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Frequency of Deworming, Parental Perception and Factors Associated with the Practice of Deworming School-age Children in North-East Nigeria

Madubueze Ugochukwu Chinyem[1*], Una Alfred Friday[1], Tafawa Balewa Ibrahim[2], Iwu Anthony Chinedu[3], Azuogu Benedict Ndubueze[1], Madubueze Christian Chukwuemeka[4] and Khalid Kasimu[2]

[1]Department of Community Medicine, Federal Teaching Hospital Abakaliki, Ebonyi State, Nigeria.
[2]Earth Green Concepts, B288 Wunti Street, Wunti, Bauchi State, Nigeria.
[3]Department of Community Medicine, Imo State University Teaching Hospital, Orlu, Imo State, Nigeria.
[4]Department of Surgery, National Hospital Abuja, FCT, Nigeria.

Authors' contributions

This work was carried out in collaboration between all authors. Authors MUC and UAF designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors ABN and IAC managed the analyses of the study. Authors MCC, TBI and KK managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aims: To assess the frequency of deworming among school children, assess parental perception of the practice and the factors influencing school child deworming practices among the parents/guardians in Bauchi State.
Study Design: It was a descriptive cross-sectional study carried out in Bauchi State North-East Nigeria in March 2016 among parents/guardians of primary school pupils. A multi-stage sampling technique was used to select 12 out of 36 primary schools for the study.

**Corresponding author: Email: ugomadubueze@gmail.com;*

Methods: There were 598 participants. A semi-structured questionnaire was used to elicit variables such as frequency of de-worming, parental perception and predictors of parents/guardian deworming practices.
Results: Nearly half 272 (45.5%) of the guardians were aware of deworming, while only 118 (19.7%) of their school children had been dewormed but 572 (95.7%) guardians saw deworming as an important practice and 560 (93.6%) wanted their children dewormed. Binary logistic regression showed that being a male child and having a previously dewormed child were positive predictors for the practice of school children's deworming.
Conclusion: The frequency of de-worming practice is low in North-East Nigeria, this was majorly due to lack of awareness. This underscores the need for scaling-up of deworming exercises alongside sensitization and health education of parents/ guardian of primary school pupils.

Keywords: Frequency; parental perception; deworming; school-age children.

1. INTRODUCTION

Infections with parasitic helminths are among the most common and widespread infections of humans in the world today especially among school-age children in developing countries [1]. They are transmitted by ingestion of eggs present in human faeces which contaminates soil in areas where sanitation is poor, hence they affect the poorest and most deprived communities [2].

The World Health Organization (WHO) estimates that over two billion people are infected with one or more soil-transmitted helminths and common species identified are the roundworm (*Ascaris lumbricoides*), the whipworm (*Trichuris trichiura*) and the hookworms (*Necator americanus* and *Ancylostoma duodenale*) [3]. WHO puts the latest estimates of children in need of treatment for these parasites at more than 880 million while over 610 million children of school age stand the risk of morbidity occasioned by soil transmitted helminthiasis and schistosomiasis [4]. The organisation recommends annual treatment in areas where prevalence rate of soil-transmitted helminthiases is between 20% and 50%, and a twice a year treatment in areas with prevalence rates of over 50% [5]. Despite these recommendations and scaling-up of deworming exercises targeted at increasing coverage of deworming among school-aged children, soil helminthiasis is still a major public health issue [6].

Studies in Nigeria have reported a high prevalence of worm infestation among school-aged children. In riverine communities of Warri North Local Government Area of Delta State, Nigeria, 77% of the school children studied were infected with intestinal helminths [7]. Another study reported the prevalence of intestinal parasitism among pupils in the rural schools (the Almajiris) in Borno state of Northern Nigeria as 80.9% [8]. A study done in Turkey in which parents were interviewed on de-worming revealed that 84.7% of parents were aware of the school health program. It also identified among others; community knowledge and perceptions of deworming, benefits of the treatment, and willingness of the community to pay as factors contributing to issues of sustainability of deworming programs [9]. Another study on community perception of school-based de-worming program in Ghana highlighted the need to educate illiterate mothers, increase involvement of families in the mass treatment process, reach children that are absent from school and make efforts to change the perception of the community about de-worming [10]. In the study carried out in Turkey, it was reported that the interviewed community members saw deworming with antihelminthics as an experiment by foreigners with the aim of inducing sexual sterility among the local population. Others believed that the drugs would introduce infection in their children Most parents in the study did not perceive worm infection as a major health problem for children [9].

Worm infection has been known to have several health and developmental consequences on the child especially the school age child. The most disadvantaged groups such as the poor and the female children often suffer most from ill health and malnutrition occasioned by worm infestation. These disadvantaged groups would gain the most from deworming [11].

Chronic parasitaemia could cause disruption of both physical and mental development of the child, give rise to anaemia, malabsorption, protein-energy malnutrition, growth stunting, reduced physical fitness, decreased school

attendance, reduced cognitive development and decreased grade attainment [12].

The most cost-effective way to deliver deworming drugs regularly to school-age children is through school based deworming programmes. This is because, a school offers a readily available, extensive and sustained infrastructure with a skilled workforce that is in close contact with the community.

Regular deworming is very important because it contributes to good health and nutrition for children of school age. In addition, it will improve their physical and mental health and development with the benefit of increase in school enrolment, attendance, cognition and reduced class repetition [11]. Deworming of school children also protects other children indirectly. This happens because the dewormed child does not shed the ova of the parasites that could in turn affect other non-infected children [13]. Therefore, this study seeks to determine the frequency of the practice of deworming, parental perception of deworming and factors associated with deworming School-age children in North-East Nigeria.

2. MATERIALS AND METHODS

2.1 Study Area

The study was conducted in March 2016 in Bauchi Local Government Area (LGA) of Bauchi State, one of the States in North Eastern region of Nigeria. The State was created in 1976 and is made up of 18 Local Government Areas (LGA) with Bauchi LGA as its capital city. Bauchi is demarcated on latitude 9°30" North and $12^0$30" North respectively. The western and eastern boundaries are demarcated by longitude $8^0$45" and 11°0". The State covers a land mass of 49,259 km^2 [14]. People of Bauchi State are predominantly Hausa/Fulani by tribe. There are 36 public primary schools in Bauchi LGA [14].

2.2 Study Population

The study was carried out among parents/guardians of pupils attending 12 randomly selected public primary schools. All consenting parents of the school children were eligible for the study.

2.3 Study Design

This was a descriptive cross-sectional study conducted in March 2016 amongst parents of primary school pupils attending the 12 selected schools in Bauchi LGA.

2.4 Sample Size Determination

The minimum sample size was calculated using the Cochrane formula for study population greater than 10,000 [15].

$$N = Z^2 \frac{(pq)}{d^2}$$

When N = minimum sample size, Z = Standard normal deviate corresponding to the probability of type I error is 1.96, p = prevalence of deworming (50%) [6]. q = 1-p, d = tolerable error of margin set at 0.05. The minimum sample size calculated was 502 but the researchers increased the sample size to 598 participants to accommodate non-response.

2.5 Sampling Technique

A multi-stage sampling technique was used to select parents of children attending 12 selected primary schools used for the survey. The first stage was a simple random sampling to select 12 schools from a list of 36 primary schools in Bauchi Local Government area. The second stage was a systematic sampling method to select 10 pupils from each class for the respective levels in the selected schools with an average of 50 pupils per school (Primary 2 to 6). The parents of the selected children were invited for questionnaire administration through the principals of the respective schools. Those who gave their consent were interviewed for the study.

2.6 Data Collection

The study instrument was a pre-tested semi-structured (with reliability coefficient of 8.0), self-administered questionnaire. The questionnaire was self-developed and comprised of three sections on socio-demographic characteristics, perception/practice and factors influencing up-take of deworming. The age and sex of the school child whose parent was interviewed were also recorded.

2.7 Statistical Analysis

The data was analysed using Statistical Software Packages for Social Sciences (IBM - SPSS version 21), for Windows. Frequencies and proportions were calculated for categorical

variables, while the means and standard deviations were calculated for numeric/quantitative variables. Comparison between categorical variables was done using a chi-square test. Fishers Exact Test was done for outputs where one or two of the cells had numbers less than 5. A '*P* ' value less than 0.05 was considered statistically significant, using a two-tailed distribution. Bivariate analysis was done to assess the relationship between socio-demographic characteristics, awareness, perception of deworming and deworming status of school children. Variables that were significant on bivariate analysis were fed into a multivariate binary logistic regression model to assess the association and interactions among factors influencing guardians deworming practice.

2.8 Ethical Considerations

The study was approved by National Research and Ethics Committee (NREC) Bauchi State. The approval ID was NREC/12/05/2013/16/03 and written informed consent was obtained from each parent or guardian.

3. RESULTS

Parents/guardians of 598 primary school children from 12 selected schools in Bauchi State were interviewed mainly on the deworming status of their wards in primary school. They were also interviewed on their historical practices of deworming and some socio-economic features of the guardians that may affect the practice of school child deworming. Also evaluated was their perception of child deworming practices.

3.1 Socio – demographic Characteristics of School Children and the Guardians

Table 1 shows that 598 school children included 302 (50.5%) males and 296 (49.5%), females whose combined average age was 10.6 years, ranging between 5 and 20 years with those aged 10 – 14 years being greatest in proportion 410 (68.6%). Their interviewed guardians were between the ages of 18 and 82 years with an average age of 44.3 ± 10.7 years. Those aged 40 – 49 years constituted the greatest proportion 211 (35.3%). The proportion of males 511 (86.5%) was more than that of the females.

Less than half 272 (45.5%) of the guardians were aware of deworming while 118 (19.7%) of the school children had ever been dewormed by these guardians. Out of this number, 29 (24.4%) were dewormed 6 months prior to the study and 90 (75.6%), dewormed over 6 months before the commencement of the study. One hundred and seventy (28.4%), guardians had ever dewormed their other children apart from those in school. The commonest reason why minority of the school children were dewormed was because majority of the guardian 326 (54.5%) never knew about deworming. One hundred and eighteen (19.7%) said that they had never given deworming a thought while the cultural practices and religious belief of one guardians respectively, did not permit deworming of children. However, 572 (95.7%) guardians saw deworming as a worthwhile practice and 560 (93.6%) would want their children dewormed (Table 2).

Table 3 revealed that the proportion of dewormed school children was greatest among those aged 5 – 9 years 44 (24.0%), compared to other age groups. Males were also favoured 71 (23.5%) in terms of deworming compared to their female counterpart 48 (16.2%). Guardians aged 30 – 39 years practiced deworming of the school child 34 (25.8%), more than other age groups. However, the females marginally practiced child deworming for the school child, 18 (20.7%) more than the males 101 (19.8%). Statistical significant relationships existed only between the sex of the school child and child's deworming status (P = .02), but not with child's age nor with guardians' sex and age group.

Findings in Table 4 revealed that higher proportion of guardian who had heard about deworming, practiced it on the selected primary school children 119 (43.9%), compared to those who were not aware (P < .001). Out of 170 guardians who dewormed their other children, 117 (68.8%), dewormed their wards in primary school as against 53 (31.2%), who did not. Similarly, 117 (20.5%), guardian who saw deworming as a worthwhile practice dewormed their primary school children, in contrast to 2 (7.7%) among those who had negative perception about deworming. Guardians who had more than 20 children 6 (23.1%), dewormed greater proportion of wards in primary school that those who had less number. Significant statistical relationship was seen between awareness/deworming of other children and deworming practices (P<.001).

Table 1. Socio – demographic characteristics of school children and the guardians

Variables	Description/Frequency (%)		
	School children		Guardians N = 598
Mean age (years)	10.6 ± 2.3 (C.I = 10.4 – 10.8)		44.3 ± 10.7 (C. I = 43.4 – 45.1)
Age group	**N = 595**		
5 – 9	183 (30.6)	< 19	1 (0.2)
10 – 14	410 (68.6)	19 – 29	46 (7.7)
15 – 20	2 (0.3)	30 – 39	132 (22.1)
		40 – 49	211 (35.3)
		50 – 59	153 (25.6)
		≥ 60	55 (9.2)
	Gender N = 598		
School children		**Guardians**	
Male	302 (50.5)	Male	511 (85.5
Females	296 (49.5)	Females	87 (14.5)

Table 2. Child's deworming status/guardians awareness and perception of deworming practices

Variables	Frequencies (N = 598)	Percentage (%)
Guardians who were aware of deworming	272	45.5
School children who were dewormed	118	19.7
Last time school child was dewormed		
≤ 6 months ago	28	4.7
7 months – 1 year ago	29	4.8
> 1 year ago	61	10.2
Guardians who have dewormed other children	170	28.4
Reasons why child was not dewormed		
My culture does not encourage it	1	0.2
My religion does not permit it	1	0.2
No money	11	1.8
It is not necessary	22	3.7
I never thought about it	118	19.7
I do not know about it	326	54.5
Guardians who feel that deworming is good	572	95.7
Guardian who want child dewormed	560	93.6

Table 3. Association between age and gender of child/guardian and deworming practices

Variables	Deworming status of school children N (%)			χ^2(*P*-value)
	Yes	No	Total	
Age group of school child				
5 – 9 yrs	44 (24.0)	139 (76.0)	183	3.1 (.12)
10 – 14 yrs	75 (18.5)	335 (81.7)	410	
15 – 20yrs	0 (0.0)	2 (100)	2	
Child's gender				
Male	71 (23.5)	211 (78.5)	302	4.9 (.02)
Female	48 (16.2)	248 (83.8)	248	
Age group of guardian				
< 19 yrs	0 (0.0)	1 (100)	1	7.1 (.23)
19 – 29 yrs	4 (8.7)	42 (9.3)	46	
30 – 39 yrs	34 (25.8)	98 (74.2)	132	
40 – 49 yrs	43 (20.4)	168 (79.6)	211	
50 – 59 yrs	28 (18.3)	125 (81.7)	153	
≥ 60 yrs	10 (18.2)	45 (81.8)	55	
Sex of guardian				
Male	101 (19.8)	410 (80.2)	511	0.04 (.89)
Female	18 (20.7)	69 (79.3)	87	

Table 4. Association between other guardians' factors and deworming practices

Variables	Deworming status of school children N (%)			χ^2(*P*-value)
	Yes	No	Total	
Guardians who were aware of deworming	119 (43.9)	153 (56.2)	272	111.1 (< .001)
Guardian had ever dewormed other children	117 (68.8)	53 (31.2)	170	356.7 ((<.001)
Guardian who see deworming as good practice	117 (20.5)	455 (79.5)	572	2.5 (.08)
Number of guardian's children				
< 6 children	46 (19.8)	186 (80.2)	232	2.1 (.56)
5 – 10 children	48 (21.9)	171 (78.1)	219	
11 – 20 children	19 (15.7)	102 (84.3)	121	
>20 children	6 (23.1)	20 (76.9)	26	
Educational status of guardian				
Vocational education	0 (0.0)	10 (100.0)	10	
Primary school	5 (6.9)	67 (93.1)	72	20.4 (.001)
No formal education	6 (12.0)	44 (88.0)	50	
Secondary school	33 (18.6)	151 ((82/1)	184	
Tertiary education	75 (26.6)	207 (73.4)	282	
Occupation of guardian				
Manufacturing	5 (33.3)	10 (66.7)	15	18.9 (< .001)
Civil servant	39 (30.0)	91 (70.0)	130	
Public servant/defence	11 (27.5)	29 (72.5)	40	
Professional	24 (24.2)	75 (75.8)	99	
Retired	12 (24.0)	38 (76.0)	50	
Artisan/non-professional	12 (14.6)	70 (85.4)	82	
Business	16 (10.81)	132 (89.2)	148	
Student	0 (0.0)	13 (100.0)	13	
Farming	0 (0.0)	21 (100)	21	

Table 5. Predictors of parents/guardians deworming practice

Variable	Wald (χ^2)	*P*-value	Exp(B) (Odds Ratio)	95% C. I of Exp (B)
Gender of school child (Male)	7.8	.01	2.5	1.3 – 4.8
Ever dewormed any child (Yes)	72.9	<.001	530.2	125.5 – 2238. 9

Also, shown in Table 4 is that the proportion of guardians who practiced deworming was greatest among those who completed tertiary education 75 (26.6%) whereas, those who had vocational education never dewormed their wards attending primary school. Among the occupational groups, the proportion of guardians in the manufacturing industry who dewormed their children in school 5 (33.3%), was more than those dewormed by persons engaged in other occupations, followed by the civil servants 39 (30.0%). Guardians who were students and those in the agricultural sector never dewormed their children who were in primary school. Occupation and educational status had highly statistical significant relationship with deworming practices for school children *(P* <.001).

A multi - variate analysis of the factors driving guardians to deworm their primary school wards using binary logistic regression, showed that the sex of the school child mattered to them. The guardians are about 3 times more likely to deworm their male primary school children than the females. Similarly, having practiced deworming on other sibling of the school child was a very strong factor for the school children's deworming. A guardian who had dewormed any of his/her other children was 530 times more likely to deworm the one in primary school.

4. DISCUSSION

Generally, findings from this study revealed that nearly half (45.5%) of the parents/guardians of the school children were aware of deworming with a consequent very low frequency of child - deworming practices in the study population. This level of awareness was much lower than that of parents in a study conducted in another State of Northern Nigeria where 70.9% had heard about deworming [16]. A study in Turkey revealed much less level of awareness (15.3%) [10]. However, in this study out of the 598 school children, only 119 (19.9%), were ever dewormed by the parents/guardians. Of this number, 28 (23.7%), received antihelminthics 6 months before the study, while 61 (51.7%) children who

were ever dewormed received the medication more than a year prior to the survey. A study of deworming status of children population in River State of Nigeria was more encouraging as 50% of the children were periodically dewormed [17]. The finding of this present study was also at variance with that of a study conducted in Brazil in which as much as 51.0% of children were dewormed 6 months prior to involving them in the study. In this present study, there was a highly statistical significant association between parents' deworming awareness and deworming of their school children (P <.001) (Table 3). In contrast, a study in Rivers State Nigeria reported that beyond awareness, knowledge of deworming did not connote practice [17].

A combination of poor awareness of deworming and high intestinal parasitic burden of over 50% prevalence reported in several studies in some states of northern Nigeria and other parts of the country complicated by poor parental deworming practices of school children is a cause for concern. For instance, in Borno and Kaduna states in the north and Delta states in southern Nigeria, prevalence of helminthiasis among primary school children were 80.9%, 67.1% and 77% respectively [7,8,18]. Going by the WHO recommendation for control of helminthiasis, therefore, twice yearly mass deworming of the school children is needed in order to effectively combat intestinal parasitic infestation in states of the region [18,19].

It is evident in this study that a very low proportion of parents practiced child deworming in general as only 28.4%, ever dewormed other children apart from those in primary school. Various reasons for the abysmal deworming practices were advanced by the parents. More than half of them (54.5%), did not deworm because they never heard about the intervention. Among those who were aware (19.7%), said they never gave it thought and 3.7%, never considered deworming their children a necessary venture.

It may be extrapolated that parents/guardians who had ever dewormed their other children may be more likely to administer prophylactic antihelminthics on their children in primary school. This calls for more awareness creation in the form of health education and social marketing on the importance of deworming. Such an exercise would emphasize the benefits of deworming in the physical and mental development as well as academic progress of the school child and the spill over benefit to their peers [14,20]. A study in Bangladesh revealed that socio cultural factors could influence parents' (women's), tendencies to seek treatment of child's intestinal parasite as well as their knowledge of helminths and exposure to health education [21]. Same could apply to school child deworming practices. Therefore, there is a need to involve stakeholders in religious and cultural milieu in re-orientating the parents and the community on the importance of school child deworming.

Despite the low level of awareness, a high proportion (95.7%), of the parents/guardians had a good perception of deworming to the extent that 93.6% of them subscribed to the deworming of their children. Such acceptance and willingness to deworm children were seen in studies carried out jointly in Ghana and Tanzania and another in Brazil [9,22]. In the Ghana/Tanzania studies, 90% of the parents were even willing to pay for the sustenance of a school based deworming program. This was contrary to the finding in Jos Plateau State, a neighbouring state to the study population, in which there was poor attitude towards deworming [16]. The findings of this study show an encouraging level of acceptance and readiness to deworm among the parents/guardians, therefore, it's likely that what was really lacking in the schools and the communities was a program designed for periodic deworming of the school children. These underscores the need for a school health and community based program that incorporates periodic mass deworming of school-age children both in and out of school in the region. The study in Kaduna State also had similar recommendation [18]. School based deworming exercise has been shown to minimize cost of delivery of the medications per child while maximizing the reach of the exercise [13].

Though studies have identified child's age as a significant risk factor for helminthic infestation [23-25]. However, there was no significant statistical relationship between the age of neither the school children nor the parents and deworming practices in the present study. Two of these studies conducted in Nigeria revealed variously that the age group 8 – 12 and 12 -17 years were most at risk [24-25]. The studies attributed the relationship to the fact that increasing age increases the risk of exposure to worm infestation such as contact with soil contaminated with faeces especially as the

school child starts developing the capacity to personal care with less assistance from parents in addition to increased outdoor activities. From the foregoing, it is obvious that the age bracket at which worm infestation is commonest, falls within the school age, hence necessitating the need for an efficient and effective implementation of periodic deworming of the group as well as integration of the practice into school health program in the region.

Being a male school child, favours the probability of receiving deworming therapy (P =.01). This practice of preferentially deworming the male child, though may be inadvertent, is justified by the finding of some studies [22,24]. A multivariate analysis of factors predicting helminthic infestation in a study conducted in Brazil identified being a male child as a highly significant risk factor (P < .001) [22]. The study in Jos report the contrary whereby more females ran a greater risk than males (P < .95) [16].

Though family size had no significant statistical association with parents/guardians' child-deworming practices in this study (P = .56), there was inverse relationship between the practice and the number of children in the family. As shown on Table 3 parents/guardian with more children dewormed smaller proportions of them. This may be the explanation to the finding in a study conducted in the western region of Nigeria in which the prevalence of worms increased with increasing family size [26]. Similar finding was reported by a study carried out in Rural China [18]. These poor deworming practices may be attributable to the reduced capacity of the parent/guardian to meet up with family needs including deworming, considering the large size of the family.

Socioeconomic characteristics of the parents/guardians such as their occupation and educational attainment revealed a highly statistically significant relationship (P < .001), with child deworming practices. The proportion of parents with higher level of (formal) education who practiced child deworming was more than that of their counterparts with lower levels to the extent that parents with vocational education never dewormed any of their school children. Several studies identified low level of parental/caregiver education as a risk factor for worm infestation to which non-deworming of children may be a one of the reasons [19,27,28]. For instance, the study which involved mothers in rural setting in China and Mexico highlighted the fact that the likelihood of intestinal parasitic infestation was less in mothers with more education than the less educated one [19,27].

Parents/guardians whose occupation entailed some sort of professionalism dewormed their children in school more their counterparts who are non-professionals. This finding may be explained by what was seen among the more educated ones. Thus, professionals are probably more educated than the artisans, farmers and students and by extension, as seen above, are more likely disposed to deworming their children compared to the non-professionals.

The result of the multivariate analysis (Table 5), showed that the likelihood of a parent/guardian deworming a school child is higher when the child is a male. The likelihood is even greater if the parent/guardian is used to deworming other sibling of the school child. In the first instance, the male school children are preferentially dewormed because they are more infested by the worms in the region. As a result, there is the tendency for parents to deworm the male children who always come down with worm infestation. Such perceptions may be common among the less educated and non-professional which explains their less likelihood to deworm their school children. It is also understandable that once a parent practiced child deworming and experienced the benefits therein for the child, such a parent is encouraged to deworm other children.

5. CONCLUSION

Deworming practices is low among parents of the school children studied. This study has shown that there was lack of awareness of deworming of school children and the benefit thereof among the parents/guardians. Also revealed was that parental preference of male child deworming affected the overall deworming profile of the study population. Educational status and occupation of guardians played prominent part singly in determining their child-deworming practices. There was high acceptability of school child deworming among the study population. However, opportunity to engage in mass deworming of the children was lacking. Therefore, education of parents, planning and implementation of school health programmes that would incorporate deworming and community based deworming program are all very vital in enhancing deworming status of school children and the control of helminthic

infestation among the children in school and those not in schools.

6. RECOMMENDATIONS

1. Periodic deworming exercise should be carried out among school children in the state.
2. Health education and community sensitization of all parents should be embarked upon to create more awareness on deworming of all children irrespective of gender.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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