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Prevalence of diaper rash and associated factors among babies aged 0 to 24 months in Adama Administrative City, Central Ethiopia: A cross sectional study

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The objective of this study was to assess the prevalence of diaper rash and identify associated factors with diaper rash among children between 0 and 24 months of age in Adama Ethiopia. A cross-sectional study was conducted with mothers using structured questionaries during face to face interview to assess risk factors associated with diaper rash. Data were analyzed using SPSS version 21 and Chi-square test was used to establish the association between diaper rash and socio-demographic and socio-economic characteristics at p-value <0.05. Multivariate logistic regressions are used to test the significance of risk factors. About 62.5% (235/376) of children in the study had experienced diaper rash. Multivariate logistic regression analysis revealed that diarrhea (AOR=0.424; 95%CI=0.203-0.902; P=0.032), food types consumed by baby (AOR=0.21; 95%CI=0.050-0.882; P=0.033), use of barrier cream (AOR=0.012; 95%CI: 0.005-0.029; P=0.000) and frequency of diaper change (AOR=3.174; 95% CI=0.068-9.438; P=0.038) were among factors associated with diaper rash. In this study changing diaper frequently, using cream and breast feeding with baby formula milk were identified as a factor that reduce the prevalence of diaper rash whereas diarrhea was identified as a risk factor that aggravate diaper rash. Thus, educating mothers on the importance of breast feeding, use of cream and diaper change is useful.

Key words: Diaper rash, prevalence, babies.

INTRODUCTION

Hygiene and health are the primary requirements to live comfortably, as the young babies form the most vulnerable group of the society, ensuring their good health is of prime concern to all members of the society. With the advent of new technologies, the growing needs of the consumer in the wake of baby care and hygiene can be fulfilled without compromising the issues related to safety, baby care and baby diaper is one of the most baby care products (Chandrasekar et al., 2013).

A diaper is a kind of underwear that allows one to

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urinate in a discreet manner and it is primarily worn by children who are not yet potty trained and can be also used by adults with in certain circumstances where access to a toilet is unavailable. These can include the elderly, those with a physical or mental disability and people working in extreme conditions (Juliet and Nikki, 2012).

Diapers were used traditionally for their convenience especially when travelling and nowadays it is used throughout the world both in developed and developing countries and Ethiopia is one of the most importer of diaper which stands ninth out of ten most diaper consumer countries of the world and the second in Africa next Nigeria. Ethiopia imports disposable diapers from different countries such as Turkey, the United Arab Emirates, Saudi Arabia, Italy, Belgium, China, Middle East, Europe, Africa and Asia. The biggest value of imported disposable babies' diapers for 2012 was 3.2 million dollars, 1,369,506.33 kg in amount (ERCA, 2013)

Increased use of diapers associated with child health challenges as baby's health is another consideration of which diaper rash is common. Diaper rash is a general term used to describe any of the various inflammatory reactions of the skin within the diaper area including the buttocks, perianal area, genitals, inner thighs and waistline (Gupta and Skinner, 2004). Diaper rash is caused due to the contact of an infant's diapered body and his diaper which result in irritation (Fernández et al., 2009).

Diaper rash was found to be common among children wearing diaper and studies conducted on prevalence of diaper rash reported different findings in different countries. Accordingly, the study conducted in Japan, USA, UK and Italy reported that the prevalence of diaper rash was found to be 87, 75, 25 and 15%, respectively (Philipp et al., 1997). The study conducted on Chinese children revealed that 43.8% of children enrolled in the study experienced diaper rash (Li et al., 2012). Another study conducted in Mauritius shows that about 79.7% babies had at least one episode of diaper rash (Biranjia-Hurdoyal et al., 2015). Similar study conducted on socio-demographic and economic determinants of diaper dermatitis in Kenya reported that the prevalence of diaper rash was found to be 27.3% (Wanjiku et al., 2016).

Various studies were conducted to investigate the prevalence of diaper rash and its associated factors among babies of which all were outside Ethiopia. The current study which was the first report in its type in Ethiopia was intended to assess prevalence of diaper rash and associated factors among babies aged 0-24 months in Ethiopia.

MATERIALS AND METHODS

Study design and setting

A cross-sectional study design was conducted with mothers having children aged 0-24 months of age at selected *Kebeles* of Adama City administration Central Ethiopia. The information was collected from 376 mothers using structured questionnaires during face to face interview conducted with mothers.

Sample size and sampling procedures

The study included all children aged 0 to 24 months in selected *Kebeles.* Sample size was determined using single population proportion formula assuming population proportion (P) = 0.5 (50%) due to absence of similar studies conducted so far in Ethiopia, 95% confidence interval was considered, 5% level of significance, marginal error of 5% and normal population distribution (Z)= 1.96.

Three sub-cities were randomly selected out of the six sub-cities and random sampling technique was again used to select three Kebeles one from each sub cities. Finally, 376 mothers who have children between 0 and 24 months were selected for an interview using systematic sampling technique considering probability proportional to size. Based on the sampling interval every 3rd children's mothers in the selected Kebeles were selected and interviewed for final report.

Data collection methods

For this study the structured data collection tool was adapted from related literature used for data collection during face to face interview with mothers having 0-24 months of age children. The questionnaires consist of different variables such as socio-economic, demographic data and factors associated with diaper rash.

Enumerators with degree level of health background and fluent in the local language were recruited and trained on the general contents of the questionnaire. Detail orientation was given for the enumerators on the signs and symptoms of diaper rash by pediatrician and data was collected under close supervision of recruited supervisor through face to face interview with selected mothers.

The assessment of the rash on the children was done according to a 4 Point Global Impression scale. The 4-Point Global Impression Scale assessment of the severity of diaper rash was modified from a similar grading scale used effectively in previous dermatological studies This assessment looked at (0 = none, 1 = slight erythema, 2 = erythema over a large area and 3 = erythema over a deeper and larger area). In this study, scales 3 were considered as a diaper rash.

Variables

For this study, diaper rash was dependent variable and age of mother, family size, age of baby, sex of baby, occupation of mother, educational status of mother, family size, family income, type of diaper worn, cost of diaper, frequency of diaper change, frequency of bathing, health status of baby, skin cleaning agent, type of feeding, application of barrier cream and diarrhea were independent that affect diaper rash.

Data analysis

Data cleaning and validation was checked, and the statistical analyses were then undertaken using SPSS version 21 computer software. Descriptive statistics such as frequency, percentage, mean, and standard deviation were used to describe independent variables. Chi-square test was used to establish the association between the dependent variable and independent.

Multivariate logistic regression analysis (with a backward

Table 1. Demographic characteristics.

Factor	N=376	%
Mean age (±SD) of children =2.3(±1.1)		
Age of child in months		
0- 6 months	110	29.3
7-12 months	113	30.1
13-18 months	88	23.4
19-24 months	65	17.3
Sex of the child		
Male	213	56.6
Female	163	43.4

conditional) was then used to examine the independent association of the various factors with diaper rashes, while simultaneously controlling for potential confounders. Statistical significance was set at P-value < 0.5.

Ethical consideration

Approval and ethical clearance of the study protocol was obtained from Samara University College of Medicine and Health Science Research Ethical Review Board. Oromia Regional State Health Bureau/Health Research Ethical Review Committee also reviewed the proposal and wrote support letter to Adama City Health office. Finally, Adama City Health office wrote a support letter to the three selected *Kebeles* and the study was conducted.

RESULTS

Socio-demographic characteristics

In this study, a total of 376 children within the age of 0-24 months were employed of which 113 (30.1%) were between 7 and 12 months, followed by 110 (29.3%) between 0 and 6 months and 88 (23.4%) between 13 and 18 months while the remaining 65 (17.3%) of children were between 19 and 24 months. The mean age of the children was 2.3 (SD±1.1) months. Majority of them 213 (56.6%) were male while the remaining 163 (43.4%) were females. Table 1 shows summary of socio-demographic characteristics among the children.

Socio-demographic characteristics of mothers

A total of 376 mothers with a mean age of 27.4 (SD±4.4) years participated in the study. The respondents were grouped into categories for simplicity of analysis and they are 15-19 years 13 (3.5%), 20-25 years 129 (34.3%), 26-30 years 141 (37.5%) and above 31 years 90 (24%). Majority 184 (48.9%) mothers attended primary education, followed by 119 (31.6%) of

mothers who attended secondary education and 38 (10.4%) and 11 (2.9%) of mothers were diploma and degree holder, respectively while the remaining 24 (6.4%) of them did not attend formal education. Family size is another demographic factor that participants asked to indicate and accordingly, majority 254 (67.6%) of mothers reported that their families are between 3 and 4, followed by 109 (29%) of mothers who reported that their families are between 5 and 6 while the remaining 13 (3.4%) of mothers reported that their family size are 7 and above as presented in Table 2.

Socio-economic characteristics of mothers

Half 189 (50.3%) of mothers responded that they did not participate in any income generating activity, while the remaining 187 (49.7%) reported that they participated in some income generating activities. Accordingly, majority 130 (34.6%) mothers were self-employed, 42 (11.2%) of them were salaried employee whereas the remaining 15 (4%) participated on causal labor. Mothers were asked to indicate the total monthly income of their families and 103 (27.4%) mothers reported that their families' monthly income is in the range of 2001 to 3000 birr followed by 80 (21.3%) mother whose families' income is in the range of 1001 to 2000 birr and 63 (16.8%) mother reported that their families' income is in the range of 4001 to 5000 birr while 9 (2.4%) mothers reported that their families' income was below 1000 birr and the remaining 43 (11.4%) mothers reported that their families' monthly income is above 5000 birr. The detail information is shown in Table 3.

Types of diaper used and changing frequency

Disposable diaper was the only diaper type used by all mothers for their children. Majority 175 (46.5%) of mothers change a diaper once per day for their babies,

Table 2. Socio-demographic characteristics.

Factor	N =376	%
Mean age (±SD) of mother = 27.4 (±4.4)		
Age in years		
15-20	13	3.5
21-25	129	34.3
26-30	141	37.5
>31	90	24
Mothers' level of education		
Illiterate	24	6.4
Primary	184	48.9
Secondary	119	31.6
College Diploma	38	10.1
Degree	11	2.9
Family size of the households		
3-4 families	254	67.6
5-6 families	109	29
7 and above	13	3.4

Table 3. Scio-economic characteristics.

Factor	N =376	%
Mothers' participated in IGA		
Yes	187	49.7
No	189	50.3
Employment status of mothers		
Unemployed	189	50.3
Self employed	130	34.6
Casual labor	15	3.9
Salaried employee	42	11.2
Monthly household income		
<1000	9	2.4
1001-2000	80	21.3
2001-3000	103	27.4
3001-4000	78	20.7
4001-5000	63	16.8
>5001	43	11.4

followed by 103 (27.4%) who change twice per day and 33 (9%) of mothers change a diaper three and more times per day while the remaining 65 (17.3%) mothers do not change a diaper for their children at all. Majority of mothers used water for cleaning the bottom of children followed by baby wipes, cloth and paper tissues. Most 236 (62.8%) mothers use cream to smoothen the bodies of their babies and while the remaining 140 (37.2%) of mother do not use any barrier cream. Majority 235

(62.5%) of the children experienced at least one and above episodes of diaper rash and the detail information is shown in Table 4. Table 4 shows the details on type of diaper use and frequency of changes.

Prevalence of diaper rash among children

Prevalence of diaper rash varies among different age

Table 4. Practice of respondents' diaper use.

Factor	N	%
Types of diaper use		
Disposable diaper	376	100
Frequency of diaper Change		
No change	65	17.3
Once per day	175	46.5
Twice and more per day	136	36.2
Cleaning agents used		
Baby wipes	116	31
Water	198	52.6
Cloth	25	6.6
Cloth and paper tissues	37	9.8
Application of barrier cream		
Nothing	140	37.2
Vaseline	94	25
Baby powder	28	7.4
More than one	114	30.3
No. of diaper rash episodes in the 6 months		
No	141	37.5
Once	50	13.3
Twice	109	29
3-4 times and above	76	20.2

groups as shown in Chart 1, the prevalence was 58% for children between 0 and 6 months, 67.3% for children between 7 and 12 months, 72.7% for children between 13 and 18 months and 47.7% for children between 19 and 24 months of age. Thus, the prevalence of diaper rash was found to be higher among the children between 13 and 18 months of age as shown in Chart 1.

Severity of diaper rash

Mothers were sked about the severity of diaper rash and majority 139 (59.1%) of mothers reported that the rash was slight, followed by 59 (25.1%) mothers who reported that the rash was not sever and 25 (10.6%) mother reported that the severity of the rash was moderate while the remaining 12 (5.1%) mothers reported that the rash was sever as shown in Chart 2.

Factors assumed to aggravate diaper rash

Mothers were asked to indicate factors that aggravate diaper rash. Thus, not changing diaper frequently was the factors that aggravate diaper rash reported by majority 111 (47.2%) of mothers followed by 74 (31.5%) of mother who reported that they do not know factors that aggravate diaper rash while heat was reported as factors that aggravate diaper rash by 50 (21.3%) mothers as shown in Chart 3.

Bivariate logistic regression result

Bivariate logistic regression analysis indicated that about ten out of sixteen factors including age of the child, age of mother, mothers' participation on income generating activities, households' monthly income, type of diaper used, cleaning agent used, diarrhea, types of food consumed by the children, frequency of diaper change and application of barrier cream (Table 5).

Multivariate logistic regression

Fitting the factors with p values less than 0.05 in bivariate logistic regression into multivariate logistic regression by specifying 'backward conditional' method with removal at P<0.05, only four of them were found to be statistically significant and associated with diaper rash. These factors

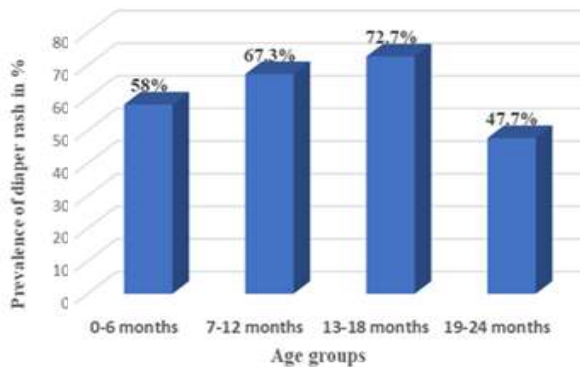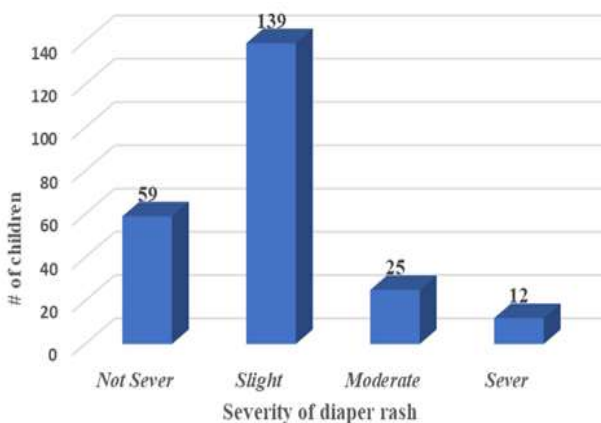**Chart 1.** Prevalence of diaper rash in age groups.
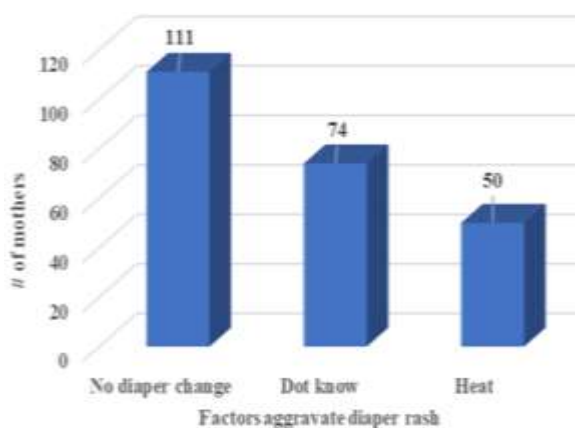

Chart 2. Severity of diaper rash.

Chart 3. Factors that aggravate diaper rash.

were type of food consumed by child (p=0.033), diarrhea (p=0.032), frequency of diaper change (p=0.038) and application of barrier cream (p=0.000) (Table 6).

DISCUSSION

The finding of the study revealed that prevalence of diaper rash which is 62.5% was found to be high and the highest frequency of diaper rash was observed in children between the ages of 13 and 18 months. This finding was in agreement with Turkey study that reported the prevalence of diaper rash 67.3% (Semra et al., 2013). The finding of the study reveals that the prevalence of diaper rash is higher as compared to other similar studies conducted in Italy, UK, Kenya and China which is 15, 25, 27.3 and 43.8%, respectively. However, the prevalence of diaper is found to be lower than as compared with similar study conducted in USA 75%, Matrious 79.7%, and Japan 87%, respectively.   The possible reason for the high prevalence of diaper rash for this study is might be that Adama is found in rift-valley with a higher temperature as compared to other countries where similar studies have been conducted and such climatic factors could increase the prevalence of diaper rashes in Adama.

Another possible reason for the higher prevalence of diaper rash might be due to the fact that all mothers that participated in this study indicated that they were using exclusively disposable diaper due to its accessibility and less cost with less changing frequency. Thus, about 65 (17.3%) of mothers responded that they do not change a diaper for their children while 175 (46.5%) of mothers change a diaper for their children only once per day and this is another factors for this high reported prevalence of diaper rash. The finding of this study reveals that the frequency of diaper change was found to be statistically significant and associated with diaper rash (p=0.038) and thus, children whose mother change a diaper once per day were 3.2 times more likely to develop diaper rash as compared to children whose mother change twice and more times per day. This finding is in agreement with similar study conducted in China which showed diaper should be changed at least every 3 to 4 h to reduce prevalence of diaper rash (Li, 2012).

On the other hand, 72% of mothers who participated in this study reported that their families' monthly income was less than 4000-birr which may not be enough to buy enough diaper to change for their children which is taken as a reason to aggravate the prevalence of diaper rash among their babies.

Diarrhea was identified by this study as statistically significantly associated with diaper rash (P=0.032). Thus, children who do not suffer from diarrhea were about 0.4 times less likely to develop diaper rash compared with children who suffer from diarrhea. This finding was in agreement with the study conducted in China which reported the negative impact of diarrhea on diaper rash (Li et al., 2012). The fact that when children have diarrhea, there is a possibility of frequent production of liquid faeces that contain greater amounts of residual digestive enzymes that can act as skin irritants

Table 5. Factors on Bivariate logistic regression associated with diaper rash.

Variable	Diaper rash		Bivariate analysis	P-value
	Yes n (%)	No, n (%)	COR (95%CI)	
Age of the babies in months				
0-6 moths	64 (58)	46 (42)	1.526 (0.824, 2.828)	
7-12 months	76 (67.3)	37 (32.7)	2.253 (1.205, 4.211)	P<0.011
13-18 months	64 (72.7)	24 (27.3)	2.925 (1.488, 5.750)	P<0.002
19-24 months	31 (47.7)	34 (52.3)	1	
Age of mothers in year				
15-20	12 (92.3)	1 (7.7)	12.000 (1.497, 96.190)	0.019
21-25	89 (67.4)	43 (32.6)	2.070 (1.193, 3.590)	0.010
26-30	89 (63.1)	52 (36.9)	1.712 (1.001, 2.927)	0.050
>31	45(50)	45 (50)	1	
Mothers occupational status				
Unemployed	112 (59.3)	77 (40.7)	0.516(0.245, 1.089)	
Self employed	88 (68)	42 (32)	0.743(0.341, 1.622)	
Casual Labor	4 (27)	11 (73)	0.129 (0.034, 0.490)	P<0.003
Salaried employee	31 (74)	11 (26)	1	
Monthly family income in birr				
< 1000	47 (64.3)	48 (35.7)	0.966 (0.210, 4.440)	
1001-2000	38 (47)	43 (53)	0.415 (0.191, 0.901)	P<0.026
2001-3000	62 (62.6)	37 (37.4)	0.792 (0.374, 1.680)	
3001-4000	55 (74.3)	19 (25.7)	1.310 (0.583, 2.947)	
4001-5000	44 (66.7)	22 (33.3)	0.966 (0.423, 2.204)	
>5001	27 (64.3)	15 (35.7)	1	
Types of diaper used				
Disposable only	235 (62.5)	141 (37.5)	1.667 (0, 0)	P<0.000
Cloth only	0 (0)	0 (0)	0	
Both	0 (0)	0 (0)	1	
Cleaning agents used				
Baby wipes	83 (72.2)	33 (27.8)	3.088 (1.438, 6.630)	P<0.004
Water	122 (61.6)	76 (38.4)	1.889 (0.931, 3.830)	
Cloth	12 (48)	13 (52)	1.086 (0.393, 3.002)	
Baby wipes and water	17 (46)	20 (54)	1	
Diarrhea				
No	101 (54.6)	84 (46.4)	0.511 (0.335, 0.782)	P<0.002
Yes	134 (70.2)	57 (29.8)	1	
Food type consumed by babies				
Exclusive breast feeding	59 (60.2)	39 (39.8)	0.782 (0.479, 1.277)	
Formula milk and breast feeding	9 (36)	16 (64)	0.291 (0.123, 0.689)	P<0.005
Breast, Cow milk and normal diet	20 (66.7)	10 (33.3)	1.034 (0.461, 2.320)	
Breast, formula milk and normal diet	147 (65.9)	76 (34.1)	1	
Frequency of diaper change				
No change	28 (43.1)	37 (56.9)	0.252 (0.135, 0.472)	0.000
Once per day	105 (60)	70 (40)	0.500 (0.306, 0.818)	0.006

Table 5. Contd.

Twice and above per day	102 (75)	34 (25)	1	
Use of barrier cream				
Nothing	16 (11.4)	124 (88.6)	0.012 (0.005, 0.0290	P<0.000
Vaseline	88 (93.6)	6 (6.4)	1.410 (0.493, 4.035)	
Baby powder	27 (96.4)	1 (3.6)	2.596 (0.318, 21.174)	
More than one	104 (91.2)	10 (8.8)	1	

Statistically significant at P value <0.05, COR, odds ratio; CI, confidence interval.

Table 6. Factors on multivariate logistic regression associated with diaper rash.

Variable	S.E	Multivariate analysis AOR (95%CI)	P-value
Diarrhea			
No	0.393	0.432 (0.199, 0.932)	0.032
Yes		1	
Food type consumed by babies			
Exclusive breast feeding	0.452	1.555 (0.641, 3.772)	
Formula milk and breast feeding	0.732	0.210 (0.050, 0.882)	0.033
Breast, Cow milk and normal diet	0.771	1.275 (0281, 5.776)	
Breast, formula milk and normal diet		1	
Application of barrier cream			
Nothing	0.451	0.012 (0.005, 0.029)	0.000
Vaseline	0.559	1.596 (0.534, 4.774)	
Baby Powder	1.088	3.269 (0.388, 27.582)	
More than one		1	
Frequency of diaper change			
No change	0.776	2.168 (0.474, 9.921)	
Once per day	0.556	3.174 (0.068, 9.438)	0.038
Twice and above per day		1	

Statistically significant at p value<0.05, AOR, odds ratio; CI, confidence interval.

(Wanjiku et al., 2016).

In terms of hygiene, the role of an effective skin cleansing agent should be to remove skin contaminants, restore normal skin pH and provide surfactants. Skin in the diaper area should be cleansed as gently as possible to avoid frictional injury. In the present study, skin cleansing agents were identified as associated with diaper rash in bivariate logistic regression analyses and the association was not observed following multivariate logistic regression. One of the most frequently used cleaning agents according to the literature is water and cloth and this study also partially confirmed that water is mostly used by mother as cleaning agent followed by baby wipes.

Another factor demonstrated by this study which was statistically significant and associated with diaper rash

was the use of barrier cream which may smoothen the skin of children that can help to reduce the risk of rash occurrence. Thus, this finding shows that children whose mother do not use barrier cream are 1.2 times more likely to develop diaper rash (P=0.000) as compared to children whose mothers use barrier cream. This finding was consistent with the study conducted in Turkey which reported use of barrier cream reduces diaper rash (Semra et al., 2013).

Types of food consumed by babies are factors for diaper rash and the present study indicated the association between diaper rash and breastfeeding. Thus, the children who consume baby formula milk and breast feed together were 2.1 times less likely to develop diaper rash (P=0.033) as compared with those children who consume breast, cow milk and normal diet. This

finding is in line with the study which reported that breastfed children have a lower incidence of diaper rashes because their stools have a higher pH, lower digestive enzyme activity and less urease-producing bacteria than infant formula-fed children and the World Health Organization has also suggested that mothers should breastfeed their babies and delay the introduction of solid foods until the age of 6 months (Saadeh, 2003).

Limitation of the study

Being the first study for the country, there are challenges with references and all the factors that may have association with diaper rash were not considered. In addition to this, the sample size employed in the study is small to represent the whole population. The study was restricted to Adama city due to time and finance shortage and thus, it may not be comprehensive for the whole country especially for other places with different climate. Thus, researches should be conducted on this regard.

Conclusions

This study is the first report on the prevalence of diaper rash in Ethiopia which demonstrated a high prevalence diaper rash in children aged 0-24 months and the prevalence of diaper rash was found to be high among the children aged 13-18 months. Diarrhea was identified as a significant risk factor that aggravate diaper rash while frequency of diaper change, application of barrier cream on the buttock of children and consumption of breast and baby formula milk together by children were factors identified to reduce the prevalence of diaper rash. Thus, it is better to be given awareness and education campaigns on diaper rash targeted at parents especially mothers during outreaches and hospital visits, use of barrier cream on the bottom of children, increasing frequency of diapers change, and provision of breastfeeding and baby formula milk together.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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