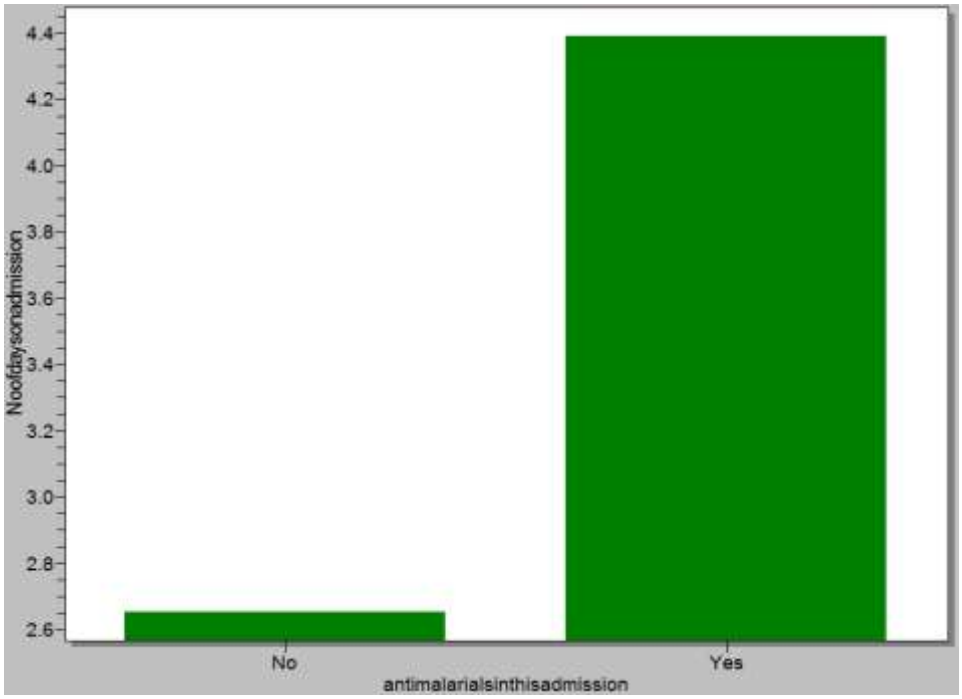
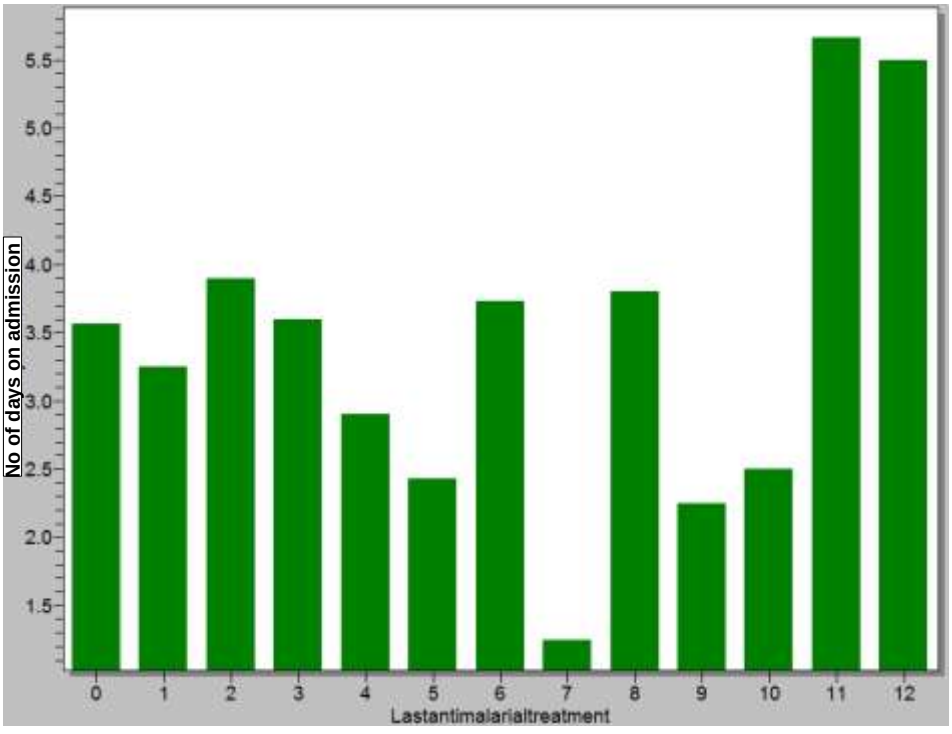


Figure 8: No of days on admission versus last antimalarials treatment



Paradoxically those who were given anti malaria whether they had malaria parasitemia or not spent more time or admission (4.4 days) compared to 2.65 days for those who were not administered anti-malarials Figure 7. All patients were eventually discharged from hospital stay. There was no regarded mortality in the study. All malaria parasite seen in the study were *Plasmodium falciparum.*

Fifty patients were administered anti-malaria out of One hundred and six patients despite the fact that only thirteen of the patients had can observing pre malaria infection, representing overtreatment.

The study show that if vitamin A is administered on a large scale it will reduce the signs and symptoms of malaria in children in our environment especially if combined with sleeping in insecticide treated nets and selective anti-malarial prophylaxis are instituted.

CONCLUSION

This study highlight and demonstrates the immune-modulating effect of vitamins A in malaria if our environment. In addition it also demonstrates the low levels of parasitaemia of malaria among febrile children presenting to the hospital.

A lot of children were treated for malaria despite negative malaria parasite smears and negative rapid diagnostic smears (12.3%) .

The administration of vitamin A shortened hospital study in those who were giving the supplement and had reversal effect on night blindness, skin rash and other clinical features f malaria including joint pain. This effect seen might be due to it, immune-modulatory or immune-boosting ability.

This study also showed a correlation between admitting temperature and long .. of hospital stay and temperature of time of collection of blood samples and length of hospital stay.

It also demonstration, use of insecticide treated net and malaria prophylaxis.

However the use of malaria prophylaxis was low (84.9%). This might be due to economic factors or low level of awareness. The study also revealed that those that received antimalarials while on administered a large mean hospital stay.

RECOMMENDATIONS

Achieving successful management of malaria in children required ancillary management in addition to anti-malarial drugs administration and vector control.

From the findings of this study the following recommendation are made:

1. Supplementation of vitamin A in the diets of children.
2. Awareness of beneficial effects of vitamin A made to the healthcare community and parents.
3. Administration of vitamin A to children with clinical features of vitamin A deficiency and febrile episodes
4. Expanded studies several centers to validate the beneficial immune boosting effects of vitamin A.

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