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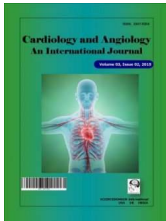
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Acute Rheumatic Fever among Primary School Students in Harari Region, Eastern Ethiopia

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Authors' contributions

This work was carried out in collaboration between all authors. Authors NA and AAR designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors TAA, JKB and EDZ managed literature searches and analyses of the study. All authors read and approved the final manuscript.

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ABSTRACT

Background: In many developed countries, acute rheumatic fever is eradicated through strong health promotion and prevention efforts; yet, it continues to cause serious health problems in many developing countries including Ethiopia. The main aim of the study was to assess the prevalence and factors associated with acute rheumatic fever among primary school students in Harari region, Eastern Ethiopia.

Methodology: A cross-sectional study was conducted among students of four primary schools from November, 2015 to April, 2016. Data were collected according to modified Jones criteria with confirmation of preceding infection by anti-streptolysin –O titre. Factors associated with the outcome were identified using logistic regression. Odds ratios and the corresponding confidence intervals were used to report the findings.

Results: Out of 1739 school children with the mean age of 11.5 years (6-19 years), 21 had Acute Rheumatic Fever (ARF). The two week prevalence of acute rheumatic fever and tonsillopharyngitis were 21/1739 (1.2%) and 231/1739 (13.2%) respectively. Regarding awareness towards causes of

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tonsillitis, 78% perceived consumption of cold foods and drinks. Factors associated with ARF were maternal illiteracy (AOR 5.54, 95% CI 1.07, 28.662) and urban school (AOR 0.254, 95% CI 0.084, 0.769).

Conclusion: The prevalence of ARF among primary school children was high. School health education program focused on acute rheumatic fever causes and consequences are needed to increase awareness among children and their parents.

Keywords: *Acute rheumatic fever; school children; tonsillopharyngitis; Ethiopia.*

1. INTRODUCTION

Acute rheumatic fever (ARF) is the immune-mediated sequel of an innocuous Group A streptococcal throat infection and occurs in 0.3 – 3.0% of children between the ages of 3 and 15 who had untreated sore throat [1]. It causes an acute, generalised inflammatory response that can affect the joints, central nervous system and subcutaneous tissues. It is however the potential damage to heart that is the most concern as it can lead to permanent disability and death [2].

ARF and Rheumatic Heart Disease (RHD) affect about 16 million people worldwide and leads to 250,000 deaths every year [3]. It constitutes 25-40% of all cardiovascular disease in developing countries. More than 80% of affected children younger than 15 years of age belong to the regions of the world where RHD is endemic. Around 8 million school children require further treatment to prevent morbidity and mortality [4].

There were important factors suggested for the increased prevalence and malignant course of rheumatic heart disease in sub-Saharan African nations. Factors like illiteracy, poverty, overcrowding were common conditions associated with the problem and as the prophylactic penicillin therapy was often inadequate the problem got worsen [5]. To identify and treat children suffering from the problem, echocardiographic screening was good method, but this was not true always in many poor countries like Ethiopia, as the device or the technicians were not existing particularly in places far from the centre [6].

Addressing ARF is complex as understanding the disease is incomplete in addition to the influence of upstream determinants of health (such as housing), inequitable access to primary health care and limitations of health literacy in the at risk population. Furthermore, knowledge of the current best practice for sore throat management is variable in the primary care workforce. These leads to in adequate treatment

and transmission of drug resistant organisms among the vulnerable children [2].

Studies showed that ARF affects mainly children between age of 6 and 15 years. Overcrowding and poor access to health care [7], urban residency and maternal illiteracy [8], low level of awareness of about the disease in the community [9] were some of the factors influencing occurrence of the problem.

Few published articles were available in children with rheumatic heart diseases in Ethiopia [10-15], while only one of them was done in the eastern part of the country [13]. These studies revealed that high prevalence of ARF in Addis Ababa (24.9%) [16]; asymptomatic RHD (19/1000) in six geographic regions [13]; high mortality rate in Gonder, Northern Ethiopia [17]; and rheumatic heart disease as a predisposing factor for infective endocarditis in Addis Ababa [18]. All these studies lack to show the burden of acute rheumatic fever in school children. Therefore, this study focused on understanding the level of acute rheumatic fever and factors associated with its occurrence among primary school children in Harari region, eastern Ethiopia.

2. METHODS AND MATERIALS

2.1 Study Area and Design

School based cross-sectional study was conducted among primary (grade 1-8) school children in Harari region, eastern Ethiopia, from November 30, 2015 to April 29, 2016. The health service coverage was estimated to be above 100%. There are four governmental hospitals, two private hospitals and four health centres in the town. More than half of the population in this region lives in urban places. In the year 2015/16, there were 84 primary level schools (grade 1-8) in the region among which 62 were government schools (39 rural, 23 urban), 17 were private schools, and 5 were inside religious organizations (1 in mosque and 4 inside church). All private schools were located in urban areas.

In these schools, there were 41,336 students (35,733 in government schools and 5,603 in private/NGO schools). The net education attendance ratio in the region was 79.8% for male and 77.6% for females [19].

2.2 Sample Size Determination and Sampling Technique

The sample size was calculated by epi info online calculator [20] using single population proportion at a precision of 1%, 95% confidence interval and p value of 0.031 [14], hence adjusting for population size and adding 10% non-response rate, the total sample size calculated was 1262.

Four schools were selected randomly using lottery method from all categories and all students in the selected schools were included in the study. These randomly selected schools were Deker primary school (a total of 630 students, Government rural), Ras Mekonin primary school (a total of 1686 students, government urban), SOS primary school (a total of 613 students, private urban) and Mekane Silassie primary school (a total of 268 students, inside religious institution).

2.3 Data Collection

Data were collected on a face-to-face interview using standardized questionnaire. The questionnaire has seven sections that assessed the socio-demographic characteristics of students and parents, health history and physical examination of students, parents' awareness about the disease and environmental conditions. Students were asked about any sore throat/ tonsillopharyngitis (lesion in the tonsils and pharynxes)/ in the preceding two weeks before data collection and confirmed by anti-streptolysin –O titre. Chest auscultation for apical pan systolic heart murmur or early diastolic murmur was conducted by trained nurses and positive cases were confirmed by internists.

2.4 Data Quality Control

The data collection tool was prepared in English and translated to local languages of the students (Oromiffa and Amharic). Pre-test was conducted in 5% of students in nearby school. Two days training was given to data collectors by investigators. Close supervision was undertaken during data collection in school by supervisors

(1 Paediatrics Nurse and 1 Internist) and investigators.

2.5 Statistical Analysis

Data were coded, and entered in to Epi Data version 3.02 and exported to SPSS version 20 for analysis. Descriptive statistics was used to describe the frequency, mean and standard deviations. Multiple logistic regression (Bivariate and multi-variate analyses) was done to control for confounders, and odds ratios and corresponding confidence intervals were used to report the association between dependent and independent variables. P values of less than 0.05 were considered statistically significant.

2.6 Ethical Considerations

Ethical clearance was obtained from Haramaya University College of Health and Medical Sciences institutional health research ethics review committee (IHRERC) and submitted to Harari region educational bureau, and the selected schools (school principals were consented). Letter of cooperation were written from Harari region Education bureau to respective schools. Parents, students and their class room teachers were informed about the objectives of the study, risks and benefits and written and signed consent were obtained after participant information were read. After data collection health education was given to all students and teachers regarding the causes, clinical features, complications, and treatments with especial emphases on prevention according to their level of understanding.

3. RESULTS

3.1 Socio-demographic Characteristics

Out of 1739 students, 804 male and 935 females participated with 90% response rate. The mean ages of students were 11.5 years (SD \pm 2.52). The mean monthly incomes of families were 2,317 Ethiopian Birr (103.9 USD). Ethnicity of Oromo, Amhara, Adere constitute 36%, 35.8% and 3.8 of study participants. The mean and median family size was 5.6 and 5 respectively with 42.8% of households have more than 5 household members. The mean, median and mode of people per bedroom were 1.6, 1.0 and 1.0 respectively.

3.2 Household Environment

Water supply was not adequate for domestic consumption in 677 (39%) of households. Regarding place of cooking, 614 and 840 households used main house and separate kitchen respectively.

3.3 Prevalence of Tonsillopharyngitis and Acute Rheumatic Fever

The 2 week prevalence of tonsillopharyngitis among school children was 231 (13.2%). According to Modified Jones criteria, 4 students had both chest pain plus migratory poly arthritis, 1 student had migratory poly arthritis plus subcutaneous nodules, 2 students had migratory poly arthritis plus Sydenham's chorea. On the other hand, 3 students were with both chest pain plus Sydenham's chorea, 2 were with both chest pain plus erythema marginatum, 3 were with chest pain plus subcutaneous nodules. Regarding minor criteria's, 3 students had chest pain plus fever plus joint swelling, 2 students had Sydenham's chorea plus fever plus joint swelling, and 1 student had subcutaneous nodule plus fever plus joint swelling. The prevalence of ARF was 21/1739 (1.2% or 12/1000) primary school children.

3.4 Knowledge about Tonsillopharyngitis and ARF

Awareness towards cause of tonsillopharyngitis was low as 180 (77.9%) of participants perceived that the cause was consumption of cold foods and drinks. Only 51 (22%) answered causes of tonsillopharyngitis was infection by bacteria and viruses. Treatment seeking of modern medications from health institutions for tonsillopharyngitis by parents was 226/ 231 (97.84%). Harmful traditional practice of tonsillectomy was practiced by 5/231(2.16%) parents (Table 3).

3.5 Factors Associated with Occurrence of Acute Rheumatic Fever

Maternal illiteracy has significantly associated with ARF (AOR 5.54, 95% CI 1.07 to 28.662). Whereas being in urban school found to be protective from ARF (AOR 0.254, 95% CI 0.084 to 0.769). In this study, overcrowding at home and school, monthly income, father's education and occupation, other environmental and nutritional variables were not associated with ARF.

Table 1. Socio-demographic characteristics of parents of study participants, Harari, Ethiopia, 2015/16

Variables	Frequency	Percentage
Maternal education		
No education	542	31.2
Primary education (grade 1-8)	385	22.1
Secondary education and above	812	46.7
Total	1739	100%
Paternal education		
No education	374	21.5
Primary education (1-8)	290	16.7
Secondary education and above	1,075	61.8
Total	1739	100%
Maternal occupation		
House Wife	349	20
Civil servant	402	23.1
Merchant/Non-governmental Organization	486	28
Daily Labourers	155	8.9
Others	347	20
Total	1739	100%
Paternal occupation		
Unemployed	50	2.9
Civil servant	482	27.7
Merchant/Non-governmental Organization	467	26.9
Daily Labourers	153	8.8
Others	587	33.7
Total	1739	100.0

Table 2. Household environment of study participants in Harar, Ethiopia 2015/16

Characteristics		Frequency	Percentage
Source of drinking water	Piped to yard	1537	88.3
	Public tap	131	7.5
	Protected well	60	3.5
	Surface water	6	0.4
	Unprotected spring	5	0.3
Household solid waste disposal	Collected by the Municipality	1534	88.2
	Garbage pit	196	11.3
	Burn	9	0.5

Table 3. Students suffering from tonsillopharyngitis, treatment seeking behaviour and knowledge of parents in Harari region, Ethiopia, 2015/16

Characteristics		Frequency	Percentage
Suffering from Tonsillopharyngitis	Yes	231	13.28
	No	1508	86.72
Treatment seeking for the problem	Modern Medication	226	97.84
	Tonsillectomy	5	2.16
Causes of Tonsillopharyngitis	Cold foods and drinks	180	77.9
	Infections	51	22.1
Tonsillopharyngitis and ARF/RHD are associated	Yes	8	3.46
	No	223	96.54

Table 4. Factors associated with ARF among primary school students of Harari region, 2015/16

Characteristics		Acute rheumatic fever		COR	AOR
		Yes	No	(95% CI)	(95% CI)
Sex	Male	9	795	1.023 (0.4, 2.5)	0.9 (0.4, 2.4)
	Female	12	923	1	1
Residence	Urban	10	1326	0.2 (0.1, 0.6)*	0.254 (0.1, 0.8)*
	Rural	11	413	1	1
Maternal education	No education	12	530	9.2(2.1, 41.3)*	5.5 (1.1, 28.7)*
	Primary	5	380	1.7(0.6, 4.8)	4.0 (0.7, 22.7)
	Secondary +	4	808	1	1
Family size	Less or equal to 5	13	1005	1.0(0.4, 2.4)	1.9 (0.7, 5.4)
	Greater than 5	8	734	1	1
Number of person/bed room	Less or equal to 2	15	1366	0.67 (0.2, 2.9)	0.9 (0.2, 4.2)
	Greater than 2	6	373	1	1
Family monthly income	Less or to 1000	12	969	0.6(0.1, 4.6)	0.6 (0.1, 5.1)
	1001-5000	7	614	0.6(0.1, 5.3)	0.9 (0.1, 7.3)
	5001 +	2	156	1	1

*significant at p-value <0.05

4. DISCUSSION

The 2 week prevalence of tonsillopharyngitis among school children in Harari region was 13.2%. This was higher than the prevalence of tonsillopharyngitis among school children of 11%

in Denizli, Turkey [21] and 7.65% in Guntur [22]. In this study, many of students were unaware of tonsillopharyngitis causes rheumatic fever and this was similar with a qualitative study done in pacific people in Auckland in which most didn't realize the significance of a sore throat [23].

The prevalence of ARF was 1.2% or 12/1000 among school children. This was lower than studies conducted in Jimma 31/1000 [14], Peru 19.7/1000 [24] and country wide study in Ethiopia 19/1000 [13]. To the contrary the prevalence of ARF in the study area was higher than that of 0.87/1000 children in India [25], 0.6/1000 in Bangladesh [26], 99/10,000 by 2012 and 114/10,000 cases in 2013 in New Caledonian [27] and 1 (0.37%) had a clinical history compatible with the diagnosis of acute rheumatic fever (ARF) in Belo Horizonte [28]. This variation may be due to epidemiological variation of diseases in poor and better of countries. This study clearly indicated that acute rheumatic fever is still a problem in poor socioeconomic societies.

Being from urban school was found to be protective of ARF. This was similar with the findings of 4.42/1000 in rural verses 0.88/1000 in urban school children in Shimla, north India [29]. But, it contradicts with the findings of Bangladesh in which urban residency was associated with ARF [30]. On the other hand, a study in Sichuan province of China revealed that there was no association between residence and ARF [31]. These studies show that geographic residence alone was not a driving factor for ARF, rather a complex contextual factors comes in to play in the occurrence of the problem. The disease can occur anywhere where people live, unless tonsillopharyngitis was not managed promptly with appropriate antibiotics.

In this study, maternal illiteracy was found to be associated with the occurrence of ARF. This was similar with a case-control study in Bangladesh [30]. Children's wellbeing was highly associated with maternal education and wealth status. As the mother is better off, the possibility of getting good nutrition and proper hygiene and care during health and sickness is maintained. As the mothers are able to read and understand, they are motivated to know much about their children and seek medical care at times of sickness.

5. CONCLUSION AND RECOMMENDATIONS

The prevalence of both tonsillopharyngitis and ARF was high in the study area. But, awareness of parents and children towards the cause of disease were low. This needs appropriate awareness creation from responsible organizations in order to prevent serious complication of ARF (rheumatic heart disease). School based health education focusing on

causes and prevention of rheumatic fever and rheumatic heart disease should be emphasized.

CONSENT

As per international standard or university standard, patient's/client'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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