www.ajbrui.org

Afr. J. Biomed. Res. Vol. 20 (May, 2017); 111- 119

Full Length Research Paper

Pain in Malaria: An Assessment of Its Prevalence, Characteristics and Determinants in Ibadan, Nigeria

Idokoko A.B[1], *Ajayi I.A[1], Falade C.O[2] and Soyanwo O[3]

[1]*Department of Epidemiology and Medical Statistics, College of Medicine, University of Ibadan, Ibadan, Nigeria*
[2] *Department of Pharmacology and Therapeutics, College of Medicine, University of Ibadan, Ibadan, Nigeria*
[3]*Palliative care unit, University College Hospital, Ibadan, Nigeria*

ABSTRACT

Morbidity and mortality due to malaria in sub-Sahara Africa remains unacceptably high, slowing socioeconomic development in endemic communities. Pain is one reason why malaria-patients seek medical attention. However, pain due to malaria is often ignored, poorly evaluated and virtually un-studied. This study explored this pain among outpatients in Ibadan, Nigeria. This facility-based, cross-sectional survey conducted in Ibadan examined seven-hundred out-patients, aged ≥6years, with acute-uncomplicated-malaria. They were evaluated for the presence, quality, intensity and effects of pain using validated instruments incorporating the category and Wong-Baker faces scales. Data were summarized, tested for association at α=0.05 and a logistic regression model of covariates fitted to predict the risk of pain. Respondents' mean age was 33.0±16.1years, 12.7% children, 66.6% females and 72.3% had "malaria pain". The head (66.0% vs.72.8%), general muscular sites (17.0% vs.39.5%), abdomen (37.7% vs.11.4%) and joints (5.7% vs.17.0%) were the commonest localization of malaria-pain while, the character was aching in 91.9% vs.90.6%, intermittent pattern in 71.2% vs. 64.7% among children versus adults, respectively. At peak, pain-intensity was rated moderate and severe in 47.2% and 23.4% of respondents, able to completely interrupt work/school in 4.3%. Respondents' gender, age-group, packed cell volume, using any antimalarial and non-usage of Artemisinin-based Combination Therapy had significant association with experiencing malaria-pain. This study highlighted pain as a significant symptom of malaria with higher risk in children, males, persons with hematocrit <30% and those not using artemisinin-based combination therapy. More attention needs to be paid to the assessment and effective treatment of malaria-pain.

Keywords; *Acute-uncomplicated-malaria, Malaria-pain, Malaria-pain-intensity, Malaria-pain-character*

*Author for correspondence: *E-mail:* ikeajayi2003@yahoo.com. Tel: +234-8023268431

Received: August, 2016; Accepted: February, 2017

Abstracted by:
Bioline International, African Journals online (AJOL), Index Copernicus, African Index Medicus (WHO), Excerpta medica (EMBASE), CAB Abstracts, SCOPUS, Global Health Abstracts, Asian Science Index, Index Veterinarius

INTRODUCTION

Malaria poses enormous public health challenge in 106 endemic countries with an estimated 3.3 billion people at risk, over 216 million new cases annually and 81% of these occur in Sub-Sahara Africa (WHO Global Malaria Programme, 2011). In South-West Nigeria, a high transmission zone, malaria is the most common reason for outpatient visits to health institutions and Plasmodium falciparum, the most virulent specie, accounts for >95% of cases (WHO Global Malaria Programme, 2011; Okonko, et al., 2010).

The International Association for the Study of Pain (IASP) defines pain as any unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage (Smith and Torrance, 2008). The painful bite of an infected female anopheles mosquito marks the beginning of a retinue of pain that malaria patients will likely suffer. After an incubation period of 10-21 days, malaria usually present clinically as fever, general malaise, headache, muscle aches, joint pains, vomiting, diarrhoea and clinical anaemia, among other symptoms (Kumar and Clark, 2006; Martín-Rabadá and Bouza, 2004; Krause, 2008; Song, et al. 2003). These symptoms, particularly pain and fever, incapacitate the sufferers so much that economic productivity is reduced due to resultant absenteeism from schools and places of work (Gallup and Sachs, 2000).

Pain as a symptom seen in malaria is a common experience that aggravates the morbidity from the illness and probably contributes most to the incapacitation experienced by sufferers as it is one of the most common reasons for patients

to seek medical attention (Smith & Torrance, 2008; Watkins, Wollan, et al, 2008; American Medical Association, 2010; Zaki, 2010).

However, malaria pain is often overlooked and not always assessed or documented in detail. Analgesics are prescribed routinely as part of malaria treatment without fully evaluating the pain. Evaluation of the severity of pain is essential to monitoring the effectiveness of treatment provided for malaria and may go a long way in ameliorating the economic burden of the disease. This study was carried out to evaluate the prevalence of pain due to malaria in patients suffering from acute uncomplicated malaria and to determine the pattern, character, site and severity of this pain, as well as, the relationship of the pain with selected variables such as fever, level of parasitaemia, packed cell volume (PCV), temperature and socio-demographic variables.

In this study, the following terms were defined thus: Febrile refers to a measured axillary temperature $\geq 37.5\ ^0$C while Children refer to persons between the ages of six (6) and twelve (12) years.

MATERIALS AND METHODS

Study Design:
This was a hospital-based, cross-sectional study at two major health facilities in Ibadan, southwest Nigeria, involving out-patients diagnosed of acute-uncomplicated malaria.

Study Sites and Setting:
The facilities used were the General Outpatient Department (GOPD) of the University College Hospital (UCH), Ibadan (a tertiary level care hospital) and the Outpatient Clinics of Our Lady of Apostles Catholic Hospital (Oluyoro), Oke-Offa, Ibadan (a secondary level health care facility). Both the GOPD, UCH and Our Lady of Apstle Catholic Hospital have patient walk-in facilities.

Ibadan is a city located in the tropical rain forest belt of south-west Nigeria where malaria transmission is holoendemic. It has a lengthy wet season (May to October) that sees somewhat of a lull in precipitation in August which nearly divides the wet season into two different periods (Ogolo & Adeyemi, 2009). Rainfall peaks in June and September and the mean total rainfall is about 1420.06mm, falling in approximately 109 days. November to February is the city's dry season, during which the typical West African harmattan is experienced. Temperature throughout the course of the year is relatively constant and the mean maximum temperature is 26.46 ^{o}C, minimum 21.42^{o}C while the average relative humidity is 74.55% (Ogolo & Adeyemi, 2009). The foregoing factors synergize to make Ibadan a high malaria transmission environment (WHO Global Malaria Programme, 2011).

The General Out-Patient clinic of the UCH is a walk-in section of the teaching hospital specifically set up for ease of access to patients while, Our Lady of Apostles Hospital is a popular first call center for outpatient consultations among the indigenous people of Ibadan. Both hospitals are known to attract relatively larger number of patients suffering from febrile illnesses.

Subjects Selection & Sample Size:
Consecutive patients, aged six years or more, diagnosed to have acute-uncomplicated-malaria (World Health Organization, 2006) by the attending physicians were enrolled for this study after testing by microscopy of Giemsa-stained thick film if they fulfilled other inclusion criteria such as presenting at the study centres with fever, and/or a history of fever within 24 hours of presentation or other symptoms compatible with acute-uncomplicated-malaria, absence of any other septic focus and provision of a verbal informed consent by the enrolee/parent or guardian for enrolees less than 18 years of age. However, patients with signs and/or symptoms of severe malaria, pregnant women, patients with haemoglobin SS or SC, recent history of trauma, patients with history or evidence of chronic pain including arthritis, those considered to be very ill by themselves or the interviewer, and those who did not provide informed consent for study were excluded.

With α chosen as 0.05, the calculated minimum sample size to achieve a power of 80% was 667 respondents.

Data Collection Procedure and Instrument:
Data were collected over a three (3) month period (July to October, 2011) Enrollees were interviewed by trained research assistants who had in-depth knowledge of the local Yoruba language and English. Laboratory scientist took capillary samples for packed cell volume (PCV) and thick blood film for microscopy from a single finger prick procedure done aseptically in the side-lab.

The data collection instrument was structured into four sections adapted from the standardized McGill Pain Questionnaire (MPQ), incorporating validated pain intensity rating scales (Melzack, 2005). This was translated into Yoruba; the predominant local language in Ibadan and back-translated for correctness.

Pain severity or intensity was evaluated using the 0-10 Numeric Pain Intensity Rating Scale (NRS) in adult subjects and the Wong-Baker FACES Pain Rating scale was for subjects of ages 6-10 years. Both scales allowed rating of the subject's pain as No pain = 0, Mild pain (1-3), Moderate pain (4-6), Severe pain (7-9) and Worst pain imaginable (10). For illiterate subjects over 12years, a similar 10cm Visual Analogue Scale (VAS) was made available for their assessment. In the same manner, the rating of the effect of pain on routine daily activities was measured on a scale of 0-10 with 0=no effect, 1-3=mild effect, 4-6=moderate effect, 7-9=severe effect and 10=complete interruption of routine life activities (American Medical Association, 2010; Chapman & Syrjala, 2001; Loeser, 2001; Melzack, 2005).

Data Analysis and Statistical Considerations
Data entry, cleaning and analysis was done using SPSS (Statistical Package for Social Sciences version 17.0). Mean ± standard deviation was used to summarize each quantitative variable while qualitative variables were summarized with proportions. The $\chi 2$ test was used to investigate bivariate associations between qualitative variables at 5% level of significance while, logistic regression model of covariates were fitted step-wisely to predict the risk of occurrence of malaria pain among the respondents. Hosmer-Lemeshow test was used to test the goodness of fit of each model if $p \geq 0.05$.

Ethical Considerations:
This study was carried out in keeping with the Modified Declaration of Helsinki (2008) by the World Medical Association as domesticated in Nigeria in the August 2007 version of the National Code of Health Research Ethics by the Federal Ministry of Health, Nigeria.

Dual ethical approvals were obtained for this study. One from the University of Ibadan/University College Hospital Institutional Health Research Committee and another from The Research Ethics Review Committee at Our Lady of Apostle's Catholic Mission Hospital, Ibadan.

Permissions from the management of the health facilities were obtained as well as individual informed verbal consent from each participant. Informed consent information leaflet were made available to potential participants. All data obtained were treated with absolute confidentiality and the laboratory investigations were done free of charge for the study subjects.

RESULTS

Seven hundred study participants diagnosed of acute uncomplicated malaria at the two study centres were enrolled into this study over a three-month period. However, data for 668 (95.4%) were analysed as responses in 32 (4.6%) questionnaires were incomplete/unsuitable. Translation and back-translation of key components of the questionnaire into the most widely spoken local language, Yoruba, as well as, adopting interviewer administration improved the accuracy and completeness of responses.

Socio-Demographic Distribution of Respondents and their Clinical Characteristics

Our findings show that 81.6% of the respondents were from the Yoruba ethnic group, 88.7% were adults (12years or older), 66.6% were females, 58.2% were married as shown in Table 1.

The mean age of respondents was 32.5±16.1years, with a range of 6-81years. Majority of the respondents (48.4%) were aged between 20 and 39 years and this group holds high economic and social value in any community.

Over 70% (474/668; 70.9%) of the respondents had taken antipyretic analgesics prior to presentation at the clinic while 150/668 (22.5%) had started a course of antimalarial as self-medication before presentation at the hospital. One hundred and five (70%) of these used one of the recommended ACTs. The use of ACT and antipyretic analgesics at home before hospital consultation may explain the relatively low (10.9%) proportion of enrolees who had axillary temperature ≥37.5^{o}C but, all respondents complained of fever or gave a 24hour history of fever at presentation.

Malaria Pain Prevalence, Distribution and Bivariate Associations

The overall prevalence of pain due to malaria among the febrile patients studied was 72.3% with age group differences as shown in Figure 1. A higher proportion of adults (73.8%) had malaria pain compared with 62.4% of children. This should be seen against the background of pain as a subjective symptom that adults are better able to express and define than children.

When stratified by age group, there was a statistically significant gender variation such that: 65.1% of female children had pain compared to 59.5% of male children. Similarly, 77.1% of adult females had pain compared to 66.3% of adult males.

Table 1
Socio-Demographic Distribution of Respondents

Socio-Demographic Characteristic	Category	Freq. (N=668)	Percent (%)
Age (years)	Children (<12years)	85	12.7
	Adult (≥12years)	583	87.3
Age Group (years)	Less than 10	58	8.7
	10-19	83	12.4
	20-29	148	22.2
	30-39	175	26.2
	40-49	98	14.7
	50-59	60	9.0
	60 or more	46	6.9
Sex	Male	223	33.4
	Female	445	66.6
Nationality	Nigerians	665	99.6
	Non-Nigerians	3	0.4
Ethnic Origin of Nigerians	Yoruba	545	81.6
	Igbo	69	10.6
	Edo	18	2.7
	Hausa	10	1.5
	Delta-Urhobo	10	1.5
	Others	16	2.4
Highest Education level	No Formal Education	36	5.4
	Primary	114	17.1
	Secondary	148	22.2
	Tertiary	370	55.4
Employment Status	Unemployed	240	35.9
	Self-employed	175	26.2
	Employee	253	37.9
Marital Status	Single	268	40.1
	Married	389	58.2
	Others	11	1.6
Religion	Christians	501	75.0
	Muslims	167	25.0

There was no statistically significant association between the presence of malaria pain among the respondents and fever at presentation, level of education, occupational status, religion, marital status and ethnic group as shown in Table 2.0. In addition to the respondent's sex (p=0.003) and age group (p=0.028), bivariate analysis showed that PCV level (p=0.005), use of antimalarial medications (p=0.009) or use of ACTs (p=0.002) have statistically significant association with the presence of pain during malaria illness (Table 2).

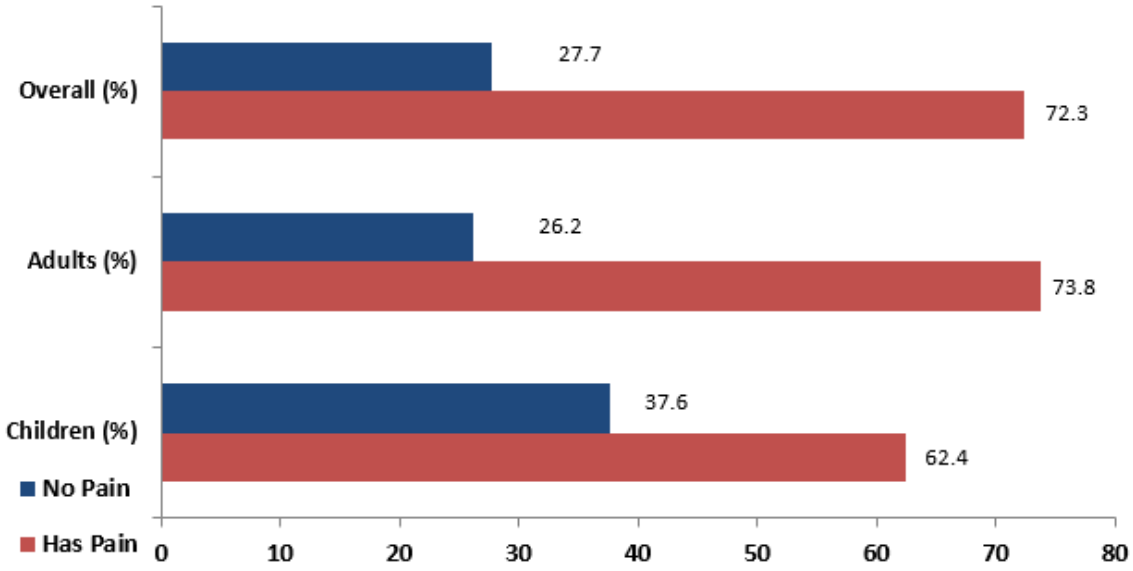

Figure 1
Prevalence of Malaria Pain and the Age Group Variation (p=0.028)

Table 2: Bivariate Analysis of having Malaria Pain with Selected Variables

Variable	Category	Had Pain		χ^2	Df	P-Value
		YES(n=483) Freq. (%)	NO (n=185) Freq. (%)			
Age Group	Children	53 (11.0)	32 (17.3)	4.8	1	0.028
	Adult	430 (89.0)	153 (82.7)			
Sex	Male	145 (30.0)	78 (42.2)	8.9	1	0.003
	Female	338 (70.0)	107 (57.8)			
Ethnic Origin	Yoruba	397 (82.2)	148 (80.0)	0.43	1	0.513
	Others	86 (17.8)	37 (20.0)			
Highest Education	None	29 (6.0)	7 (3.8)	3.1	3	0.383
	Primary	83 (17.2)	31 (16.8)			
	Secondary	100 (20.7)	48 925.9)			
	Tertiary	271 (56.1)	99 (53.5)			
Employment Status	Unemployed	168 (34.8)	72 (38.9)	3.2	2	0.199
	Self-employed	122 (25.3)	53 (28.6)			
	Employee	193 (40.0)	60 (32.4)			
Marital status	Single	186 (38.5)	82 (44.3)	2.5	2	0.284
	Married	290 (60.0)	99 (53.5)			
	Others	7 (1.5)	4 (2.2)			
Religion	Christians	367 (76.0)	134 (72.4)	0.9	1	0.343
	Muslims	116 (24.0)	51 (27.6)			
Axillary Temp. at Presentation	Afebrile	427 (88.4)	168 (90.8)	0.8	1	0.373
	Febrile(≥37.5°C)	56 (11.6)	17 (9.2)			
Used Analgesics	**Yes**	250 (71.2)	54 (69.2)	0.1	1	0.726
	No	101 (28.8)	24 (30.8)			
Used Antimalarial	**Yes**	121 (25.1)	29 (15.7)	6.8	1	0.009
	No	362 (74.9)	156 (84.3)			
Used ACTs	**Yes**	89 (18.4)	16 (8.6)	9.7	1	0.002
	No	394 (81.6)	169 (91.4)			
PCV <30%	**Yes**	17 (5.3)	14 (13.7)	8.0	1	0.005
	No	303 (94.7)	88 (86.3)			

Table 3: Localization of Malaria Pain by Respondents

Body Site/Region	Freq.	Percent. (%)
Head(n=483)	348	72.0
General Muscular(n=483)	179	37.1
Joints(n=483)	76	15.7
Abdomen(n=483)	69	14.3
Lower Limb(n=483)	39	8.1
Back(n=483)	29	6.0
Upper Limb(n=483)	20	4.1
Chest(n=483)	18	3.7
Neck(n=483)	12	2.5
Other Body Areas (genitals, etc.) (n=483)	5	1.0

Character, Pattern and Location of Malaria Pain

Overall, the character of the pain due to malaria, as experienced by respondents, was most commonly aching (91.7%). This was 90.6% versus 91.9% among adults versus children, respectively. Other terms used to describe malaria pain by respondents were throbbing (2.3%), burning (3.5%), colicky (2.1%) and sharp (0.4%). Three hundred and fifteen (70.5%) of 447 who responded to the pattern of occurrence of malaria pain question said their pain occurred intermittently (64.7% versus 71.2% among children versus adults, respectively) while, 132 (29.5%) said it was a continuous pain (28.8% versus 35.3% among children versus adults, respectively). This study found that the most common sites of pain among the respondents are in the following order of frequency; head (72%), general muscular sites (37.1), joints (15.7), abdomen (14.3%) and the lower limb (8.1%) (Table 3). The pain location showed age group variation such that the head (66.0% versus 72.8%), general muscular sites (17.0% versus 39.5%), abdomen (37.7% versus 11.4%) and joints (5.7% versus 17.0%) were the most common location of pain among children versus adults, respectively.

Our findings suggest that malaria pain did not radiate to other parts of the body in 87.2% of respondents. There was however some difficulty with determining the specific site of pain radiation during data collection because most of the respondents had more than one site of pain at the same time. Hence, defining which pain radiate to another site was difficult.

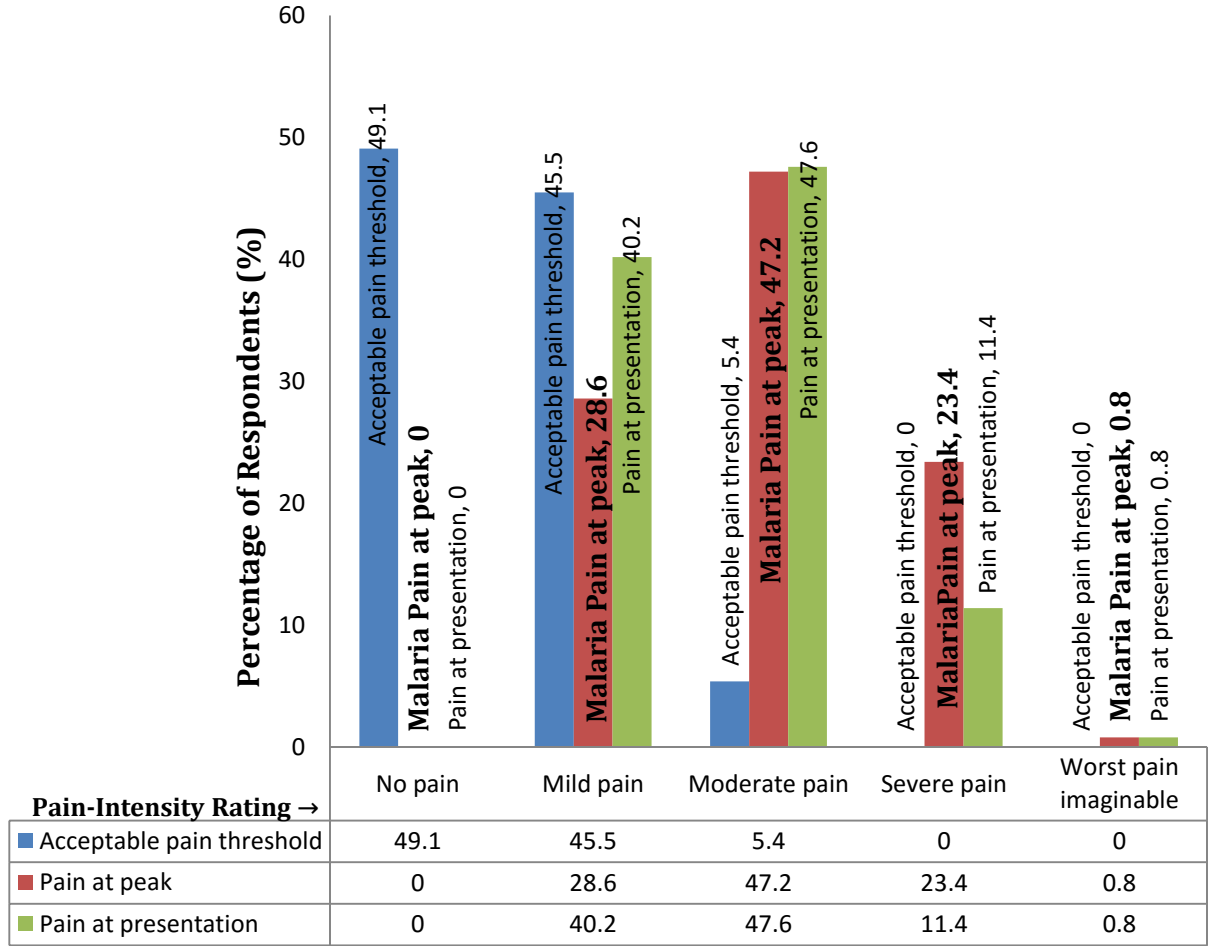

Figure 2

Rating of Malaria Pain-Intensity by Respondents at Peak and at Presentation in Clinic

Table 4
A Logit Model of Factors Statistically Associated with Malaria Pain

Explanatory Variable	Category	Adjusted Odds Ratio (OR)	95% CONFIDENCE INTERVAL OF OR		*p-VALUE*
			LOWER	UPPER	
Age (years)	**Children**	1.72	0.93	3.20	0.086
	Adult (ref.)	1.00			
Sex	**Male**	1.53	0.94	2.58	0.087
	Female (ref.)	1.00			
Used Antimalarial	**Yes**	1.71	0.77	3.82	0.190
	No (ref.)	1.00			
Used ACTs	**No**	5.40	1.71	16.88	0.004
	Yes (ref.)	1.00			
Anaemia	**No**	0.36	0.17	0.78	0.009
	Yes (ref.)	1.00			

Malaria Pain Intensity

Overall, with respect to malaria pain intensity at time of presentation to clinic, 230 (47.6%) respondents rated their pain as moderate, 189(39.1%) said it was mild and 5 (11.4%) reported severe pain (Figure 2). On assessing the expression of their malaria pain intensity in words, this study found that 311 (64.4%) respondents rated their malaria pain as just discomfort; 113 (23.4%) said it was mild while, a few said it was horrible [4 (0.8%)] and only 1 (0.2%) said it was excruciating at the worst/peak time of the pain.

Using the Numeric pain intensity Rating Scale (NRS) for the respondents' pain at worst/peak time point, 228 (47.2%) respondents rated their pain as moderate pain, 138 (28.6%) had mild pain, 113 (23.4%) had severe pain and 4 (0.8%) had worst pain imaginable. These findings seem comparable to that found using the verbalized rating above.

When examined together, the findings above show that a considerable number of respondents experienced severe pain as a result of malaria illness but. However, none of the socio-demographic characteristics of respondents or their clinical parameters were significantly associated with the experience of severe malaria pain at 5% level of significance.

Determinants and Risk of Pain in Malaria

Variables that had statistically significant association with experiencing pain during malaria illness were pulled step-wisely into a logistic regression model to determine the risk of experiencing pain due to malaria in the presence of those factors in the respondents. Hosmer and Lemeshow goodness of fit test of model fitness was significant (p=0.461) for this model. Details of the result are as shown in Table 4, which reveal that children were 1.7 times more likely than adults; and males were 1.5 times more likely than females to experience malaria pain but, both findings were not statistically significant at 95% confidence level. If the level of significance is shifted to the 10% level then, children had 70% excess risk over adults and males had 50% excess risk over females to develop pain in the course of their malaria illness.

When respondent's clinical characteristics were pulled into the model, those who did not use ACT prior to presentation were 5.4 times more likely than those who did to have malaria pain which implies 440% excess risk on the side of those who did not use ACTs prior to presenting in hospital. In like manner, respondents with PCV<30% (classified as anaemic) were 2.8 times more likely than those with PCV ≥30% to suffer pain during a bout of malaria. Both findings were statistically significant with 95% confidence (0.17-0.78, p=0.009).

Table 4 also show that those who used any antimalarial drug before reporting to clinic had a higher risk of malaria pain than those who did not take any antimalarial drug. That finding is statistically insignificant, (95% CI 0.77-3.82, p=0.190), as the adjusted-OR crossed the 1.0 neutrality mark. In other words, the logit model of determinants of malaria pain shows that there is statistically significant evidence that having PCV < 30% or not using artemisinin-based combination therapy (ACTs) early increased respondent's risk of having malaria pain in the presence of all other statistically associated factors.

Effects of Malaria Pain on Respondents' Essential Daily Life Activities

Results of the assessment of the perceived effect of malaria pain experience on respondents' routine essential life activities seem to support the prior knowledge that malaria inhibit individual productivity with enormous socioeconomic consequences resulting in slowed development of endemic societies (Gallup & Sachs, 2000).

Malaria pain was perceived by respondents to have affected their essential life activities to varying degree as shown in Table 5. One hundred and seventy-five (36.2%) respondents with malaria pain said it did not interfere with their work or school but, a much larger number (63.8%) rated the interference of malaria pain on their attendance at school or work as mild (25.3%), moderate (21.3%), severe (12.8%) and completely (4.3%). The finding that 63.8% of the respondents claimed that the pain interfered with their work or school activities clearly brings to light the contribution of malaria pain to the socio-economic burden of malaria as highlighted by Gallup & Sachs, 2000.

Although 35.8% of the respondents said that malaria pain did not interfere with their mood, it is noteworthy that 29.2% of respondents said it influenced their mood mildly, 23.8% moderately, 9.7% severely and 1.4% completely.

Table 5
Respondents' Perceived Effect of Malaria Pain on Selected Life Activities

Life Activity	Does not interfere Freq. (%)	Mildly interfere Freq. (%)	Moderately interfere Freq. (%)	Severely interfere Freq. (%)	Completely interfere Freq. (%)	Total Freq. (%)
School or work	175 (36.2)	122 (25.3)	103 (21.3)	62 (12.8)	21 (4.3)	483 (100)
Mood	173 (35.8)	141 (29.2)	115 (23.8)	47 (9.7)	7 (1.4)	483 (100)
Walking	192 (39.8)	149 (30.8)	97 (20.1)	41 (8.5)	4 (0.8)	483 (100)
House chores	185 (38.3)	143 (29.6)	113 (23.4)	36 (7.5)	6 (1.2)	483 (100)
Relation with people	202 (41.8)	160 (33.1)	93 (19.3)	23 (4.8)	5 (1.0)	483 (100)
Sleep	219 (45.3)	120 (24.8)	91 (18.8)	41 (8.5)	12 (2.5)	483 (100)
Enjoyment of life	210 (43.5)	135 (28.0)	93 (19.3)	38 (7.9)	7 (1.4)	483 (100.)

The pain also interfered with the ability of respondents to ambulate to varying degrees among 291 (60.2%) of respondents while 192 (39.8%) study participants claimed that the pain did not interfere with walking (see Table 5.0.). In a similar manner, 185 (38.3%) respondents reported no interruption in the performance of routine house chores as against 283 (60.7%) that had interruption of house chores as a result of pain perceived to be due to malaria and this occurred in varying degrees. The pain experienced also affected respondents' relationship with other people; 202 (41.8%) said it did not.

Our findings also showed that almost half of the respondents (45.3%) slept well, as they usually did despite the malaria pain experienced. When enquiries were made on the effect of malaria pain on other aspects of life, respondents said malaria pain interfered with their usual feeling of enjoyment of life. Two hundred and seventy-three (56.7%) respondents had interruption in their enjoyment of life; some mildly 135 (28.0%), others moderately [93 (19.3%)], severely [38 (7.9%)] and some completely [7 (1.4%)].

DISCUSSION

Our study was conducted in south west Nigeria where the Yoruba ethnic group constitutes the majority of inhabitants, it is thus not surprising that 81.6% of the respondents were of the Yoruba ethnic group. As seen in Table 1.0., most of the respondents (88.7%) were person 12years of age or older, mean age was 32.5±16.1 years, with a range of 6-81years leaving out the under-5-year-old children who suffer most from malaria. We deliberately chose a minimum age of six years as part of our inclusion criteria in order to ensure that study participants were old enough to understand the pain rating instruments and report more correctly their perception of pain. Almost half (48.4%) of the enrolees were aged between 20 and 39 years. This underscores the significance of the findings of this study as this age-group holds high economic and social value in any community.

The majority of the respondents in this study were females (66.6%). This may be explained by the knowledge that women have a higher tendency to utilize health services and a socio-cultural trend that makes women more likely to seek medical care compared to males (Bertakis et al, 2000). The finding that most of the respondents had at least primary education is a reflection of study location being in southwest Nigeria where free primary education has been a government policy since 1955. This educational exposure may have also informed their choice of hospital care as against traditional herbal alternatives that is most common among the un-educated population in this region (Bertakis et al, 2000).

The findings shown in Figure 1.0 puts the prevalence of pain among cases of acute uncomplicated malaria reporting to health facilities in Ibadan at 72.3%, with some age group variability. More adults (73.8%) had malaria pain compared with 62.4% of children and this difference was statistically significant (p=0.028). This study also showed that 77.1% of adult females had pain compared to 66.3% of adult males. This finding that more females compared to males reported pain may be explained by a similar sex difference found in a clinical pain threshold study by Lowery et al. The generally held social perception that females have a lower threshold for pain compared to males can only apply if we can rule out the culturally-lauded tendency for men to conceal their pain experience just to prove machoism. However, explaining this gender difference from the generally held social perception that females have a lower threshold for pain compared to males may not apply here because this study didn't rule out the culturally-lauded tendency for men to conceal their pain experience just to prove machoism (Lowery et al, 2003).

Further bivariate analysis did not find any statistically significant association between the presence of malaria pain among the respondents and parameters such as fever at presentation, educational status, occupational status, religion, marital status or their ethnic group as shown in Table 2.0. The respondent's sex (p=0.003), age group (p=0.028), haematocrit (p=0.005), prior any antimalarial drug use (p=0.009) or specifically ACT use (p=0.002) have statistically significant

association with the presence of pain during malaria illness. These findings have useful clinical and health policy application.

The character of the malaria pain experienced by respondents was most commonly aching (91.7%), intermittent (70.5%) in pattern, and mostly localised to the head, general muscular sites, joints, abdomen and did not radiate to other body location in 87.2% of respondents. An earlier study carried out in Pakistan by Zaki, (2010) reported similar findings regarding abdominal pain. The pathophysiologic mechanisms of these findings require more research attention.

This study assessed the acceptable pain threshold for the respondents where most of the respondents (49.1%) said they would rather not feel any pain at all and 45.5% would tolerate mild pain intensity only. This makes very lucid the need for analgesia in the routine clinical care of patients with acute uncomplicated malaria. It is very important to minimize the suffering of patients given the findings that 47.2% rated their malaria pain intensity as moderate pain and 23.4% said it is severe pain, which are far above the acceptable pain threshold of the respondents. From further analysis, none of the socio-demographic characteristic or clinical parameters had significant association with the experience of severe malaria pain at 5% level of significance.

The logit model reflects that children are 1.7 times more likely than adults; males are 1.5 times more likely than females to experience malaria pain in this study, though these were not statistically significant at 95% confidence level. At the 10% level of significance, it will become statistically significant that children had 70% excess risk over adults and males had 50% excess risk over females to develop pain in the course of their malaria illness in this study. When all other factors were pulled into the logit model of determinants of malaria pain, there was statistically significant evidence that having PCV < 30% or not using artemisinin-based combination therapy (ACTs) early increased respondent's risk of having malaria pain in the presence of all other statistically associated factors.

This study highlighted the role of malaria pain in the overall socio-economic burden of malaria on the patient, their family and the society as it assessed the perceived effect of malaria pain experience on respondents' routine essential life activities. Findings are consistent with prior knowledge that malaria inhibit individual productivity with enormous socioeconomic consequences resulting in slowed development of endemic societies (Gallup & Sachs, 2000). As shown in Table 5.0., malaria pain made 63.8% of respondents unable to effectively do their work or school activities. Malaria pain also affected mood (64.2%), relationship with people (58.2%) and ability to ambulate (60.2%) in the respondents studied. Findings also showed that the pain disrupted sleep in 54.7% of the respondents. This clearly bring to light the contribution of pain to the socio-economic burden of malaria as highlighted by Gallup & Sachs, 2000.

The findings of this study should be interpreted with the understanding that no satisfactory objective indicators of pain exist and that pain is a fundamentally subjective state. This restriction to subjectivity reduces pain to a scientific meta-phenomenon and forces the investigator or clinician to depend on the patient for accurate and reliable data. Moreover, clinical pain intensity does not vary directly with the extent or severity of clinical pathology or even with the number of nociceptors stimulated. (Chapman & Syrjala; 2001). Meticulous efforts were made to rigorously enforce inclusion and exclusion criteria during this study but, there remain a very small chance that some patients who had non-malaria febrile illnesses or other concomitant infection or comorbidities might have been inadvertently included in this study. Also, this study was carried out in two centres excluding community malaria cases that didn't report to hospital and children under 6 years of age who may not be able to express their pain experience in measurable terms detectable by the instruments used. As a result, findings and inferences from this study should be applied accordingly.

In conclusion, the findings of this study highlights pain as a significant contributor to the burden of malaria and its intensity rating is much above the threshold acceptable to patients. Physicians and other health care workers should endeavour to make accurate evaluation and treatment of pain, a priority in the management of acute uncomplicated malaria. The use of highly efficacious antimalarial drugs such as ACTs which reduce parasite biomass quickly thereby shortening the period of illness may reduce the duration of malaria pain and is recommended.

The findings underscore the need to incorporate intervention for pain management and its research into current local, national and global efforts to roll back and eliminate malaria as a public health problem. However, further multi-centre longitudinal studies may help improve our knowledge and understanding of the pathophysiologic mechanism of pain, its course and management among patients suffering from malaria.

Competing interest/conflict of interest/sponsorship

The authors hereby declare that there is no conflict of interest with respect to this work. It was essentially an academic research with no external funding. The investigators bore the direct and indirect cost of this work. Adhoc staffs were properly remunerated according to pre-agreed terms.

Acknowledgement

The authors are grateful to all the patients who willingly gave informed consent to this study, as well, as the management and staff of the General Outpatient Department of University College Hospital, Ibadan and Our Lady of Apostles' Catholic Hospital, Oluyoro, Oke Offa, Ibadan, Nigeria for their contributions in diverse ways.

REFERENCES

American Medical Association (2010): Pain Management: Pathophysiology of Pain and Pain Assessment. *AMA CME Module 1*. Chicago, *https://www.hitpages.com /doc /6629256520007680/1*

Bertakis KD, Azari B, Helms LJ, Callahan EJ, Robbins JA (2000): Gender Differences in the Utilization of Health Care Services. J Fam Pract., 49(2):147-52

Chapman CR, Syrjala KL (2001): Measurement of Pain. In: Loeser JD, Butler SH, Chapman CR, Turk DC, eds. *Bonica's Management of Pain.* 3rd ed. Baltimore, MD: Lippincott Williams & Wilkins, ebook.pdb: 40.

Gallup JL, Sachs JD (2000): The Economic Burden of Malaria. In *CID Working Papers, Harvard University*, 52:1-24.

Krause PJ (2008): Malaria (Plasmodium). In Behrman RE, Kliegman RM, Jenson HB, Stanton FB, eds. *Nelson Textbook of Paediatrics*. 18th ed. Philadelphia: WB Saunders; 1477-1485.

Kumar P, Clark M (2006): Infectious Diseases, Tropical Medicine and Sexually Transmitted Diseases: Protozoal Infections. *Kumar and Clark Clinical Medicine*. 6th ed. London: Elsevier; 95-106.

Loeser JD (2001): Medical Evaluation of the Patient with Pain. In: Loeser JD, Butler SH, Chapman CR, Turk DC, eds. *Bonica's Management of Pain.* 3rd ed. Baltimore, MD: Lippincott Williams & Wilkins, ebook.pdb: 37.

Lowery D, Fillingim RB, Wright RA (2003): Sex Differences and Incentive Effects on Perceptual and Cardiovascular Responses to Cold Pressor Pain. *Psychosomatic Medicine*, 65(2): 284–291.

Martín-Rabadá P, Bouza E (2004): Blood and tissue protozoa. In: Cohen J, Powderly WG, Berkley SF, Calandra T, Clumeck N, Finch RG, Hammer SM, Holland SM, Kiehn TE, McAdam KPWJ, Maki DG, Norrby SR, Opal SM, Ronald AR, Solberg CO, Verhoef J, eds. *Infectious Disease*. 2nd ed. Edinburgh: Elsevier; 2443-2447.

Melzack R (2005): The McGill Pain Questionnaire: From Description to Measurement. In: Raja SN, ed. *Anesthesiology*, 103(1), 199-202.

Ogolo, E. O., & Adeyemi, B. (2009): Variations and Trends of Some Meteorological Parameters at Ibadan, Nigeria. *The Pacific Journal of Science and Technology*, *10*(2), 981-987.

Okonko IO, Donbraye-Emmanuel, OO, Donbraye E, Abubakar MJ, Fowotade A, Fadeyi A, Babalola ET, Ojezele MO, Adeyi AO (2010): Malaria parasitaemia among patients in Ibadan, Southwestern Nigeria. *Journal of Applied Biosciences*, **29**:1774-1780.

Smith BH, Torrance N (2008): Epidemiology of Chronic Pain. In: McQuay HJ, Kalso E, Moore RA, eds. *Systematic Reviews in Pain Research: Methodology Refined*. IASP Press. 247-273.

Song HH, O SO, Kim SH, Moon SH, Kim, JB (2003): Clinical Features of Plasmodium Vivax Malaria. *Korean Journal of Internal Medicine*, **18**:220-224.

Watkins E, Wollan P, Melton L, Yawn B (2008): A Population in Pain: Report from the Olmsted County Health Study. *Pain Medicine* 2008, **9**(2):166-174.

WHO Global Malaria Programme (2011): *World Malaria Report 2011*. Geneva: WHO Press, 3-48.

WHO (2006): Diagnosis of Malaria. In *WHO Guidelines for the Treatment of Malaria*. Geneva: WHO Press, 8-12.

Zaki SA (2010): Abdominal Pain as a Presenting Feature in Malaria. *Sri Lanka Journal of Child Health,* 39:158-159.