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Chikere CB, Omoni VT and Chikere BO (2008). Distribution of potential nosocomial pathogens in a hospital environment. *Afr. J. Biotechnol.* 7: 3535-3539.

Moran GJ, Amii RN, Abrahamian FM, Talan DA (2005). Methicillinresistant *Staphylococcus aureus* in community-acquired skin infections. *Emerg. Infect. Dis.* 11: 928-930.

Pitout JDD, Church DL, Gregson DB, Chow BL, McCracken M, Mulvey M, Laupland KB (2007). Molecular epidemiology of CTXM-producing *Escherichia coli* in the Calgary Health Region: emergence of CTX-M-15-producing isolates. *Antimicrob. Agents Chemother.* 51: 1281-1286.

Pelczar JR, Harley JP, Klein DA (1993). *Microbiology: Concepts and Applications.* McGraw-Hill Inc., New York, pp. 591-603.

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ARTICLES

Research Articles

**The knowledge and practice of universal precautions amongst midwives in Central Hospital, Benin City** 331

Serah Osamudiamen Bolaji-Osagie, Florence O. Adeyemo and Olayinka. A Onasoga

**Predictors of optimum antenatal iron-folate supplementation in a low resource rural set-up in Eastern Kenya** 337

Juma M., Oiy Shadrack O. and Konyole Silvernus O.

**Prevalence of *Entamoeba histolytica* among primary school children in Akure, Ondo State, Nigeria** 346

Simon-Oke Iyabo Adepeju\* and Ogunleye Esther



*Full Length Research Paper*

# The knowledge and practice of universal precautions amongst midwives in Central Hospital, Benin City

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**This study seeks to assess midwives' knowledge and practice of universal precautions in Central Hospital, Benin City. The study employed descriptive research design. The target population was all registered midwives in Central Hospital Benin City. A total number of 180 respondents were drawn from the total population using purposive sampling technique. A structured questionnaire containing 29 items was designed and developed. It was divided into 3 sections; section A to collect Socio-Demographic Data, section B to ascertain the level of Knowledge of Universal Precautions among midwives under study and section C designed to collect information about the Practice of Universal Precautions among the midwives under study. Data was scrutinized by experts to ensure face and content validity. Test re- test was used for reliability test which yielded 0.85 h. Statistical Package for Social Sciences (SPSS) for windows 14.0 was used. For data analysis, descriptive statistics in the form of frequencies, percentages, Pearson product moment correlation was used. Level of significance was set at 5% (0.05) such that significant associations were established when  $p < 0.05$ . The study revealed that knowledge of universal precautions amongst midwives and their practices of universal precautions are significantly high, because more than half of the midwives in the study area practices universal precautions while discharging their official duties. Findings also showed that there is significant association between knowledge of universal precautions and practice among midwives. If midwives continue to adhere strictly to universal precautions principles, then there will be less contamination of HIV/AIDS, hepatitis B as well as other blood infections.**

**Key words:** Knowledge, practice, universal precautions, midwives.

## INTRODUCTION

Healthcare workers (HCWs) are at risk of occupational hazards. As they perform their clinical activities in the

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hospital, they are exposed to blood borne infections by pathogens, such as Human Immunodeficiency Virus (HIV), hepatitis B and hepatitis C Viruses, from sharps injuries and contacts with deep body fluids (Sadoh, et al., 2006). In an era of HIV epidemic in sub-Saharan Africa, occupational risk is real and significant. Pruss-Ustun et al. (2005) stated that developing countries account for the highest prevalence of HIV-infected patients in the world and the highest needle stick injuries. Orji et al. (2002) opined that needle stick injuries were the commonest occupational health hazard reported from a Nigerian teaching hospital. World Health Organization (2003) estimated that there are approximately 3 million cases of needle stick injury (NSI) in healthcare workers each year, with 90% of these occurring in developing countries.

Healthcare-acquired infections (HAIs) are potentially life-threatening to health; it kills thousands of people every year, and burdens the medical industry with millions, if not billions of wasted dollars (Michelle, 2007). World Health Organization (2002) estimated that about 2.5% of HIV, 40% of hepatitis B and C cases that occurred among Healthcare workers worldwide is the result of exposures to occupational hazards. Nursing students are thought to be at high risk of needle-stick injury (NSI) due to poor technique inexperience and poor use of universal precautions (Ofili et al., 2003). The fact that blood and other body fluids from patients are becoming increasingly hazardous to healthcare providers, it has become a great concern to the public as well as health professionals all over the world. The practice of universal precautions as a way of safeguarding against possible infections in the workplaces had become more and more widely accepted by health workers (Bamigboye and Adesanya, 2006). Universal Precautions encompasses a wide range of steps taken during regular work day by healthcare workers and must be adhered to strictly in order to protect self, patients and co-workers from infection. It is important that all midwives routinely follow these precautions at anytime because there is possibility of coming in contact with patient's blood or body fluids during antenatal, labour or puerperium.

Universal Precautions are vital measures that have been adopted to help prevent health workers from being occupationally infected as well as reduce nosocomial infection. Midwives are envisaged to be caregivers to both mothers, foetus, infants and the family at large. Finding out their knowledge and practice of universal precautions will help reduce vulnerability to blood borne infections, promote healthy well being among individuals and to enhance their dreams as competent midwives in the society. In order to meet the millennium goals-4 (reduction of child mortality), 5 (improved maternal health), 6 (combat HIV/AIDS malaria and other diseases), it is important to assess the knowledge and practice of

universal precautions among midwives in Central hospital, Benin City.

### Statement of problem

Midwives are at risk of being infected with blood-borne pathogens from clinical blood exposure through injuries with sharp instruments and needle sticks if universal precautions are not strictly adhered to. According to Tseko and Pilane (2006), occupational related HIV transmission among healthcare workers results mostly from needle pricks, blood and body fluid splashes. World Health Organization (2006) reports that among the 35 million health workers worldwide, about 3 million sustain percutaneous exposures to the blood borne pathogens each year, including 2 million to hepatitis B virus (HBV), 0.9 million to hepatitis C virus (HCV) and 170,000 to human immune deficiency virus (HIV). These injuries may result in 70,000 HBV, 15,000 HCV and 5,000 HIV infections. If these diseases are contracted by midwives, it may ruin their career, cause loss of interest in the profession and may stimulate nonchalant attitude in carrying out services. This has prompted the researcher to assess the knowledge and practice of universal precautions among midwives in Central Hospital, Benin City.

The broad objective for this study is to assess midwives knowledge and practice of universal precautions in Central Hospital, Benin City, to assess the level of knowledge of universal precautions among midwives in Central Hospital, Benin City, to determine the level of practice of universal precautions among midwives in Central Hospital, Benin City, to determine the knowledge of universal precautions amongst midwives in not significantly high and to determine the practice of universal precautions amongst midwives in not significantly high.

### Statement of hypotheses

There is no significant association between knowledge of universal precautions and practice among midwives.

### METHODOLOGY

Descriptive research design was employed in this study. The Central hospital, Benin City where the study was done is located in zone A, ward 1 of Oredo Local government area in Benin City, Edo State. It is bounded on the west by Federal prisons, separated by Sapele road and the east by Oba palace separated by airport road. There is a major round about adjacent to the hospital known as Ring road and behind it is Ezoti Street. Staff strength of the hospital is seven hundred and twenty working in twenty-six departments. There are thirty-two units of which eight of the units are for maternal and child healthcare services. There are four hundred and twenty

bed spaces and two hundred and seventy one nurses-midwives working in these units of the hospital. The target population for this study included all registered midwives in Central hospital Benin City.

#### Sample size and sampling technique

A total number of 180 respondents were drawn from the total population using purposive sampling technique from the thirty-two units in the hospital. Data was collected from all midwives with the use of questionnaire.

#### Instrument for data collection

After a thorough review of literature, a structured questionnaire was designed and developed with 29 items, containing qualitative and quantitative information on universal precautions among midwives. It was divided into 3 sections; section A to collect Socio-Demographic Data, section B to elicit the level of Knowledge of universal precautions among midwives under study and section C designed to collect information about the Practice of Universal Precautions among the midwives under study.

#### Validity/reliability of instrument

The questionnaire developed was thoroughly scrutinized by experts to ensure face and content validity. Test re-test was used for reliability test which yielded 0.85 h.

#### Method of data collection

The midwives were asked to fill the questionnaires and returned. The data was collected over a period of four weeks in a period of 5 working days between the hours of 8 to 4.

#### Method of data analysis

Data collected was entered into the computer using Statistical Package for Social Sciences (SPSS) for windows 14.0. Both descriptive and inferential statistics were used to analyze the data collected. Descriptive statistics in the form of frequencies, percentages, Pearson product moment correlation. Level of significance was set at 5% (0.05) such that significant associations were established when  $p < 0.05$ .

#### Ethical consideration

Permission was granted by the Assistant Director of Nursing in Central Hospital Benin City. The study and its purpose were explained to the respondents (midwives) and all information gathered from respondents were treated confidentially.

## RESULTS

### Socio-demographic characteristics

Table 1 reveals that majority of the respondents 50

(27.8%) were between 31 and 40 years, 51 to 60 years, 35 (19.4%) of them were between 21 and 30 years, while 45 (25.0%) of the respondents were between age 41 to 50 years. Females comprised 168 (93.3%) of the group. With respect to marital status, majority of the respondents were married 130 (72.2%), 20 (11.1%) are singles while 30 (16.7%) were widows.

Majority of the midwives were Chief nursing officers and Nursing officers I with 40 (22.2%), 38 (21.1%) were Nursing officers II, 20 (11.1%) were Assistant Chief nursing officers, 15 (8.3%) and 7 (4.0%) were Principal nursing officers, 165 (91.7%) were Christians. Majority 84 (46.7%) of the midwives were Bini while the least were Hausa 3 (1.7%) and other tribes 30 (16.7%).

### Research question one

Is the knowledge of universal precautions amongst midwives not significantly high? Population t-test was employed to answer this research question, since it was a one variable research question, the result of the responses of respondents were computed and is presented in Table 1. The result presented in Table 2 is to assess level of knowledge among midwives in universal precautions. As presented in Table 2, the sample mean of 17.03 is greater than the population mean of 12.00 at 179 degree of freedom, this result implies that this research question which sought to find out knowledge of universal precautions amongst midwives is significantly high therefore more than half of the midwives in the study area seem to have knowledge of universal precautions.

### Research question two

The practice of universal precautions among midwives is not significantly high? Population t-test was employed to answer this research question, since it was a one variable research question, the result of the responses of respondents were computed and is presented in Table 3. The result presented in Table 3 assessed the level of universal precautions practiced among midwives. As presented in Table 3, the sample mean of 15.98 is greater than the population mean of 14.15 at 179 degree of freedom,  $p < .05$  this result implies that this research question which sought to find out midwives practices of universal precautions is significantly high, therefore more than half of the midwives in the study area practices universal precautions while discharging their official duties.

### Hypothesis one

There is no significant association between knowledge of

**Table 1.** Frequency distribution of socio-demographic characteristics of midwives in Central Hospital, Benin City.

Demographic data	Respondents in this study (N = 180)		Percent
	Variable	Frequency (N)	
Age (years)	21 - 30	35	19.4
	31 - 40	50	27.8
	41 - 50	45	25.0
	51 - 60	50	27.8
Sex	Male	12	6.7
	Female	168	93.3
Marital status	Single	20	11.1
	Married	130	72.2
	Widow	30	16.7
Rank	Assistant director of nursing service	7	4.0
	Chief nursing officers	40	22.2
	Assistant chief nursing officers	20	11.1
	Principal nursing officers	15	8.3
	Senior nursing officers	20	11.1
	Nursing officers 1	40	22.2
	Nursing officers 11	38	21.1
Religion	Christianity	165	91.7
	Islam	10	5.5
	Traditional	5	2.8
Ethnicity	Bini	84	46.7
	Yoruba	27	15.0
	Ibo	36	20.0
	Hausa	3	1.7
	Others	30	16.7

**Table 2.** Population t-test of midwives knowledge of universal precautions.

Groups	N	Mean	SD	t-test	Significance
Sample mean	180	17.03	2.55	-	-
Population mean	-	12.00	-	166.03	0.002

**Table 3.** Population t-test of midwives practices of universal precautions.

Groups	N	Mean	SD	t-test	Significance
Sample mean	180	15.98	2.83	156.23	0.004
Population mean	-	14.15	-	-	-

universal precautions and practice among midwives, Pearson Product moment correlation was used to test

this hypothesis at  $p < 0.05$ , the result is presented in Table 3. As presented in Table 4, the calculated r-value



**Table 4.** Pearson product moment correlation of knowledge and practice of universal precautions among midwives.

Variables	N	Mean	SD	r-value	Significance
Knowledge of universal precaution	180	14.82	2.43	0.68*	0.000
Practice of universal precautions	180	12.45	2.12	-	-

\*significant at  $p < .05$ ;  $df = 178$ ; critical  $r$ -value = 0.138.

of 0.68 is greater than the critical  $r$ -value of 0.138 at 178 degree of freedom. This result implies that the null hypothesis which states that there is no significant association between knowledge of universal precautions and practice among midwives is rejected while the alternate is upheld, there is no association between midwives attitude towards universal precaution.

**DISCUSSION**

This study has attempted to assess the knowledge and practice of universal precautions among Midwives in Central Hospital, Benin City. The socio-demographic characteristics showed that majority 50 (27.8%) of the midwives were between the ages of 31 to 40 years and 51 to 60 years which implies that they were of their prime age. Majority of the respondents were females, this may be due to the fact that people believe that midwifery is a female profession since it involves women and childbearing. Majority of them were married and were of a lower and higher cadre. It was also revealed that the Christians and the Bini’s predominate the organization. Majority of them have had a work experience of between one to ten years.

The study revealed that knowledge of universal precautions amongst midwives is significantly high. This is in contrast with the findings of Ofili et al. (2003) in a study carried out among nurses in Central Hospital, Benin City, that the nurses had a poor knowledge about universal precautions as only 34.2% of nurses had heard about universal precautions. Furthermore, Gammon (2005) stated that globally, knowledge of universal precautions is inadequate and compliance is low. Most of the respondents have had previous training on universal precautions which may have influenced their knowledge positively

The findings of this study also showed that midwives practices of universal precautions is significantly high, because more than half of the midwives in the study area practices universal precautions while discharging their official duties. This finding is consistent with Ferguson et al. (2006) that majority of their respondents believed that stopping to use standard precautions would have put the patient at risk in a study carried out among community

hospital-based healthcare workers on reasons for not using precautions. Also, this study is inconsistent with Deloy et al. (2005) that majority of the respondents accepted that they adhere to universal precaution rules while a few others do not. The study revealed that there is significant association between knowledge of universal precautions and practice among midwives. This finding does not corroborate with the study of Chan et al. (2002) whose study showed no significant association between the nurses knowledge and compliance with Universal Precaution.

**Implications of universal precautions for midwifery practice**

Universal precautions will help prevent midwives from infections. The knowledge and practice of universal precautions in midwifery practice will not only prevent midwives from infections but every health workers, clinical students, patients as well as nurses aids. This study will also give insight to midwives to adhere strictly to universal precautions as professional nurses and midwives as well as in other health related field.

**SUMMARY**

This study was designed to assess the knowledge and practice of universal precaution among midwives in Central Hospital, Benin City. This study reveals that, majority (85.1%) of the respondents were between the age of 31 to 40 years and 51 to 60 years and of a lower and higher cadre, there were more female midwives in the organization than male, majority of them were married and were Christians. The Bini’s were the predominant ethnic group. The findings of this shows midwives level of knowledge and practice of universal precaution was high.

**CONCLUSION**

Universal precautions are vital measures that have been adopted to help prevent health workers from being infected in the line of duty. The knowledge and practice of

universal precautions has been shown to prevent majority of healthcare workers from blood borne infections, if midwives continues to adhere strictly to universal precautions principles, then there will be less contamination of HIV/AIDS, hepatitis B as well as other blood infections. Knowledge is not enough to prevent infections but adequate skills during practice is very pertinent.

## RECOMMENDATIONS

Based on the findings of this study the following recommendations were made:

- 1) This study suggests that more personal protective equipment should be provided in all health institution by the government.
- 2) Strategies to promote the use of universal precautions which take into account behaviour change and accrual of knowledge including its integration into practice should be incorporated into all school's curriculum.
- 3) Nurse-Midwives' Managers and occupational health workers should take a leadership role to ensure that safe practices are used in the care of patients.
- 4) Obligatory training programme in universal precautions for all nurses and midwives should be provided in all healthcare organizations.
- 5) Implementation of policies on universal precautions for strict adherence is essential.
- 6) A system for monitoring the appropriate use of personal protective equipment is essential in nurse-midwifery programmes.

## Conflicts of interest

Authors have none to declare.

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*Full Length Research Paper*

## Predictors of optimum antenatal iron-folate supplementation in a low resource rural set-up in Eastern Kenya

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There is depressed prevalence of the optimum iron-folate supplementation in Kenya and in other sub-Saharan Africa countries. The study was motivated by the paucity of area-specific data on predictors of optimum iron-folate supplementation. The aim of the study was to assess the maternal, knowledge and institutional factors that predict 90+ days (optimum) iron-folate supplementation among pregnant women in a rural set-up in Eastern Kenya. A descriptive cross-sectional study to collect quantitative data from 352 mothers of under-five years old children attending 7 health facilities in Kalama Division of Machakos constituency within Machakos County in lower Eastern Kenya. Using a standard questionnaire, mothers recalled the number of days they had ingested iron-folate supplements in their latest pregnancies. The overall prevalence of optimum supplementation (90+ days) during latest pregnancies was 18.3% and on average the study mothers were supplemented for ~38 days during the antenatal period. Mothers who visited antenatal care (ANC) for  $\geq 4$  days (odd ratio [OR]: 2.756, 95% confidence interval [CI]: 1.396-5.445) were more likely to take iron-folate supplements for 90+ days and be supplemented for more days (45.8) than  $< 4$  days visitors (26.2 days),  $p=0.017$ . Earlier ANC visit was associated with the mean days of supplementation ( $p=0.006$ ), but not with optimum supplementation (OR: 0.412, 95% CI: 0.236-0.719). Knowledge on supplementation for a minimum of 90 days predicted optimum supplementation (OR: 5.872, 95% CI: 2.945 -11.709). Knowledge on when to start supplementation and importance of supplementation only predicted higher days of supplementation ( $p<0.05$ ), but not the optimum supplementation. Pregnant women who used tablet form were more likely to be supplemented optimally (OR: 1.007, 95% CI: 1.004-1.116). Those who were supplemented with a combined form of supplement were more likely to have more days of supplementation ( $p=0.004$ ), but not optimum (OR: 1.125, 95% CI: 0.419-3.021) compared to those who used single iron and folate supplement. To increase the proportion of pregnant mothers taking iron-folate supplements for 90+ days in low resource rural set-ups, there should be intensified counselling/education on ANC attendance  $\geq 4$  times and on minimum number of days for optimum iron-folate supplementation. Use of tablets as opposed to syrup increases the likelihood for antenatal ingestion of iron-folate supplements for 90+ days in rural low-resource set-up.

**Key words:** Predictors, optimum supplementation, iron-folate supplements, pregnant women.

## INTRODUCTION

Iron and folate supplementation during pregnancy is important for sound maternal health and favourable perinatal outcomes. As pregnancy commences and proceeds, most pregnancy cases show haematological changes suggesting iron and folate deficiency; the haemoglobin and serum iron, serum folate and red cell folate concentrations fall and the total iron binding capacity rises (Mahomed, 2000). The dietary intake of the two elements cannot meet the increased need during pregnancy and this justifies supplementation. At pregnancy, women meet foetal requirements only by drawing upon maternal iron stores (Abu-Saad and Fraser, 2010). The need for folic acid increases during times of rapid tissue growth which during pregnancy includes an increase in red blood cell mass, enlargement of the uterus, and the growth of the placenta and foetus (Bailey, 2000). World Health Organisation (WHO) currently recommends 30 to 60 mg of elemental iron and 400 µg (0.4 mg) of folic acid taken by all pregnant adolescents and adult women, that started as early as possible and taken throughout pregnancy, one supplement a day (WHO, 2012). Kenya is one of the countries that register very low proportions of pregnant women supplemented for at least 90 days during pregnancy. Currently (pending the release of the Kenyan DHS 2014 results), only 2.5% of pregnant women are supplemented for 90+ days (GOK, 2008). In Ethiopia (a neighbouring country to Kenya) this figure stands at 0.4% (Gebremedhin et al., 2014). These are very low coverage figures given that almost half of the women of reproductive age in Kenya for instance, are anaemic (GOK and UNICEF, 1999).

It is apparent that factors that influence or predict optimum supplementation may differ from setting to setting. The understanding of the way these factors influence the days of supplementation as well as optimum supplementation in the different locations is important in informing context specific policy and programming. This understanding will allow for customised iron-folate supplementation strategies to contribute more to improved perinatal outcomes, maternal health, maternal survival, and child health and nutrition. This study assessed the optimum supplementation of iron and folate supplementation and the attendant influencing factors in the low resource rural set-up of Eastern Kenya.

## METHODOLOGY

### Study design and setting

The study employed a descriptive cross-sectional study, utilizing

quantitative data collection methods from mothers of under-five years old children attending health facilities for post-natal care. It was conducted in Kalama Division of Machakos constituency that is within Machakos County in lower Eastern part in Kenya. The key variables collected were the number of days of supplementation during the last pregnancy, socio-demographic data, nutrition literacy, antenatal clinic attendance and information on the supplements provided.

### Sample size

A fairly equal representation of mothers with children of different age groups within the under-five's bracket was aimed at. Five groups of mothers were considered: mothers with 0-11 months old children, those with 12-23 months olds, 24-35 months olds, 36-47 months olds and 48-60 months olds. The sample size  $n$ , was computed as per the formula by Gibson and Ferguson (1999) to have a representative number from each group. The group representation was to adjust for any change (with time) of government policy or programs related to iron-folate supplementation (Gibson and Ferguson, 1999).

$$n = [(u+v)^2 \times (s_1^2 + s_2^2)] / (m_1 - m_2)$$

where  $n$ =sample size,  $u=0.64$  which corresponds to  $\beta$  for the test of 95% confidence interval,  $v= 1.94$ , corresponds to an  $\alpha$  of 5% two tailed test,  $s_1$ = the standard deviation of days of supplementation in one group (a hypothetical 15),  $s_2$ = the standard deviation of days of supplementation in other one group (a hypothetical 15),  $m_1$  and  $m_2$ = corresponding means of days of iron-folate supplementation. Assuming that the maximum period of supplementation is 90 days and that the minimum is zero, it was assumed that the mean of one group ( $m_1$ ) could be 0 (no supplementation) and other ( $m_2$ ), at 45 days (halfway between 0 and 90 days). Using these assumptions, the sample size of 66 per each of the 5 age groups was arrived at. With a contingency consideration of 5%, a total minimum sample size of 346 mothers of under-five year old children was targeted.

### Sampling of the participants

Mothers were selected from the seven health facilities in the study area. A list of all the seven health facilities offering maternal and child health services in Kalama division was obtained from the district community health nurse. The mean number of mother-child pairs attending the child welfare clinic was obtained for each facility from the facility records. This was used to compute the number to be selected from each of the facility (proportionate-to-size). The proportionating was done per age group. For each day of assessment for each of the health facility, a count of mothers in the waiting bay with children under five years was done by about 9 am when most of the mothers attending post-natal clinic are expected to have arrived. The mothers were then assigned numbers per the age groups of their children which were confirmed from the child clinic cards before assigning the random numbers. Using random tables, mothers corresponding to the randomly selected number per age group were considered for the study. This was done until the target for each of the age group was reached. When the target number per age group was reached in a facility, the selection for the respective group was stopped. If the target per age was not

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reached on the first day, the selection continued for the proceeding days until the target numbers per facility were reached.

### Exclusion criteria

Underage mothers (<18 years of age) were excluded since they could not consent to the survey. Guardians (that is, those who were not mothers of children under five years old) accompanying the children to the health facilities were also excluded.

### Data collected and analysis

The data collection tools were developed in reference to the WHO (2001) safe motherhood assessments tools with some adjustments to suit the study objective. Key data collected included maternal socio-demographic characteristics, maternal knowledge on iron-folate supplementation, and access and use of the iron-folate supplements. The coded data was entered into a Statistical Package for Social Sciences (SPSS) for windows version 17. Student's t-test for independent samples was used to assess the means of supplementation among various groups, while the odds ratio (OR) was used to assess if the exposure (the various factors) was associated with higher odd of the outcome (90+ days of supplementation). Linear regression analysis indicated the correlation between the days of supplementation and some numerical variables.

### Ethical considerations

The research was approved by Great Lakes University ethical research committee. Additional approval was obtained from the National Commission of Science, Technology and Innovation (NACOSTI), Kenya. Anonymity of the study participants was ensured throughout the data collection period. Privacy was also ensured by conducting the interviews in enclosed and sound proof rooms. Only mothers who consented to the study were interviewed.

## RESULTS

### General characteristics of the study participants

The study participants represented a low resource rural population of reproductive age women in Eastern Kenya. The socio-demographic characteristics of study group are summarised in Table 1. Mothers of under-fives considered for the study had a mean age of 28 years old with most being <30 years old. They had a mean number of children of 2. Majority (%) were married Christians and had completed primary school education. Farming was the most common economic pre-occupation among them while engaging in merry-go-round groups as the most common group involvement among the various available options. Majority (~80%) had been supplemented with iron folate during their last pregnancies.

### Maternal factors predicting optimum iron-folate supplementation

Optimal iron-folate supplementation was defined as

supplementation for a minimum of 90 days during the course of their last pregnancies as specified by the Demographic Health Survey (GOK, 2008). Table 2 depicts the likelihood of maternal factors influencing the mean days of supplementation and the proportion optimally supplemented. For the mean days of supplementation, the p-values were computed using the Student's t-statistics and  $p < 0.05$  indicated a statistical significant difference between the groups compared. The  $OR > 1$  (with the lower OR value also  $> 1$ ) indicated that exposure (respective factor) was associated with higher odds of outcome (supplementation for 90+ days). The opposites were true for  $p < 0.05$  and  $OR < 1$ . Those not supplemented at all (20.1%) were not precluded from this analysis.

On average, mean supplementation days was 38 and only 18% were supplemented optimally during their last pregnancy period. Maternal age was neither a determinant for mean days of supplementation nor for the optimum supplementation. Same was true for the number of children (indicative of parity), religion, level of education and income. Those who were married had ingested the supplements for comparable days as the single mothers ( $p > 0.277$ ) and there were no odds for differing proportion of optimum supplementation between the two groups (OR: 1.402; 95% confidence interval [CI]: 0.673-2.922). There was no indication that mothers earning higher income had increased odds for optimum supplementation (OR: 1.402; 95% CI: 0.521-3.771), and the same case was when mothers were salaried (OR: 0.728; 95% CI: 0.404-1.310) as compared to those who were not salaried. Group engagement influenced the days of supplementation but not the odds for optimum supplementation. The gestational age at first antenatal care (ANC) significantly determined the number of days of supplementation ( $p = 0.006$ ), but did not increase the odds for optimum supplementation (OR: 0.412, 95% CI: 0.236-0.719). ANC visit of  $> 4$  was associated with both higher mean number of days of supplementation ( $p = 0.000$ ) and the odds for optimum supplementation (OR: 2.756, 95% CI: 1.396-5.445) (Table 2).

For the numerical variables, linear regressions were run with the days of supplementation as dependent variable. Only 1.1% of increase in the days of supplementation could be explained by the increase in number of visits ( $r = 0.104$ ,  $r^2 = 0.011$ ) (Figure 1). About 4.1% of the gestational age at first ANC visit explained the days of supplementation ( $r = -0.202$ ,  $r^2 = 0.041$ ), while 1.4% of income (US\$ per day) explained the days of supplementation ( $r = 0.118$ ,  $r^2 = 0.014$ ). Only 0.1% of days of supplementation was explained by years spent in school by the mothers ( $r = 0.032$ ,  $r^2 = 0.001$ ). There was no relationship between the age of mother days of supplementation ( $r = 0.04$ ,  $r^2 = 0.000$ ) and this was same for the number of children ( $r = 0.04$ ,  $r^2 = 0.000$ ). In all the test independent variables, there was positive correlation (+ve r) and gestational age at first visit at the health facility

**Table 1.** Socio-economic characteristics of the group.

<b>General characteristic</b>	<b>Proportion/Value (n=352)</b>
Mean age in years (SD)	28.0 (5.4)
<b>Age category (%)</b>	
<30 years	64.5
>30 years	34.9
Mean number of children (SD)	2.2 (1.3)
<b>Marital status (%)</b>	
Single	19.6
Married (monogamous)	72.7
Married (polygamous)	2.8
Widowed	1.1
Cohabiting	0.3
Separated	1.1
<b>Religion (%)</b>	
None	4.9
None-Catholic Christian	69.7
Catholic Christian	21.1
Muslims	2.0
Indigenous religion	2.3
<b>Attainment of education level (%)</b>	
Primary education and below	56.5
Secondary education and above	43.5
<b>Source of income (%)</b>	
None	25.0
Farming	33.5
Self employed	16.8
Salaried	9.9
<b>Group belonging to (%)</b>	
Mother support groups	17.1
Merry-go-round group	43.1
Credit group	6.3
Church group	24.9
Self-help group	3.7
Supplemented with iron-folate (%)	79.1

was the most correlated with the number of days of supplementation of all the variables tested (highest  $r^2$ ).

### Maternal knowledge factors

As depicted in Table 3, all the knowledge factors did influence the mean days of supplementation ( $p < 0.05$ ). It was only for the knowledge on the minimum length of supplementation that was associated with higher odds for optimum supplementation (OR: 5.872, 95% CI: 2.945-

11.709). It was also observed that all types of knowledge positively influenced the days of supplementation (Table 3).

### Institutional and supplements factors

Table 4 shows the association between the institutional factors and supplement factors as related to mean days of supplementation and optimum supplementation. Only those supplemented with iron folate were considered for this analysis. In this group, slightly more than a fifth were

**Table 2.** Maternal factors and supplementation.

Factors	Mean days of supplementation (n=352)		Proportion supplemented 90+ days (n=352)	
	Mean days	p-value <sup>∞</sup>	Proportion (%)	OR (95% CI) <sup>*</sup>
Overall	38.1	-	18.3	-
<b>Age of the mother</b>				
<30 years	38.7	0.642	20.3	0.675 (0.372-1.224)
>30 years	36.2		14.6	
<b>Number of children</b>				
1-3 (Primigravidae)	39.2	0.460	19.4	0.722 (0.322-1.620)
>3 (Multigravidae)	35.0		14.8	
<b>Marital status</b>				
Single	33.6	0.277	14.5	1.402 (0.673-2.922)
Married (or ever married)	39.2		19.2	
<b>Religion (do if the data allows)</b>				
Christian	42.4	0.264	22.6	-
Muslims	25.7		0.0	-
<b>Education level</b>				
Primary education and below	11.1	0.091	24.0	0.402 (0.220-0.734)
Secondary education and above	34.2		11.3	
<b>Employment status</b>				
Salaried	37.1	0.678	14.3	1.402 (0.521-3.771)
No-salaried	38.9		18.9	
<b>Income</b>				
<1 US\$ a day	37.1	0.509	19.9	0.728 (0.404-1.310)
>1US\$ a day	39.8		15.3	
<b>Belonging to a mother support group?</b>				
Yes	27.6	0.017	19.3	0.643 (0.289-1.430)
No	40.2		13.3	
<b>Number of ANC visits</b>				
≥4	45.8	0.000	23.6	2.756 (1.396-5.445)
<4	26.2		10.1	
<b>Gestational age at first ANC visit</b>				
1st trimester	45.4	0.006	26.2	0.412 (0.236-0.719)
2nd, 3rd trimester and never attended	34.0		12.8	

<sup>∞</sup>P-values based on student t-test for independent samples at  $\alpha=0.05$ . <sup>\*</sup>Risk values as generated by 2 by 2 cross-tabulations.

optimally supplemented. Cost prohibition, taboo prohibition and side effects experienced did not significantly influence the mean days of supplementation and the odds for optimum supplementation. Time taken to reach the health facility (indicative of the distance from the health facility) did influence the mean days of

supplementation ( $p=0.026$ ), but not the odds for optimum supplementation (OR: 0.199; 95% CI: 0.044-0.889). The type of supplement (syrup versus tablets) did influence the odds for optimum supplementation (OR: 1.007 95% CI: 1.004-1.116), but not the days of supplementation ( $p=0.592$ ). Source of supplements and

**Table 3.** Maternal knowledge factors and supplementation.

Knowledge factors- Knowledge on:	Mean days of supplementation (=241)		Proportion supplemented 90+ days (n=241)	
	Mean days	P-value <sup>∞</sup>	Proportion (%)	OR (95% CI) <sup>‡</sup>
<b>When expected to start supplementation</b>				
First trimester	46.1	0.03	30.8	0.300 (0.172-0.524)
Other trimesters	33.7		11.8	
<b>Minimum length of supplementation</b>				
90+ days	50.2	0.00	29.3	5.872 (2.945 -11.709)
<90 days	25.4		6.6	
<b>Importance of supplementation (prevents anaemia?)</b>				
Yes	44.6	0.00	22.9	0.251 (0.110-0.571)
No	21.9		6.9	
<b>Importance of supplementation (reduces chances for birth child complications?)</b>				
Yes	59.2	0.00	36.3	0.262 (0.147-0.467)
No	31.8		13.0	
<b>Importance of supplementation (reduces chances for maternal mortality?)</b>				
Yes	57.6	0.00	34.2	0.305 (0.171-0.544)
No	32.4		13.7	
<b>Importance of supplementation (reduces chances for congenital malformation?)</b>				
Yes	55.2	0.00	30.1	0.414 (0.228-0.754)
No	33.5		15.2	

<sup>∞</sup>P-values based on student t-test for independent samples at α=0.05

<sup>‡</sup> Risk values as generated by 2 by 2 cross-tabulations

tablet form (single or double form) did influence both supplementation days (p=0.004), but not the odds for optimum supplementation (OR: 1.125, 95% CI: 0.419-3.021).

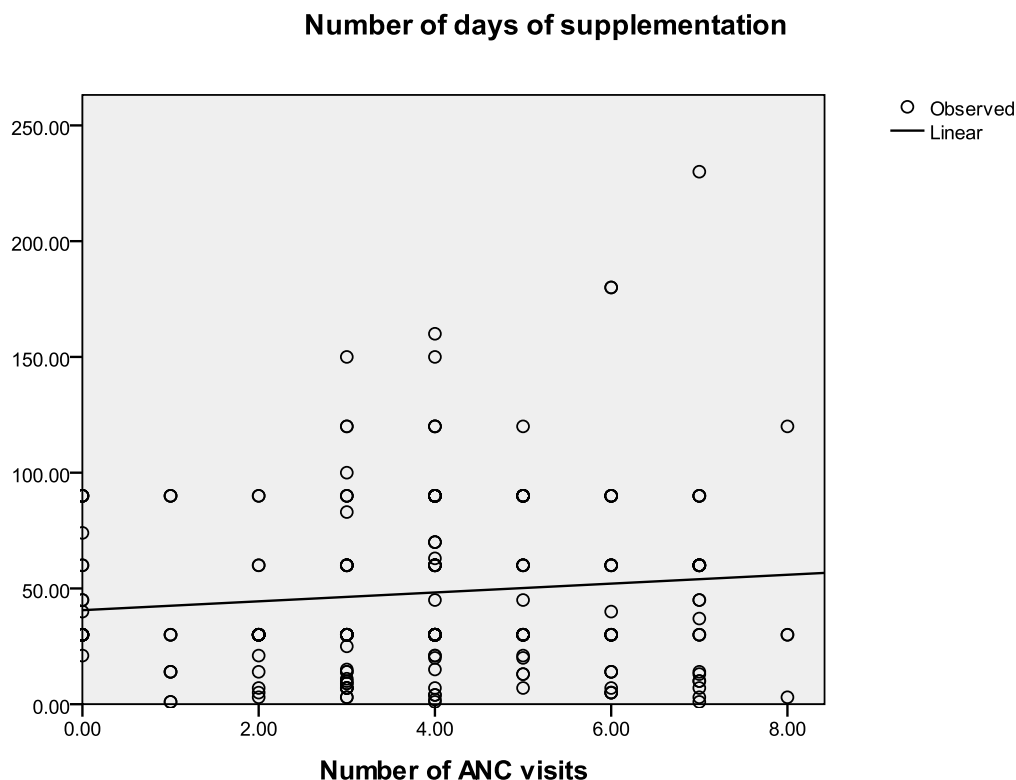
**DISCUSSION**

This study reports the days of antenatal iron-folate supplementation, proportion optimally

supplementation and factors that predict supplementation. Compared to the national prevalence of supplementation of 90+ days of 2.5% and that of Eastern province of ~2.0% (GOK, 2008), the population under study was far much better optimally supplemented (~18%). The study participants were drawn from the health facilities and thus were not representative of the population of all women of reproductive age. It is known that majority (about 60%) of the pregnant

mothers do not seek antenatal services and do not give birth at the health facilities (GOK, 2008). In a non-health facility survey (household survey), lower prevalence of optimum supplementation could be expected. Mothers, who visit ANC for ≥4 days are more likely to take iron-folate supplements for 90+ days. Earlier initial ANC visit rather than later is related to the days of supplementation, and this compares favourably with observed association between the the





**Figure 1.** Curve fit for the number of ANC visits verses the days of supplementation.

hemoglobin (Hb) concentration and earlier prenatal visits (Lutsey et al., 2008). Women who come late to antenatal clinic miss opportunities to start supplementation early in pregnancy (Maina-Gathigi et al., 2013). Examining the marital status factor, there is no significant spouse involvement in promoting optimal supplementation. Although this study did not assess the level of spouse participation, it has been noted generally that in Kenya, there is increased male participation in the ANC in Kenya especially in the advent of Prevention of Mother to Child Transmission (PMTCT) (Mangeni et al., 2013). This is however not the case for optimum iron folate supplementation. One of the pathways in which spouse influence can positively affect iron supplementation is through the spouses acting as active reminders (Seck and Jackson, 2008; Nisar et al., 2014), and it is thus evident that the spouses of the study mothers are not playing this role in a significant manner. There was no depiction that mothers who are salaried tend to be optimally supplemented as compared to those who were not, and this is explained by the reality that in this poor resource set-up, the supplements are mainly provided free of charge. This means that having disposable income does not guarantee access to the supplements and by extension optimum supplementation. This is consistent with findings that level of income (<1 US\$ a day verses > 1US\$ a day) did not predict neither the

mean days of supplementation nor the proportion of mother who were supplemented 90+ days.

ANC visits  $\geq 4$  times is an important predictor of optimum supplementation and this is through the pathway of having increased contact with the health workers for counselling, initiation of supplementation, replenishment of the supplements and constant reminders for supplementation. This is consistent with some studies which have shown similar observations. In the Tanzania study, the OR for the proportion receiving iron supplementation increased with the number of visit, with OR reaching >1 with 4 to 8 visits (Ogundipe et al., 2012). Those women who visit perinatal health services are more familiar with supplement provided (Dusch and Elder, 2002). However, this present study showed that only a small proportion (1.1%) of the days of supplementation could be explained by the number of ANC visits ( $r^2=0.011$ ) and shows that other factors are also important as well. Only 4.1% ( $r^2=0.041$ ) and 1.4% ( $r^2=0.014$ ) of days of supplementation could be explained by gestational age and income, respectively. The highest  $r^2$  was observed for the gestational age of the first visit and this is indicative of the relative importance of start ANC visit as soon as the mother discovers that she is pregnant, but this is not associated with the optimum supplementation. In this study set-up, maternal age, number of children, religion, education level, and income

**Table 4.** Institutional and supplementation factors determining supplementation.

Factor	Mean days of supplementation (=241)		Proportion supplemented 90+ days (n=241)	
	Mean days	P-value <sup>∞</sup>	Proportion (%)	OR (95% CI)
Overall	49.3	-	23.1	-
<b>Source of supplement</b>				
Government facility	33.17	0.000	6.0	1.760 (0.621-4.986)
Non-government facility	99.3		10.2	
<b>Form of supplement</b>				
Syrup	60.0	0.592	0.0	1.007 (1.004-1.116)
Tablet	49.2		7.1	
<b>Tablet form</b>				
Combined	55.7	0.004	6.7	1.125 (0.419-3.021)
Single	42.9		7.4	
<b>Side effects experienced?</b>				
Yes	46.1	0.145	8.3	0.675 (0.248-1.837)
No	52.6		5.8	
<b>Taboo prohibitive?</b>				
Yes	35.8	0.836	37.5	0.107 (0.230-0.492)
No	38.1		6.0	
<b>Time taken to reach health facility</b>				
<30 minutes	45.5	0.026	10.1	0.199 (0.044-0.889)
>30 minutes	55.6		2.2	
<b>Cost is prohibitive?</b>				
Yes	32.3	0.018	37.1	0.327 (0.155-0.691)
No	37.5		16.2	

<sup>∞</sup>P-values based on student t-test for independent samples at  $\alpha=0.05$ . \* Risk values as generated by 2 by 2 cross-tabulations.

did not determine either the days of supplementation or optimum supplementation. Many other studies have attempted to explain the other area-specific reasons for failures to adhere to the iron folate supplementation guidelines in different parts of the world (Dye et al., 2015; Galloway and McGuthrie, 1994; Bondarianzadeh et al., 1998; Taye et al., 2015; Wulff and Ekström, 2003).

Knowledge on minimum recommended days of supplementation (90+ days) predicts optimum supplementation. Knowledge on when expected to start supplementation and importance of supplementation only predict higher number of days of supplementation, but not the optimum supplementation. In general nutrition, literacy is correlated with nutrition outcomes and this is the same for the optimum supplementation. The specificity of the knowledge (knowledge on 90+ days) is thus more important since it is more direct. Those with

this knowledge therefore stands a high chance for optimum supplementation (OR: 5.872, 95% CI: 2.945-11.709). In this particular study area, the knowledge on the importance of iron folate supplementation influences the mean days of supplementation. This is consistent with a number of findings. For instance, perceived health benefits of supplementation were found to be positively associated with supplements intake (number of pills) (Lutsey et al., 2008). Dusch and Elder (2002) found that inadequate counselling (which is strongly associated with knowledge), was a significant barrier to iron supplementation among pregnant women. In a study that defined compliance to iron supplementation as number of tablets ingested/tablets prescribed, compliance was associated with the perception of improved health upon taking the supplements. In a Kenyan study (Maina-Gathigi et al., 2013), the need for health workers to better

explain the importance of supplements to pregnant women was underscored. However, the knowledge on the importance did not increase the likelihood for optimum supplementation.

Form of supplement (syrup versus tablet) is associated with optimum supplementation. Syrup seem not be preferred by antenatal mothers. There is no indication that side effects, taboo towards the supplements, distance away from the health facility and the cost of the supplements does influence optimum supplementation.

## Conclusions

Our findings point onto some programmatic implications for optimal iron folate supplementation in Eastern Kenya and potentially for other resource poor rural set-ups. While intensifying awareness, education and mobilisation for iron folate supplementation, there is need to emphasize more on the attendance of ANC more than 4 times and this includes commencing antenatal visit as soon as the mothers suspects that they are pregnant. While all forms of knowledge on iron folate supplementation are important, counselling and education on the minimum days of supplementation should be more emphasised to promote optimum supplementation. Using tablets as opposed to syrup increases the likelihood for antenatal ingestion of iron-folate supplements for 90+ days among pregnant mothers in low resource rural set-ups.

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## Conflicts of interest

Authors have none to declare

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## Full Length Research Paper

# Prevalence of *Entamoeba histolytica* among primary school children in Akure, Ondo State, Nigeria

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Amoebiasis is one of the major causes of morbidity and mortality world wide, especially in developing countries because of lack of safe potable water and low level of hygiene due to high level of poverty. This study determined the prevalence and spatial distribution of amoebiasis in school age children in Akure, Ondo State, Nigeria. Two hundred and seventy eight (278) stool samples were examined for the cyst or trophozoites of *Entamoeba histolytica* using direct smear and floatation techniques. One hundred and eighty-eight (67.6%) of the samples were found to be positive for the parasite. Females (68.3%) were more infected than males (66.9%), but there was no significant difference between prevalence and sex. Children within the age group of 4 to 6 years old had the highest rate (85.3%) of infection. There was a significant difference between prevalence and the age groups. The highest prevalence of 33 (94.3%), 58 (95.0%), 80 (88.9%) and 73 (91.3%) were recorded among children who drink water fetched from the stream, buy food from food vendors, use pit toilet and were de-wormed nine months before stool sample collection ( $P < 0.05$ ). Improved sanitation, personal hygiene and policy for regular de-worming of school age children by parents and Government will decrease the rate of intestinal infections.

**Key words:** Prevalence, *Entamoeba histolytica*, amoebiasis, infection, hygiene, children.

## INTRODUCTION

Intestinal parasites infection (IPIs) are globally endemic and have been described as constituting the greatest single world wide causes of illness and diseases (Steketee, 2003). Amoebiasis is a condition due to the infection by *Entamoeba histolytica* and is known to cause about 450 million infections per annum in developing countries, with an incidence of about 50 million and 100,000 deaths (Ravdin and Petri, 1995). Intestinal

Amoebiasis is said to be the world greatest cause of death attributed to parasitic infection after malaria and schistosomiasis (Walsh, 1985). The infection is acquired through the faecal-oral route by consumption of food, water or drinks contaminated with cysts of the parasite. Licking or sucking of faecally contaminated hands have been documented to introduce the infection to humans (Aribodor et al., 2012).

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*E. histolytica* is an aerobic parasitic protozoan belonging to Genus *Entamoeba* and an etiology agent of Amoebiasis. *E. histolytica* is pathogenic in the caecum and colon of human being. The term '*histolytica*' literally means "Tissue dissolving" referring to the carnivorous habit of the organism. *E. histolytica* is the most unique among the Amoebas because of its ability to hydrolyse host tissue. It can become a highly virulent and invasive organism causing diarrhea. Acute infection of Amoebiasis may be presented with other infection apart from bloody diarrhea such as ulceration of the colonic mucosa, abdominal pain and a palpable mass in corresponding areas of the abdomen. Amoebiasis may give rise to amoebic liver abscess and intestinal pathologies (Aribodor et al., 2012).

Amoebiasis is widely spread in its distribution, occurring in all parts of the world. The invasive amoebiasis is more prevalent in certain areas of the world including West and South-East Africa, China, Mexico and Western portions of South America, and the India subcontinent (Ravdin, 1988). The distribution of the infection was reported to relate more with inadequate environmental sanitation, poor personal hygiene and climate. Ademiluyi and Odugbesan (2013) reported that illegally disposed wastes within and around human immediate environment, open type latrines, unsafe drinking water and improper hand washing has really promoted and increased diarrhea and Amoebic dysentery cases.

In Nigeria, amoebiasis is prevalent and widespread (Ajero et al., 2008). There have been several reports from various parts of Nigeria (Adeyeba and Akinlabi, 2002; Taiwo and Agbolade, 2000) which recognizes them as important health problems especially among young children. Several epidemiological studies have indicated a high prevalence of intestinal parasitic infections among Nigerian children (Agbolade et al., 2004). Amoebiasis is contagious wherever the living condition is unsanitary and when the hygiene is poor. The chances are higher that the infection will pass from one person to another. When infected stool contaminates food or water supplies, it spreads to many people at once (Hague et al., 1995). Infants under a year old are rarely infected with amoebiasis (Ajero et al., 2008). The incidence gradually increases during childhood and usually reaches its highest incidence in young adult (Azikiwe, 2006). Worm infestation results in malnutrition, anaemia and retarded growth, they cause absenteeism in children of school age and affect their performance, other physical and mental health problems with serious consequences may occur and overall development (Evans and Stephenson, 1995). The high prevalence of *E. histolytica* infections is closely linked with poverty, poor personal hygiene, poor environmental hygiene, and poor health service providers having an inadequate supply of drugs and lack of adequate and proper awareness of the transmission

mechanisms and life cycle patterns of these parasites (Adeyeba and Akinlabi, 2002; Mbanugo and Onyebuchi, 2002).

The high morbidity and death associated with the disease, especially among school age children in Nigeria, are of significance, hence the need for this study.

## MATERIALS AND METHODS

### Study area

The study was carried out in Akure South Local Government Area of Ondo State, South West Nigeria between March and June, 2013. Akure Local Government lies on Latitude 7° 24 N and Longitude 5° 21 E with an average temperature of 27°C. Two schools, Federal University Staff Nursery and Primary School and St. Peter's Primary School were randomly selected.

### Sample collection and examination

Prior to the commencement of the research work, permission was sought from the school authorities and parents of the pupils were informed. A total of 278 pupils aged between 2 to 12 years were enrolled in the study. Information on age, sex, source of food eaten in school, source of drinking water, type of toilet used, parents occupation and last day de-wormed were obtained from the subjects. Clean, labelled faecal plastic specimen bottles were given to the pupils and were instructed on how to introduce sample (stool) into the bottles. Stool samples were collected and transported to the research laboratory, Department of Biology for parasitological examination. In some cases, the stool samples were preserved using 10% formol ether.

### Preparation of faecal smears and identification of parasite

#### Wet preparation

A small portion of the stool specimen was collected and mixed with 3% iodine solution to form a smear. A drop of 3% iodine was also dropped on the microscope slide, covered with a cover slip and viewed under the microscope using x40 objective for identification of the parasite. This method was used because iodine stains the nucleus of *E. histolytica* properly for easy identification. Floatation method was also employed in analyzing the faecal samples. A portion of the stool was placed into a test tube containing saturated salt solution (0.98%) which is three-quarter full. The test tube was covered and shaken until the stool was completely emulsified, more salt solution was carefully added through pipette until the meniscus of the fluid was leveled with the tip of the test tube. A slide was held horizontally over the tube so that the surface touched the meniscus of the fluid and left standing for about five minutes. It was stained with eosin and after five minutes, cover slip was placed on the slide. The slide was examined under x10 and x40 objectives for identification of cyst of *E. histolytica* with its features as described by Cheesborough (1998).

### Statistical analysis

Data collected were analyzed using Chi-square test to determine association between variables. Values were considered significant

**Table 1.** Prevalence of *Entamoeba histolytica* infection in relation to sex.

Sex	Number examined	Number positive	Percentage positive
Male	133	89	66.92
Female	145	99	68.28
Total	278	188	67.63

**Table 2.** Age related prevalence of *Entamoeba histolytica* infection.

Age	Number Examined	Number positive	Percentage positive
1-3	50	33	66.00
4-6	68	58	85.29
7-9	78	55	70.51
10-12	82	42	51.27

at  $P < 0.05$ .

## RESULTS

Out of 278 pupils sampled, 188 (67.63%) were positive for *E. histolytica* and 100 (35.97%) were negative. The prevalence of *E. histolytica* in relation to sex showed that out of the 133 male examined, 89 (66.92%) were positive or infected, while of 145 female pupils examined, 99 (68.28%) were infected with *E. histolytica*. The slight increase in female compared to the male is not statistically significant ( $P > 0.05$ ) (Table 1). Table 2 showed that the prevalence of the infection in relation to age was highest (85.29%) in 4 to 6 year age group while the least infection of 42 (51.22%) was recorded in 10 to 12 year age group. There was a significant difference between ages of the pupils ( $P < 0.05$ ) (Table 2). The infection of *E. histolytica* in relation to sources of drinking water is shown in Table 3. Pupils using water from the stream had the highest infection (94.29%), while the least infections (55.15%) were found in pupils using tap/borehole water. The prevalence of infection according to sources of drinking water is significant.

The prevalence of *E. histolytica* in relation to sources of food eaten in school showed that pupils who bought food from vendors had the highest infection (95.01%) while those that brought their food from their homes had the least infection (55.87%) (Table 4). There was a significant difference between food sources. Table 5 showed that the prevalence of infection in relation to type of toilet used was highest (88.89%) in pit toilet, followed by bush (77.78%) and least infection was found in water closet (55.29%). The infection of *E. histolytica* in relation to the last date the pupils took de-worming drugs is shown in Table 6. Pupils that were de-wormed a month earlier

before this research work had the least infection (25.0%), while those that were de-wormed nine months and above had the highest infections (81.25 and 91.25%), respectively. Analysis showed a significant difference ( $P < 0.05$ ).

## DISCUSSION

The results obtained from this work showed that 188 (67.6%) of the 278 stool samples examined were positive for *E. histolytica*. Children aged 4 to 6 had the highest prevalence of 85.3% while age 10 to 12 had the least prevalence of 51.2%. The prevalence of *E. histolytica* recorded in this study is quite higher than those obtained by some other researchers. A prevalence of 26.7% among school age children was recorded in Lafia, Nasarawa State (Reuben et al., 2013), in Anambra, Southeast and Jos, Plateau State Nigeria, rates of 12.6 and 17.0% were recorded among children, respectively (Amuga and Onyeka, 1995; Dawet et al., 2012). However, the highest prevalence of 72% for *E. histolytica* among other intestinal parasites was reported among food vendors in Abeokuta (Idowu and Rowland, 2004). Also report has shown 5.3% in India (Nduka et al., 2006) while 39.8% prevalence of the *E. histolytica/dispar* complex with microscopy in Northern Ghana (Ukpai and Ugwu, 2003). The comparative high prevalence of *E. histolytica* in this study can be attributed to poor sanitary practices, unhygienic methods of waste disposal, shortage of good water supply and low standard of personal hygiene among the children, since the transmission is mainly by faeco-oral route (Emmy-Egbe, 2009).

The insignificant difference ( $P < 0.05$ ) in infection according to sex observed in this study agrees with Dawet et al. (2012) and Houmsou et al. (2010), where



**Table 3.** Prevalence of *E. histolytica* in relation to source of drinking water.

Source of water	Number examined	Number positive	Percentage positive
Well	107	80	74.77
Tap/Borehole	136	75	55.15
Stream	35	33	94.29
Total	278	188	67.63

**Table 4.** Prevalence of *E. histolytica* infection in relation to sources of food eaten at school

Food source	Number examined	Number positive	Percentage positive
Buying	67	58	95.01
Home	179	100	55.87
Others	38	30	78.95
Total	278	188	67.63

**Table 5.** Prevalence of *E. histolytica* infection in relation to type of toilet

Type of toilet	Number examined	Number positive	Percentage positive
Pit	90	80	88.89
Water closet	170	94	55.29
Bush	18	14	77.78
Total	278	188	67.63

**Table 6.** Prevalence of *E. histolytica* in relation to the last date of de-worming

Month	Number examined	Number positive	Percentage positive
1	60	15	25.0
2	58	35	55.17
9	80	65	81.25
>9	278	188	67.63
Total	80	73	91.25

they recorded non-significant differences in distribution of intestinal parasites by sex among primary school children in Jos, Plateau State and Markudi, Benue State, respectively. Taiwo and Agbolade (2000) maintained that both sexes have the same chance of contracting the disease, in as much as boys go barefooted during games and girls do so in most of their games. However, this result is in collaboration with the work of Lawan et al. (2004) where the females had higher infestation rate (57.5%) than their male counterpart (42.5%) in children under five years in Jos.

The high prevalence of 85.3 and 70.5% recorded among children between age groups 4 to 6 and 7 to 9,

respectively could be as a result of their low immunity, social and sanitary habits since they spend most of their time outdoors. They play a lot with and on sand with no care and also eat most of the time with unwashed hands. A moderate prevalent rate of 55.7% recorded in ages 1 to 3 could also be attributed to their minimal contact with the outside environment since both at home and school they are always indoors for most of their activities. The age group 10 to 12 recorded lowest prevalence rate which could be attributed to their maturity and hygiene consciousness. The significant prevalence ( $P < 0.05$ ) according to age recorded in this study is consistent with Houmsou et al. (2010), who reported that younger children

children below 14 years had high prevalence (54.5%) of intestinal parasite than older ones. Houmsou et al. (2010) and Reuben et al. (2013) also reported that age were significantly associated with the prevalence of *E. histolytica/dispar*.

The significant difference ( $P < 0.05$ ) in the prevalence of *E. histolytica* in children that sourced water from well, tap and stream (74.8, 55.2 and 94.3%, respectively) could be due to the extent to which these water sources are associated with defaecation habits, sewage disposal habits and the level of sanitation at home and in the community at large. This result revealed that the prevalence of intestinal parasitosis was higher among children using water sources other than pipe-borne water alone. This work collaborate the report of Amuga and Onyeka (1995) where they reported significant infection rates of 26.9 and 25% of *E. histolytica* for users of surface water and unprotected well water, respectively while low infection rate of 11.4 and 15 were recorded for tap water and protected borehole water, respectively. Similarly, Lawan et al. (2004) reported a statistically significant relationship between gastro intestinal infection and source and domestic treatment of drinking water, among the under-fives in Jos. However, the result of this study is contrary to the reports of Dawet et al. (2012) and Oyerinde et al. (1979) who reported that the prevalence of *E. histolytica* was not associated with type of water supply but was seemingly influenced by storage of household supplies.

The significant difference ( $P < 0.05$ ) in the prevalence of *E. histolytica* in children that sourced food eaten at school from buying (food vendor), home and other sources (95.0, 55.9 and 79%) could be due to the sanitary habits of the food vendors since their sole aim is to make profit. The lowest prevalence recorded in children who brings food from their various homes could be attributed to the level of good hygiene practiced at home. With respect to toilet types, children who use water closet toilet had the least prevalence (55.3%) while children who use pit toilet had the highest prevalence of 88.9% which could be as a result of the poor hygiene and maintenance of the environment as previously reported by Ademiluyi and Odugbesan (2013) since most of the children after using the toilet will not wash their hand and still eat with such hands. Flies also carry foods contaminated with faecal material from one place to another (Reuben et al., 2013).

The significant difference ( $P < 0.05$ ) between the prevalence of *E. histolytica* and last date of de-worming among the children studied showed that it is advisable for parents and guardians to de-worm their ward in the space of three months interval as specified by some researchers. The children that were de-wormed a month earlier of this study had the least prevalence (25%) while those that were de-wormed nine months and above had

high prevalence of 81.3 and 91.3%, respectively.

## Conclusion

The high prevalence of *E. histolytica* infection in children in tropical Africa is a developmental challenge which calls for the assessment of the impact of programmes on millennium development goals in the areas of health. Mass chemotherapy and integrated measures of parasitic control would be of utmost importance in reducing the level of infections among children. Therefore, it is recommended; that the public should be sensitized on personal and public health; health education on these parasitic diseases should be taught in school and through the local health workers to the people of their immediate environment.

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## Conflict of interest

Authors have none to declare

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