Skin diseases among schoolchildren in Africa

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Chapter 7

Prevalence and risk factors of inflammatory acne vulgaris in rural and urban Ghanaian schoolchildren

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Abstract

Background
We aimed to investigate the prevalence and risk factors of inflammatory acne vulgaris in schoolchildren visiting rural and urban schools in Ghana.

Methods
Data on acne, age, sex, height and weight were collected from 1394 schoolchildren. The prevalence of acne was calculated for 1061 children between 9 and 16 years of age. Potential risk factors were estimated by logistic regression.

Results
In the rural schools only 1 (0.2%) out of 572 children had acne, compared to 63 (12.9 %) out of 489 children in the urban schools (P< 0.001). The prevalence of acne in the urban areas increased from 4.1% in girls and 1.3% in boys between 9 and 10 years old to 28.4% in girls and 16.4% in boys between 13 and 14 years old and leveled off in children between 15 and 16 years of age. The risk adjusted for age and BMI with 95% confidence interval of girls developing acne compared to boys was 3.2 (1.7-6.1). The risk of developing acne for children with a high BMI was 2.0 (0.9-4.3) and for children with a low BMI 0.7 (0.2-2.4) compared to children with a normal BMI.

Conclusion
The prevalence of inflammatory acne vulgaris in Ghanaian schoolchildren was very low in the rural areas and ranged between 1.3% and 28.4% in the urban areas, depending on the sex and age of the schoolchildren. Living in an urban area, increasing age, female gender and high BMI were the main risk factors associated with an increased risk of acne.

Conflict of interest
The authors state no conflicts of interest

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Introduction

Acne vulgaris is a common skin condition in children and adolescents between the age of 10 and 18 years.[1] The prevalence of acne strongly depends on its definition and the age categories of the studied populations. In industrialized countries this condition affects between 31% and 95% of the adolescent population.[1-4] Acne can also persist beyond adolescence.[5]

The prevalence of acne is considerably lower in developing countries.[6-9] Community-based studies, specifically studying acne vulgaris in African countries are scarce and are summarized together with studies performed in other developing countries in Table 1. Hospital-based studies on skin diseases, among which acne, in a population of people of all ages were more frequently reported (Table 1). The prevalence of acne in hospital-based studies in Africa ranged between 2.8% and 8.9% with the exception of a hospital-based study performed in South Africa which showed a prevalence of 16%.[10-17] Only few studies compared the prevalence of acne in schoolchildren who are living in rural and urban areas (Table 1). One study performed in Ethiopia showed a higher prevalence of acne in rural areas (3.3%) compared to urban areas (0.8%).[18] Another study performed in Brazil, however, found the opposite with a prevalence of acne in the rural areas ranging between 0% and 0.7% compared to prevalences ranging between 0.7% and 3.5% in the urban areas.[8]

Different prevalences of acne between industrialized and developing countries may be explained by differences in genetic and environmental risk factors such as diet, usage of medication or cosmetics, and body weight, reflecting the nutritional status of the children. The difference in acne prevalence between rural and urban areas within one country, however, cannot easily be explained by genetic factors and is probably influenced by environmental differences or different food habits.

The purpose of this study was to estimate the prevalence of inflammatory acne vulgaris in schoolchildren living in rural and urban areas of the Greater Accra Region of Ghana and to study risk factors of inflammatory acne vulgaris.

Methods

Recruitment of schoolchildren and Ethical Approval

This cross-sectional study is part of a larger project in which the association of helminth infection and other potential risk factors with allergic sensitization and atopic eczema among school children in Ghana are studied.[19] The children were recruited from 13 schools between January 2006 and March 2007. Between 5 and 16 February 2007 two dermatologists (A.P.M. Lavrijsen and A.A. Hogewoning) visited 11 of these schools in rural and urban areas in the Greater Accra Region of Ghana and screened a total of 1394

Table 1 Reported prevalences of acne vulgaris in developing countries.

Publication year	Country and reference	Study population (N)	Age group (years)	Prevalence of acne	Rural	Urban	Study design*	Study aim**
Africa								
1997	Ethiopia[18]	219	5-15	1.8%	3.3%	0.8%	C	SD
1998	Mali[13]	10575		4.2%			H	SD
2000	Ethiopia[17]	1000	0-12	8.9%			H	SD
2001	Ghana and UK[12]	2254 3383		4.6%[&] 5.5%[&]			H	SD
2003	Egypt[40]	8008		5.4%			C	SD
2003	South Africa[11]	7029		16%			H	SD
2004	Nigeria[16]	1091		2.8%			H	SD
2005	Nigeria[15]	2871	18-73	4.3%			H	SD
2007	Nigeria[14]	5982	0-92	6.7%			H	SD
2007	Senegal[10]	93	14-46	5.3%			H	A
2008	Ghana (this study)	1061	9-16	6.0%	0.2%	12.9%	C	A
Asia and South America								
1981	Brazil[8]	9955	6-16	2.7%	0-0.7%	0.2-3.5%	C	SD
1998	Peru[24]	2214	12-18	42%			C	A
2002	Papua New Guinea, Paraguay[6]	1315		0%			C	A
2003	India[9]	12586	6-14	0.93%			C	SD

*C = Community-based, H = Hospital-based; **SD = Prevalence of skin disease, A = Prevalence of acne; [&]acne and rosacea pooled.

schoolchildren for inflammatory acne vulgaris, atopic eczema and other skin diseases. A questionnaire was administered to each child, collecting information concerning living conditions. The skin of each child was fully examined by one or both dermatologists. All skin diseases observed, with special attention for inflammatory acne vulgaris and atopic eczema were recorded on the questionnaire.

Children whose parents consented by signing or thumb printing an informed consent form were enrolled in the study. The Institutional Review Board of the Noguchi Memorial Institute for Medical Research in Ghana granted ethical approval for this study.

Definition of acne

The clinical diagnosis of inflammatory acne vulgaris, ascertained by two dermatologists experienced in dermatology of African skin, was used for recording the presence of inflammatory acne. The diagnosis of inflammatory acne was defined by the presence of at least 6 pustules or papulopustules on the face.[20] The severity grade was not assessed separately.

BMI

The height and weight of the schoolchildren were measured to calculate the Body Mass Index (BMI) as a marker of nutritional status. The measurements of height and weight were done in a period ranging between 12 months before and 1 month after the dermatological examination. The BMI was calculated by dividing the body weight with the square of height (kg/m^2).

The BMI in childhood is strongly dependent on age and to a lower extent on sex.[21] Two recent studies of Cole et al. have provided cut-off points for BMI in childhood that are based on international data.[21,22] The cut-off point for overweight was linked to a BMI of > 25 kg/ m^2 (high BMI) and for underweight linked to a BMI of < 17 kg/ m^2 at age 18 years (low BMI).

Statistical Analysis

The differences in prevalence (point prevalence) of inflammatory acne vulgaris, BMI and age in relation to the four types of schools were analyzed with the Pearson's chi square test and ANOVA test. Comparison of age, sex, height, weight and BMI between children with and without inflammatory acne was made with the Pearson's chi square test and an independent T-test.

Logistic regression analyses were performed taking the presence or absence of inflammatory acne as the dependent variable. The model included gender, age and BMI. The odds ratios, 95% confidential intervals and, where appropriate, p-values were reported. In all cases, statistical tests were considered significant when p-values were less than 0.05. All statistical analyses were performed using the SPSS 16.0 software package.

Study Area and Socio-economic Status

The general study area was in the Greater Accra Region of Ghana between longitudes W 000.35377° and E 000.42752° and latitudes N 005.72647° and N 005.53550°. All the urban schools were in the Accra Metropolis where we included two private rich schools with a high socio-economic status (Mona Lisa School where 36 and Morning Star where 35 children were seen); two private schools with middle to high socio-economic status (Greenhill International where 189 and The Youngster International where 167 children were seen) and one public school with low socio-economic status (Immanuel Presbyterian Primary School where 214 children were seen). Five rural schools were located in Dangme East (Agbedrafor where 119, Anyamam where 214, Goi where 79, Koluedor R/C Primary School where 128 and Toflokpo where 108 children were seen) and one rural school was located in Ga East (Pantang Primary and JSS where 105 children were seen). Main income earning activity in the Ga district is farming, while fishing, salt mining and farming are characteristics of Dangme East.

Results

A total of 1394 children participated in the study (Table 3). No statistically significant difference in gender distribution among the four types of schools was found (Table 3). The children in the rural schools were, however, significantly shorter and weighted less than those in the urban schools, except for the 4-8 year old children in the urban public schools. This difference was also reflected in significant differences in median BMI in older children between the schools. The children in the urban private rich schools had a higher median BMI compared with the other types of school, which was also reflected by a higher percentage of children with a high age-adjusted BMI in the urban private rich schools (Table 3).

Under the age of 9 years we did not observe inflammatory acne vulgaris in any of the schoolchildren. Children in this age category were therefore excluded from further analysis. Children in the age category between 17 and 20 years were also excluded from further analyses since there were only 13 children in this age group (Table 3).

In the rural schools only 1 (0.2%) out of 572 children had acne, compared to 63 (12.9 %) out of 489 children in the urban schools (P< 0.001). Figure 1 shows the distribution of inflammatory acne vulgaris in the urban schools amongst 9 to 16 year old boys and girls. The prevalence of acne in the urban schools increased from 4.1% in girls and 1.3% in boys between 9 and 10 years old to 28.4% in girls and 16.4% in boys between 13 and 14 years old and leveled off in children between 15 and 16 years of age to 18.8 % in girls and 13.3% in boys (Figure 1). This confirms that girls develop acne at a younger age than boys. At the age of 15 years the prevalence of inflammatory acne among boys appeared to approach the prevalence among girls.

Table 2 BMI cut-off points for low, normal and high BMI in relation to age which were used in our study.

	Girls				Boys			
Age	Thinness grade 2	Thinness grade 1*	Normal	High**	Thinness grade 2	Thinness grade 1*	Normal	High**
5	< 12.99	12.99-13.85	13.86-17.19	17.20 and more	< 13.22	13.22-14.12	14.13-17.44	17.45 and more
6	< 12.90	12.90-13.81	13.82-17.52	17.53 and more	< 13.10	13.10-14.03	14.04-17.70	17.71 and more
7	< 12.95	12.95-13.92	13.93-18.02	18.03 and more	< 13.09	13.09-14.07	14.08-18.15	18.16 and more
8	< 13.08	13.08-14.13	14.14-18.68	18.69 and more	< 13.17	13.17-14.23	14.24-18.75	18.76 and more
9	< 13.29	13.29-14.42	14.43-19.44	19.45 and more	< 13.34	13.34-14.48	14.49-19.45	19.46 and more
10	< 13.59	13.59-14.80	14.81-20.19	20.20 and more	< 13.58	13.58-14.79	14.80-20.19	20.20 and more
11	< 14.01	14.01-15.31	15.32-21.19	21.20 and more	< 13.87	13.87-15.15	15.16-20.88	20.89 and more
12	< 14.56	14.56-15.92	15.93-22.13	22.14 and more	< 14.25	14.25-15.57	15.58-21.55	21.56 and more
13	< 15.14	15.14-16.56	16.57-22.97	22.98 and more	< 14.74	14.74-16.11	16.12-22.26	22.27 and more
14	< 15.72	15.72-17.17	17.18-23.65	23.66 and more	< 15.28	15.28-16.68	16.69-22.95	22.96 and more
15	< 16.22	16.22-17.68	17.69-24.16	24.17 and more	< 15.82	15.82-17.25	17.26-23.59	23.60 and more
16	< 16.62	16.62-18.08	18.09-24.53	24.54 and more	< 16.34	16.34-17.79	17.80-24.18	24.19 and more
17	< 16.89	16.89-18.37	18.38-24.83	24.84 and more	< 16.80	16.80-18.27	18.28-24.72	24.73 and more
18 and older	< 17.00	17.00-18.49	18.50-24.99	25.00 and more	< 17.00	17.00-18.49	18.50-24.99	25.00 and more

*Adapted from [21]; **Adapted from [22]

Table 3 Baseline characteristics of the study population.

		Type of school				
	Whole group	Rural	Urban public	Urban private	Urban private rich	P-value
No of children	1394	753	214	356	71	
Male: N (%)	660 (47.3)	361 (47.9)	103 (48.1)	161 (45.2)	35 (49.3)	P=0.823*
Age						
Median (SD)	11.0 (2.4)	10.0 (2.3)	11.0 (2.7)	10.5 (2.4)	11.0 (2.6)	P=0.040**
Age: N (%)						
4- 8	317 (22.8)	169 (22.5)	45 (21.0)	90 (25.3)	13 (18.3)	P<0.001*
9-12	802 (57.7)	473 (63.1)	105 (49.1)	186 (52.2)	38 (53.5)	
13-16	259 (18.6)	99 (13.2)	62 (29.0)	79 (22.2)	19 (26.8)	
17-20	13 (0.9)	9 (1.2)	2 (0.9)	1 (0.3)	1 (1.4)	
Height (cm) Median (SD)						
4- 8	121.7 (7.6)	120.5 (7.2)	118.6 (7.9)	125.5 (7.1)	128.3 (8.9)	P<0.001**
9-12	136.6 (9.7)	134.0 (8.8)	138.5 (7.9)	142.1 (10.1)	143.1 (9.1)	P<0.001**
13-16	152.3 (9.8)	145.8 (9.2)	153.8 (7.4)	156.1 (8.1)	158.4 (8.6)	P<0.001**
17-20	155.1 (10.3)	154.1 (11.6)	162.8 (1.1)	156.3 (0)	154.4 (0)	***
Weight (kg) Median (SD)						
4- 8	24.0 (4.8)	24.0 (4.5)	21.0 (3.8)	24.0 (4.6)	27.0 (8.2)	P=0.001**
9-12	32.0 (8.5)	32.0 (6.5)	32.0 (7.6)	32.0 (11.8)	36.0 (9.9)	P<0.001**
13-16	43.0 (11.4)	39.0 (7.7)	46.0 (9.6)	45.0 (12.4)	52.0 (16.3)	P<0.001**
17-20	49.0 (10.2)	45.0 (9.2)	50.0 (2.8)	66.0 (0)	56.0 (0)	***
BMI (kg/m^2) Median (SD)						
4- 8	16.0 (2.1)	16.6 (2.1)	14.5 (1.7)	15.2 (2.0)	16.4 (3.7)	P<0.001**
9-12	17.2 (2.7)	17.6 (2.1)	16.4 (2.5)	16.2 (3.6)	17.0 (3.3)	P=0.006**
13-16	18.6 (3.5)	18.3 (2.3)	19.4 (3.5)	17.8 (4.0)	20.0 (5.0)	P=0.007**
17-20	19.6 (3.0)	18.8 (1.7)	18.9 (1.3)	27.0 (0)	23.5 (0)	***
BMI, age adjusted: N (%)[£]						
Thinness grade 2	72 (5.2)	26 (3.5)	17 (8.1)	23 (6.5)	6 (8.5)	P=0.000*
Thinness grade 1	190 (13.8)	71 (9.6)	41 (19.4)	74 (20.9)	4 (5.6)	
Normal	999 (72.7)	587 (79.4)	140 (66.4)	223 (63.0)	49 (69.0)	
High	114 (8.3)	55 (7.4)	13 (6.2)	34 (9.6)	12 (16.9)	
Missing information	19	14	3	2	0	

BMI, body mass index

* Chi-square test; **ANOVA test; [£] Thinness grade: See for definition Table 2.

***No statistics performed, because of low numbers of children in some categories.

Since there was only one child with acne in the rural schools and since rural schools significantly differed from urban schools with respect to length, weight and BMI, the analyses of risk factors for acne were restricted to the 9-16 year-old children attending the urban schools (Table 4). Children with inflammatory acne were significantly older and more often girls compared to children without acne. They more often showed a high BMI in comparison with children without inflammatory acne (Table 4). The percentage of acne was not significantly different between the public, private and private rich urban schools (Table 4). Female gender, increasing age and high BMI appeared to be independent risk factors for inflammatory acne vulgaris after adjustment for these factors (Table 4).

Table 4 Risk factors for inflammatory acne vulgaris in 9 to 16 year old children attending urban schools.

	No Acne N (%)	Acne N (%)	Adjusted odds ratio (95% CI)*
Sex:			
Male	206 (93,6)	14 (6,4)	1
Female	220 (81,8)	49 (18,2)	3.2 (1.7-6.1)
Age:			
9-12	301 (91.5)	28 (8.5)	1
13-14	99 (76.7)	30 (23.3)	3.3 (1.8-5.9)
15-16	26 (83.9)	5 (16.1)	2.6 (0.87-7.5)
BMI**			
Thinness grade 2 and 1	31 (91,2)	3 (8,8)	0.68 (0.19-2.4)
Normal	356 (88,1)	48 (11,9)	1
High	36 (75,0)	12 (25,0)	2.0 (0.93-4.3)
Urban School			
Public	149 (89.2)	18 (10.8)	1
Private	226 (85.3)	39 (14.7)	1.5 (0.82-2.9)
Private rich	51 (89.5)	6 (10.5)	0.94 (0.34-2.6)

*The odds ratios are adjusted for sex age, BMI and type of school.
**This information is missing from 3 children without acne.

Discussion

The prevalence of inflammatory acne vulgaris in Ghana was less than 1% in the rural schools and varied between 1.3% and 28.4% in the urban schools depending on the age and sex of the schoolchildren. The prevalence of acne in Ghana was low in comparison with some industrialized countries[1-4] but was higher in the urban schools compared to other community-based studies of schoolchildren in developing countries like India, Ethiopia and Brazil (Table 1).[8;9;18] Although the diagnoses of acne in the latter studies were not clearly defined, these studies support our finding that the prevalence of acne is much lower in developing countries than in industrialized countries.

With the changing socio-economic situation in developing countries, especially westernization in urban areas, it is believed that the prevalence of acne vulgaris in developing countries will increase to the level of industrialized countries. This has already been observed among the Inuit people in Canada who had given up nomadic life and had moved into settlements adopting a western lifestyle. Acne vulgaris has become common among the Inuit, although the condition used to be rare among this ethnic group.[23]

In our study girls appeared to develop acne at a younger age than boys, but boys were catching up as they became older (Figure 1). Between the ages of 16 and 18 boys are more likely to have acne.[1;24;25]

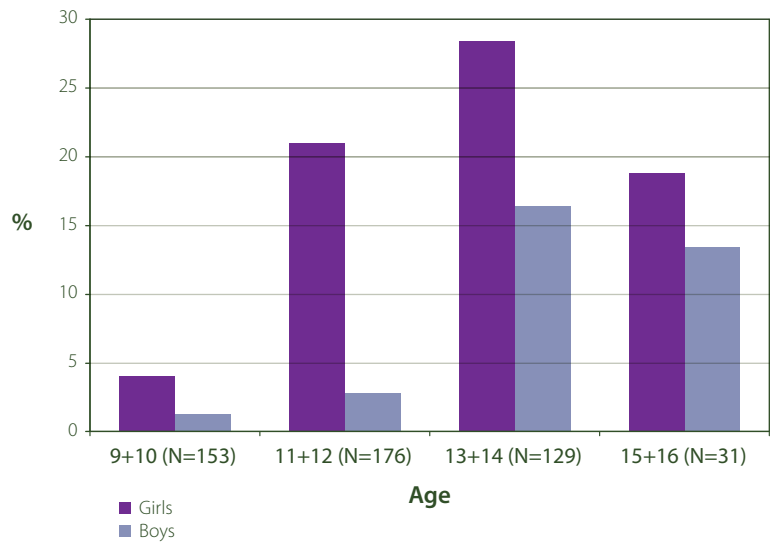
The striking difference between the prevalences of acne in rural and urban schools may reflect differences in genetic background or differences in environmental exposure. It is not likely that genetic factors explain the different prevalences of acne between rural and urban schools in our study. The most important environmental differences between the rural and urban areas in the greater Accra region are the lower food intake and the higher exposure to helminth infections in the rural areas, which are factors that both can lead to a lower nutritional status of the children. The significantly lower height and weight of the rural children may reflect chronic malnutrition in the rural areas.[26]

A lower nutritional status may protect against the development of acne. The observed association between a higher BMI and acne among the children who were attending the urban schools would nicely fit in this hypothesis. An association between overweight and acne has also been described by Tsai et al. [27] and Bourne. [28] However, Bourne et al. found this association only in adult males.[28]

The observed differences in height and BMI reflecting the nutritional status of the children may not be the only factors explaining the profound difference in the prevalence of acne between the rural and urban schools. Other factors which could explain this difference may be the use of cosmetics or the consumption of different types of food.

In urban areas cosmetics with comedogenic ingredients, bleaching creams containing corticosteroids and pomade are much more available and potentially could contribute to the higher prevalence of acne in urban areas.

Figure 1 Percentage of children with acne in urban areas between 9 and 16 years of age.



An association between diet and acne has long been suggested.[29] This has also been suggested by Cordain et al.[6] who found no cases of acne among non-Westernized societies like the Kitavan Islanders of Papua New Guinea and Ache hunter gatherers of Paraguay. They postulated that the difference in the prevalence of acne between developing and industrialized countries cannot be solely attributed to genetic differences but likely results from different environmental factors such as diet, which have a substantially lower glycemic index than Western diets.[6]

Evidence for the relation between diets with high glycemic index and acne is gradually accumulating.[29] Insulin-like growth factor 1 (IGF-1) and high levels of insulin, induced by a high glycemic-load diet, stimulate sebaceous glands and the synthesis of androgens.[6;29-33] A recent randomized controlled trial using a high-protein, low glycemic-load diet versus a high glycemic-load diet showed a decrease in acne severity and improved insulin sensitivity.[32;33] It is likely that rural children in our study may have had limited access to processed products and products with refined carbohydrates and this may be one of the possible reasons to explain the difference in acne prevalence in urban and rural children.[34-37] Consumption of milk, containing hormonal constituents, is also described to contribute to the formation of acne.[29;38;39]

Additional community-based studies in developing countries are necessary, especially studies comparing rural with urban areas to confirm the profound difference in the prevalence of acne between these areas.

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