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Comparative effectiveness of arthemether-lumefantrine and artesunate-amodiaquine combination in treatment of uncomplicated malaria patients attending federal medical center Umuahia (FMC)

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Abstract
Malaria is a parasitic infection transmitted by the Anopheles mosquito that leads to acute life-threatening disease and poses a significant global health threat. The study aimed to compare the effectiveness of artemether-lumefantrine and artesunate-amodiaquine combinations in the treatment of uncomplicated malaria in patients attending Federal Medical Center, Umuahia, Abia State, Nigeria. Four hundred and four patients were recruited from those who were clinically diagnosed of uncomplicated malaria amongst those who visited the Federal Medical Center, Umuahia. Sample size was calculated using Cochran's formula. The following laboratory procedures were carried out for malaria parasite identification: parasite clearance rate, pack cell volume. The effectiveness of Artemether-lumefantrine and Artesunate-Amodiaquine was assessed using parasite clearance hematological analysis. The results of this study showed that there were good adherence to the two drug combinations (AA and AL) and their Creatinine at $p<0.05$ for day 0, 3, 7, 14 and 28 of AA and AL, with $p=0.0001$ of all the days. The results of the study also showed that Artesunate-Amodiaquine displayed more parasite clearance rate than artemether-lumefantrine with median parasite count of 80 and 90 respectively. The result also showed that Artesunate-Amodiaquine had a better median parasite count reduction (96) than Artemether-lumefantrine (98) after 4 weeks indicating that Artesunate-Amodiaquine has better effect in parasite reduction than Artemether-lumefantrine. It is therefore recommended that further studies should be carried out in other parts of the country to ascertain if the drug's combination effect are the same.

Keywords: Malaria, artemether-lumefantrine, artesunate-amodiaquine, resistance, haematology

1. Introduction
Malaria is a parasitic infection transmitted by the Anopheles mosquito that leads to acute life-threatening disease and poses a significant global health threat [1]. The number of total malaria cases globally increased in 2021(from 245 million in 2020 to 247 million in 2021), with most of the increase occurring in Africa. However, case incidence remained stable from 2020 to 2021 (59 cases per 1000population at risk) following an increase from 2019 (57 cases/1000 population) [2]. The increase in 2020 was associated with disruption to prevention and control strategies attributed to the COVID-19 pandemic. Similarly, deaths due to malaria increased in 2020 with respect to 2019 by 10%, but then declined to 619,000 in 2021 [2]. According to data from the Global Fund's malaria programme, at the start of the pandemic use of insecticide-treated bed nets decreased in certain areas, although home delivery of nets to avoid crowding managed to increase the number of nets distributed overall. However, the number of people with suspected malaria fever decreased by around 4%, with a consequent decline in treatment [3]. Overall, an estimated 63,000 malaria deaths between 2019 and 2021 were attributed to interruption of malaria control strategies in some areas due to COVID-19 [2]. Transmission and control of malaria are mediated by complex interactions and feedback loops among humans, mosquitoes, parasites, their environments, healthcare systems, and policy implementation at a given period of time [4].

Despite the significant progress in malaria reduction since 2010, according to the latest World malaria report, there were 249 million cases of malaria in 2022 compared to 244 million cases in 2021. The estimated number of malaria deaths stood at 608 000 in 2022 compared to 610 000 in 2021. The WHO African Region continues to carry a disproportionately high share of the global malaria burden. In 2022 the Region was home to about 94% of all malaria cases and 95% of deaths. Children under 5 years of age accounted for about 78% of all malaria deaths in the Region. Four African countries accounted for just over half of all malaria deaths worldwide: Nigeria (26.8%), the Democratic Republic of the Congo (12.3%), Uganda (5.1%) and Mozambique (4.2%) [5]. Artemisinin-based combination therapies (ACTs) have been the cornerstone in the efforts to reduce the global burden of malaria. However, the gains are jeopardized by the emergence and spread of resistance to artemisinin derivatives and their partner drugs in the Greater Mekong sub-region (GMS) in South-East Asia (SEA). Artemether-lumefantrine and artesunate-amodiaquine are adopted in treatment guidelines for uncomplicated *p. falciparum* malaria in majority of Sub-Saharan countries while dihydroartemisinin-piperaquine has been introduced in some few countries in the region [6]. The emergence of resistance to artemisinin derivatives and partner drugs mefloquine, piperaquine and lumefantrine in five countries of the GMS is of great concern to the world. Mutations in K13 propeller region [6] has been associated with delayed parasite clearance in the GMS region. In the effort to facilitate early detection of resistance for artemisinin derivatives and partner drugs, WHO recommends monitoring of ACT's efficacy in the malaria endemic countries [6]. And as such there is need to compare the most effective amongst Artermeter-lumefantrine and Artesunate-amodiaquine combination in the treatment of uncomplicated malaria in patient attending FMC Umuahia.

2. Methods

2.1 Study Location

This was a hospital-based study that was carried out in the Departments of Family Medicine, Chemical Pathology and Medical Microbiology, in Federal Medical Center, Umuahia, Abia State. The study was conducted at the General Outpatient Department (GOPD) of the hospital.

2.2 Study design

A longitudinal study design comparing the effectiveness of artesunate-amodiaquine and artemether-lumfantrine (ASAQ and AL) Fixed-Dose Combinations in patients using parasite clearance rate and haematological biomarkers of adult patients aged between 18 to 65 years, with a 28-day follow-up period.

2.3 Sample size determination

Study size was obtained using Cochran's Formula [7] with a confidence interval of 95% and a precision size of 10%. The total study size of the patients used in this study was four hundred and four (404). On account of uncomplicated malaria was 59.7% of patients who attended outpatient clinics.

2.4 Study Population

The study population consisted of outpatients who came to the health facility with uncomplicated malaria-like symptoms. Patients were referred to the study team for recruitment. Inclusion criteria for the study were as follows: (1) Patient with uncomplicated malarial within the ages of 18 and 65 (2) Patients with uncomplicated malarial without features of complications of malaria such as coma, convulsion, hematuria, jaundice, etc. (3) Patient with no prior history of hepatic, renal, neurological or any similar condition associated with disease pathology. (3) Patients who after being informed of the prospective study are willing to participate in the study. Criteria to stop the treatment and/or withdrawal of a patient from the study included the following: (1) occurrence of serious adverse effects (2) unsatisfactory therapeutic response. (3) Violation of the protocol; (4) withdrawal of consent; and (5) being lost to follow-up. Before inclusion, written informed consent was obtained from the patient or the patient's legal guardian. Approval was obtained from the hospital ethics committee before study onset.

2.5 Study Procedures

For each patient involved in the study, the protocol was read and explained to him/her. On acceptance, patient had to sign the informed consent forms to take part in the study. For all the recruited patients, baseline examinations and laboratory investigations were conducted immediately and free of charge. Those among the patients who met inclusion criteria at baseline were randomly assigned to one of the two treatment groups following a randomization list. In each study site, computer generated randomization codes were prepared by an independent individual. These codes were enclosed in sequentially numbered opaque sealed envelopes, each of which contained the treatment allocation. The envelopes were assigned in sequential order to participants after inclusion.

2.6 Method of selection and drug administration to participants in the study

Selected patients were divided into two groups of 202 patients per group to receive either AL or AA. Upon inclusion, the patient's name, age, sex, weight, educational qualification, mobile phone numbers and address were obtained.

Group 1 received oral Artemether plus Lumefantrine (Elbe Pharmaceuticals) 80/480, prescribed to adults above 35kg. On day 1 of administration, the start dose (1 tablet) was taken as observed and second dose was taken 8 hours after the start dose. On days 2 and 3, one tablet was taken in the morning and repeated 12 hours later.

Group 2 received oral artesunate plus amodiaquine, (IPCA pharmaceuticals) 100/270mg, prescribed to adults above 35kg. One tablet was given twice daily in the morning and evening, 12 hours apart for 3 days. All participants in each group received the first dose of antimalarial under observation and were educated about AL and AA dose regimen and the need to adhere to therapy. They were also advised on the need to take the drugs immediately after meals, especially, fatty food for those in group 1 who had AL. Patients were advised to repeat the dose should vomiting occur immediately after swallowing.

All participants in both groups were sent short message service (SMS) using a mobile telephone at appropriate times they were supposed to take the drugs on the second and third days of treatment and same was used to summon them on post treatment days (3rd, 7th, 14th and 28th day) to evaluate their clinical and laboratory outcomes. Participants were also assessed on the third day of treatment for adherence to the treatment regime. At each visit a symptom assessment questionnaire was used to determine a patient's clinical outcome. Participants found not to be improving (whose symptoms persisted) were referred to the clinician for further review and treatment.

2.7 Clinical Procedures

Patients were evaluated in the General Outpatients clinic of Department of Family Medicine in FMC Umuahia with the assistance of the Registers and Consultants of the Department Features of uncomplicated malaria were sought for. Patient demographic characteristics like: Age, sex, occupation, religion were also noted.

Vital measurement such as: Blood pressure, body weight, pulse, temperature were documented for each patient after which blood samples were collected aseptically for the investigations of some hematologic and biochemical parameters. These were done prior to the administration of the drugs. The vital signs of the patient were also monitored during and after treatment schedules.

2.8 Malaria parasite identification

Thick film

Using 10% solution Giemsa solution: Two drops of blood were placed at center of a clean microscopic slide. The blood was spread to make smear, covering an area of about 2cm. the slide was placed on a rack for 15 minutes to air dry the film. The slide was placed in a staining trough containing 10% Giemsa solution and allowed to stain for 15 minutes. After which the slide was immersed in a trough containing clean water. The back of the slide was cleaned and placed in a draining rack to air dry, after which, the slide was viewed with immersion oil X100 objective lens on the microscope to detect the presence of malaria parasite by viewing 100 fields of the thick film. Starting at the topmost part of the film, a field with a good number of white blood cells was identified and was counted. A multiply tally counter was used to simultaneously count both parasite and white blood cells by clicking on the assigned key as parasite or white cells were observed. After the parasite and white cells in one field had been counted in one field, the next field was counted following a left to right and then a right to left sequence avoiding fields that overlapped. Once more than or equal to a hundred parasite in two hundred white blood cells was counted, counting was stopped and results was recorded as the number of parasite per 200 white blood cells. When less than or equal to ninety-nine parasites in five hundred white blood cells was counted, counting was stopped and the result was recorded as the number of parasite per 500 white blood cells. All the parasite and white blood cells in the final field was counted even when the white cells count exceeded 200 or 500. The actual number of parasite and white blood cells was recorded and the parasite density was calculated using an estimate average white cell count of 8000/µ [8]: using the formula; Calculate the parasite density from the formula:

$$\text{Parasite/µL blood} = \frac{\text{Number of parasite counted X 8000 white blood cells/µL}}{\text{Number of white blood cells counted}}$$

2.10 Haematologic analysis

Pack cell volume (PCV) [8]: A heparinized capillary tube was filled three quarter with capillary blood. The unfilled end was scaled, using a plasticine. Carefully, the filled capillary tube was placed in one of the numbered slots of the microhaematocrit rotor with the scaled end against the rim gasket. I centrifuged at 12000 revolutions per minute for 5 minutes, the PCV was read using the Haematocrit reader.

Table 1: Demographic data of the patients

Demographic Characteristic	Interval	N (%)
Weight (kg)	43-52	94(23.2)
	53-62	61(15.0)
	63-72	138(34.0)
	73-82	85(21.0)
	83-92	16(3.6)
	93-102	8(2.0)
	103-112	4(0.9)
Age (years)	18-22	11(27.3)
	23-27	84(20.6)
	28-32	66(16.2)
	33-37	45(11.0)
	38-42	29(7.1)
	43-47	25(6.1)
	48-52	18(4.4)
	53-57	11(2.7)
	58-62	17(4.1)
Sex	Male	200(49.5)
	Female	204(50.5)
Location	Nkwoegwu/Umuawa	117(28.96)
	Old Umuahia/Ubakala	174(43.07)
	Umuahia/Umudike	113(27.97)

N=frequency or no participants, (%) = valid percentage

Table 2: Demographic data of the patients

	AA	AL
Sex	**MF (N)**	**MF (N)**
Nkwoegwu/Umuawa	2927	33 30
Old Umuahia/Ubakala	46 47	38 43
Umuahia/Umudike	26 28	29 30
Total	101 102	100 103

AA=Artesunate-Amodiaquine
AL=Artemether-Lumefantrine
M=male, F=female
N=number

2.11 Statistical Analysis
Data collected from the study were analyzed using statistical package for the social sciences (SPSS) version 20. Then data collected from the study were expressed as mean ± SD, normality test was done by the use of one-sample Kolmogorovsmimov test. Related samples Friedman's two-way analysis of variance by ranks, independent sample median test, and independent samples Mann-whitney U test. Student's test were used for the main analysis. The level of significance were $p<0.05$.

3. Results
This survey was done with respect to weight, age, sex and locations. Thirty-four percentage of the patients' weight fell within 63-72kg followed by 43-52 kg with 23.2% with the least being those within 103-112kg with 0.9% patients (Table 4.1). In the age distribution, 18-22 years of age has the highest number of patents with a percentage of 27.3 followed by 23-27 (20.6) and 58-62 being the least with 4.1% (Table 4.1). The sex and location of the participants, Nkwoegwu/Umuawa for AA, male is 28, female is 27, for AL male is 32 and female 30. Old Umuahia/Ubakala for AA, male is 46, female is 47, for AL male is 38, female is 43. Umuahia/Umudike for AA, male is 26, female is 28 and for AL, male is 29, female is 30. Patients from Nkwoegwu/Umuawa contributed 43.07% of the study population followed by those from Old Umuahia/Ubakala 28.96% and then those from Umuahia/ Umudike contributed 27.97%.

Table 2 shows the patients adherence behavior to the therapy. This was done by direct observation of the blister package of AL and AA tablets. This was defined as the number of tablets of AL or AA left on the third (day of treatment when the treatment regimen was expected to be completed). The result shows that a total of 179 out of the 202 patients treated with AL completed their drugs, giving 88.1% adherence, while 182 on AA completed their therapy at the appropriate time giving 89.7% adherence.

Table 3: Participants adherence behavior to drug combination type

	AA	AL
Adherence pattern	**N(%)**	**N(%)**
0.00	21(10.3)	24(11.9)
1.00	181(89.7)	178(88.1)
Total	202(100)	202(100)

Zero (0.00) = Participants who did not adhere to therapy
One (1.00) = Participants who adhere to therapy
N=no of Participants (frequency)
%=% of frequency
AA=Artesunate-amodiaquine
AL=Artemether-lumefantrine

4. Results from response to questionnaire
These symptoms from the questionnaire include response to bitter taste, response to fever, response to weakness and response to vomiting.

Table 3, showed that both drugs had similar effect on fever resolution, by day 14 and day 28th, 100% of patients on AA had normal body temperature, while 100% on AL had normal body temperature. (Table 4). Both drugs had similar effect on the outcome of vomiting with AA and AL at 42.8% and 49.7% respectively, the same as 3rd day. 10.3% and 8.8% respectively. However, by days 7, 14 and 28, there were no recorded cases (Table 5).

4.5. AA left more people weak after days 0 and 3 with values of 57.7% and 43.8% on the 0 and 3. However, on the day 28, fewer percent of individuals were weak from the lot who consumed AA as compared to AL with the values of 0.5% and 2.9% respectively. (Table 6).

Table 5: Effect of the drug combination (AA, AL) on fever resolution

Day	**0**	**3**	**7**	**14**	**28**
Drug	**AA AL**	**AA AL**	**AA AL**	**AA AL**	**AA AL**
Number of persons	146, 151	33 68	09 17	00 00	00 00
With fever % of fever Resolution	71.9 74.3	16.3 33.4	4.4 8.3	0.0 0.0	0.0 0.0

Table 6: Effect of the drug combination on vomiting (AL and AA)

Day	**0**	**3**	**7**	**14**	**28**
Drug	**AA AL**	**AA AL**	**AA AL**	**AA AL**	**AA AL**
Number of persons that vomited	87 101	21 18	00 00	00 00	00 00
% of persons that vomited	42.8 49.7	10.3 8.8	0.0 0.0	0.0 0.0	0.0 0.0

Table 7: Effect of the drug combination on weakness

Day	**0**	**3**	**7**	**14**	**28**
Drug	**AA AL**	**AA AL**	**AA AL**	**AA AL**	**AA AL**
Number of persons that were weak % of persons that were weak	116 114	122 88	18 10	04 03	01 06
	57.1 56.7	60.0 43.8	8.8 4.9	1.9 1.4	0.5 2.9

4.1 Parasite Clearance
The result of Figure 1 showed the 28-day therapeutic effectiveness of the drugs with respect to adequate parasite clearance and clinical response. The result showed that at day 3,7 and 14 the median parasite count was the same while on day 28 AA showed more parasite clearance then AL with median parasite count of 80 and 90 respectively, (Figure 1).

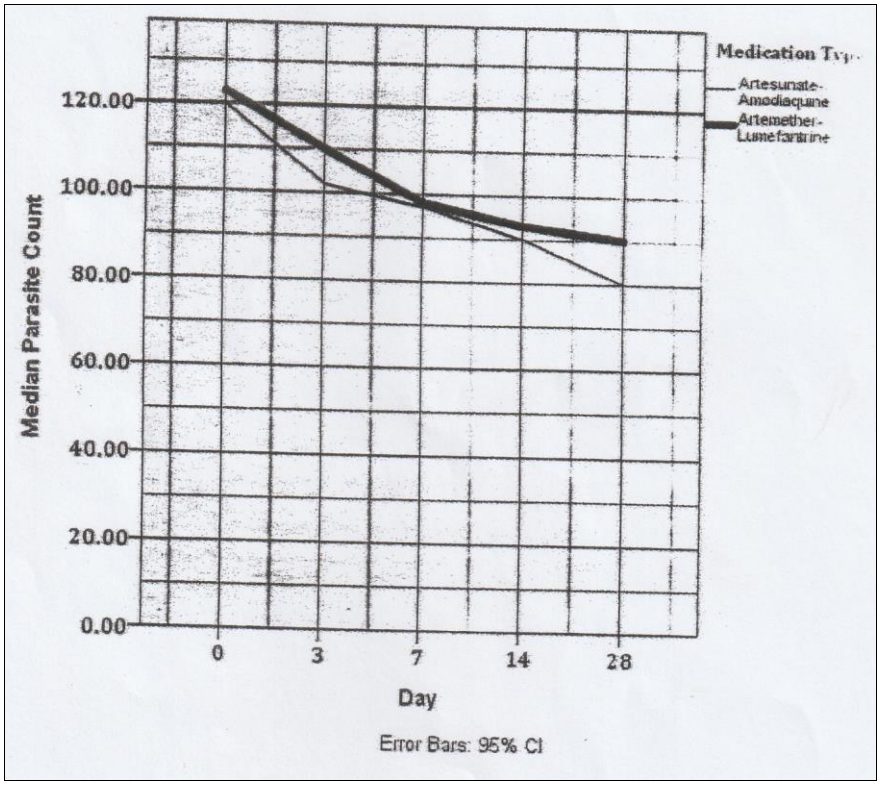

Fig 1: Median parasite count

From Table, the result for PCV for male participants showed that on day 0, 3, 7, 14 and 28 for AA the mean PCV were 36.73±2.69. 35.13±2.22. 35.30±2.25. 35.75±.2.33, 36.50±2.27 respectively, while for AL the values were 37.07±2.48, 35.23 ±1.88, 35.20±1.57, 35.43±1.54, 36.10±2.04 respectively. Generally, there was a significant reduction of PCV at $p<0.05$ for day 0, 3, 7, 14 and 28 of AA and AL, with p=0.0001 of all the days (Table 4.6).

Table 8: The Effect of AL and AA on Mean ± SD of PCV in % for male

Standard test value = 46						
Day Artesunate-Amodiaquine				Artemether-Lumefantrine		
	Mean ± SD (%)	T	P-Value	Mean ± SD (%)	T	P-Value
0	36.71±2.69	-34.57	0.0001	37.07±2.48	-35.71	0.0001
3	35.13±2.22	-49.19	0.0001	35.23±1.88	-56.88	0.0001
7	35.30±2.25	-47.77	0.0001	35.20±1.57	-68.37	0.0001
14	35.75±2.33	-44.29	0.0001	35.20±.1.54	-68.27	0.0001
28	36.50±2.27	-452.08	0.0001	36.10±2.04	-45.75	0.0001

The result for PCV for female participants showed that on day 0, 3, 7, 14 and 28 for AA, the mean PCV 36.68±2.91, 34.84±2.41, 34.85±2.33, 35.41±2.21, 36.16±2.15 respectively while for AL are 37.41±2.61, 35±1.69, 35.24±1.59, 35.78±1.78, 36.75±1.99 respectively. Generally, there was a significant reduction of PCV at $p<0.05$ for day 0, 3, 7, 14 and 28 for AA and AL with p=0.0001 of all the days (Table 9).

Table 9: The Effect of AL and AA on Mean ± SD of PCV in % for Female

Standard test value =41						
Day Artesunate-Amodiaquine				Artemether-Lumefantrine		
	Mean ± SD (%)	T	P-Value	Mean ± SD (%)	T	P-Value
0	36.68±2.91	-15.00	0.0001	37.41±2.26	-13.86	0.0001
3	34.84±2.41	-25.83	0.0001	35.35±1.69	-33.69	0.0001
7	34.85±2.33	-26.63	0.0001	35.24±1.59	-36.69	0.0001
14	35.41±2.21	-25.55	0.0001	35.78±.1.78	-29.54	0.0001
28	36.16±2.15	-22.78	0.0001	36.75±1.99	-21.50	0.0001

5. Discussion of findings

Malaria remains a serious health concern in sub-Saharan Africa [9]. The WHO African Region continues to shoulder the heaviest burden of malaria. Globally in 2022, the Region accounted for: • 94% of all malaria cases (233 million cases); • 95% of all malaria deaths (580 000 deaths). About 78% of all malaria deaths in the Region were among children under the age of five. In 2022, four countries in the Region-Nigeria (26.8%), the Democratic Republic of the Congo (12.3%), Uganda (5.1%) and Mozambique (4.2%) accounted for nearly half of all malaria cases globally (Fig. 3.3c). Four African countries also accounted for just over half of all malaria deaths globally: Nigeria (31.1%), the Democratic Republic of the Congo (11.6%), Niger (5.6%) and the United Republic of Tanzania (4.4%) [10]. Due to the development and increasing resistance of *P. falciparum* to various antimalarial drugs

available, the WHO introduced and recommended the use of artemisinin-based combination therapy (ACT) for the treatment of malaria [11, 12]. This study compared the effectiveness of Artemether-Lumefantrine and Artesunate-Amodiaquine drug combinations in the treatment of uncomplicated malaria patients attending Federal Medical Center, Umuahia, Abia State, and South-East Nigeria.

In this study, there was a high rate of adherence with the patients which might be due to counselling given to the patients prior to treatments as well as continuous phone calls and SMS sent to them at periods, they were supposed to take the drugs. Despite all these, there were still experiences of some level of non-adherence to therapy. Adherence to treatment was likely to be affected by factors such as age, number of tablets and duration of treatment. Higher level of adherence observed in AA (89.7%) could be attributed mainly to its once daily administration at a time unlike AL (88.1% adherence) which was taken six tablets at 0, 8, 24, 36, 48 and 60 hours interval. This was because taking the correct dose of the drugs prescribed at the right time gave adequate and sustained plasma level of drug, leading to increase in cure rate and reduction in development of resistance [13]. The key criterion used to assess the effectiveness of these anti-malarial agents was the elimination of malaria parasites, which in turn led to resolution of symptom such as fever. Unless otherwise stated, the primary effectiveness endpoint is in the result obtained in this study was the 28-day parasite clearance. This described the proportion of patients with clearance of asexual parasitaemia within seven days of initiating study treatment without recrudescence at day 28, based on blood smears result as recommended by [14]. The evaluable population included all patients with confirmed P. falciparum malaria who received at least one dose of any of the study drugs and had parasite counts performed at the pre-specified time points, including day 28, or who discontinued due to unsatisfactory therapeutic effect (censored) [15]. From the result of this study, greater percentage of people in the AA group achieved malaria parasite clearance on day 28 when compared to the percentage in the AL group. AA achieved median parasite/ul clearance of 80 while AL achieved median parasite/ul clearance of 99. This was similar to a work done by [13] that found out that there was a good adherence rate to the two drugs under study and their tolerability were high. Parasite clearance rates and fever resolution were similar in both drugs with AA achieving greater clearance on day 28. The result of this study did not agree with the results of [16] which showed that AL, thereby suggesting to the continual use of the drug as antimalarial. The effectiveness of AA made its use as plausible alternative treatment of uncomplicated P. falciparum malaria in their study area which was Colombian pacific region [17] in their study stated that five years after the introduction of ACTs in Nigeria, the two most commonly used ACTs (AA and AL) still remained effective and safe for the treatment of P. falciparum malaria. This was partly in agreement with the result of this study, except on day 28 that AA showed high parasite clearance rate than AL [18], in their study also found out that AA was as effective and well tolerated as well as AL in the treatment of uncomplicated P. falciparum. This was in support of the outcome of this study that only showed higher parasite clearance rate with AA on day 28 this is in line with [19] Yeka *et al*. opined that AA was safe and effect showed that AA was safe and effective for repeated use, reduced gametocyte carriage and was well tolerated and effective as AL which also is in agreement with the result of this study, [20] showed that AL continuation was as safe as AA. This was in agreement with the result of this study, the only difference was on day 28 that AA showed more parasite clearance rate [21]. Schramm *et al*. reported that AA and AL were both highly efficacious treatment of uncomplicated P. falciparum malaria in Nimba country. This was also in agreement with the result of this study except on day 28 that AA showed better effect to AL [22]. Also reported in their multisite efficacy study conducted in five sites across Mozambique that AL and AA were still highly efficacious and well tolerated. This was also in agreement with the result of this study except on day 28, that AA showed more parasite clearance rate than AL. The difference in fever resolution between the two drugs study showed no statistically significant difference between the two drug combinations (AA and Al). Both drugs (AA and Al) were well tolerated as obtained in the result while the weakness noted in both drug combinations could be attributed to the massive breakdown of the parasitized RBCs causing anemia and subsequent effect of the antimalarial on blood sugar and hemoglobin which further reduced the hemoglobin and its oxygen capacity, leading to dysponea and weakness.

There were significant difference (p<0.005) between the effect of AL and AA combinations on PCV for both male and female at p=0.0001. This may be due to the drug's ability to restore systemic haematology. This agreed with the study carried out by [23] the team reported thus; Mean packed cell volume increased in all patients, with no significant differences between treatments [24]. Martensson *et al*., 2005 also reported a significant and similar increase in the mean hemoglobin level from baseline to day 42 was noted in both intervention groups. Mean hemoglobin levels increased from 85 g/L (95% CI, 83-87 g/L) to 99 g/L (95% CI, 97-101 g/L) in the ASAQ group and from 87 g/L (95% CI, 85-89 g/L) to 102 g/L (95% CI, 100-104 g/L) in the AL group, alluding perhaps to the haematology modifications.

6. Conclusion

From the result of this study, it was found that greater percentage of people in AA group achieved malaria parasite clearance on day 28 when compared to the percentage in the AL group. AA achieved median parasite/ul of 80 while AL achieved median parasite/ul of 99. There was good adherence to the two drug combinations. Generally, there was a significant reduction of PCV, on days 0, 3, 7, 14 and 28.

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Conflict of interest

None was declared

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