Prevalence and pattern of skin disorders among female schoolchildren in Eastern Saudi Arabia

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ABSTRACT

Objectives: To determine the prevalence and pattern of skin disorders among female schoolchildren in primary and intermediate schools in Al-Khobar city, Eastern Saudi Arabia.

Methods: This is a cross-sectional study conducted in Al-Khobar city, Kingdom of Saudi Arabia during the period from January-March 2003. It involved 2239 female schoolchildren randomly selected from 30 regular public and private primary and preparatory schools. We used a multi-stage stratified random sampling technique with proportional allocation. We collected data using a pre-designed structured questionnaire and clinical examination.

Results: The prevalence of skin diseases among female schoolchildren in Al-Khobar city was 98.6%. The most common skin disease and conditions group was the pigmentary disorders (91.6%), followed by a group of dermatitis/eczema and related conditions (26.7%), and disorders of skin appendages (25.3%). The common skin diseases and conditions in this study were melanocytic nevi (MN) (68%), post-inflammatory pigmentation (56.6%), scars (26.8%), acne (22.5%), dandruff (18.1%), pediculosis capitis (5.2%) and eczema (3.1%). Postinflammatory hyper/hypo pigmentation was more common among primary schoolchildren, whereas MN, dandruff, keratosis pilaris, acne and folliculitis were significantly more common among preparatory schoolchildren.

Conclusions: The prevalence of skin disorders among female schoolchildren in Al-Khobar city was very high. Therefore, we recommended the introduction of a preventive health education program for schoolchildren at different levels and their families and teachers on skin diseases.

Saudi Med J 2006; Vol. 27 (2): 227-234

Skin disorders are among the most frequent ailments of schoolchildren in both developing and industrialized countries.[1] Reports state that skin diseases account for 6-24% of all visits to the pediatric clinic.[2] The school environment makes children vulnerable to cross transmission of communicable skin diseases among themselves and their families. Among schoolchildren, it is considered a nuisance causing much morbidity and disability. Although skin diseases are common among children worldwide, there are only a few population-based epidemiologic studies measuring the prevalence of skin diseases in children.[3-14] In Saudi Arabia, there are few reports of surveys conducted on the prevalence of skin disease, mainly in male school children.[15-19] Our objective is to determine the prevalence and pattern of skin disorders among female schoolchildren in primary and intermediate schools in Al-Khobar city, Kingdom of Saudi Arabia.

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Received 11th May 2005. Accepted for publication in final form 27th September 2005.

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Methods. This is a cross-sectional study conducted in the Al-Khobar city, Kingdom of Saudi Arabia from January-March 2003. The target population was composed of all female schoolchildren in regular public and private primary and preparatory (total number of 28,766 students). The sample size was estimated based on the proportion of schoolchildren suffering from skin diseases and conditions computed from the pilot study. Accordingly, the final study sample size was determined, and a total number of 2239 schoolchildren were included. A multi-stage stratified random sampling technique with proportional allocation was used as follows. First, schools were sub-classified by its type (governmental/private) and educational levels (primary/preparatory). Using the random digits table, 10 governmental and 5 private schools from every educational level were selected. Accordingly, the desired sample size was obtained from 30 schools. A simple random sample was then used to select the classes. In the second stage, a systematic random sampling technique was used to select the desired number of schoolchildren from randomly selected classes. The study parameters were as follows: 1. Prevalence of skin diseases and conditions. Skin diseases were classified according to the modified 10th revision of the international classification of disease (ICD-10).[20] 2. Pattern of skin diseases and conditions. Self-administered designed structured questionnaires were distributed to all selected schoolchildren a few days before clinical examination, to be completed by their parents. The questionnaires were then collected on a daily basis. Informed consent for inclusion in the study was obtained from the parents by invitations accompanied by a letter explaining the purpose and details of the study. The questionnaires consisted of schoolchildren information, which included student name, age, nationality, educational level, school and class name, telephone number, history of skin diseases, chronic medical diseases, history of taking regular medications and family history of skin diseases. Atopic dermatitis was defined using the United Kingdom Working Party diagnostic criteria for atopic dermatitis. To meet these criteria, the student must have a history of an itchy skin condition plus 3 or more of: 1. a history of a rash in the skin creases (folds of elbows, behind the knees, fronts of ankles, around the neck); 2. a personal history of asthma or hay fever; 3. a history of generally dry skin in the last year; 4. onset under the age of 2 years; 5. visible flexural dermatitis as defined by a photographic protocol.[21] All the selected schoolchildren were examined by the investigator in a private room in daylight in the same school. All the parts of the body were exposed except the thighs and perineum. The undiagnosed cases were examined in the same school by the female consultant dermatologist. During the main study, a random sample was selected from both normal students and those with skin diseases and were re-examined by the female dermatology consultant. A comparison of both examinations (validity of diagnosis) showed McNemar test = 2, $p>0.1$ and sensitivity of 100% with a specificity of 94%. False negative = 0% and false positive = 6%. Reliability of the questionnaires was examined using Cronbach's α statistic, and the alpha coefficient was 0.8, which was considered highly reliable. All variables were checked for accuracy and completeness and were coded. Data were then entered into a personal computer, and the Statistical Package for Social Sciences version 10 was used for data entry and analysis. Appropriate statistical analytical techniques were performed. Frequency distribution tables were constructed for the schoolchildren features and for the distribution of various skin conditions. Chi-squared test was used in cross-tabulation analysis to test the significance of association between skin conditions and the qualitative variables. All the necessary approval required was obtained from the relevant authorities before the conduct of the study. Positive skin disease cases were treated and referred to a dermatology clinic for follow up and treatment.

Result. The response rate was 100%. The students' ages ranged between 6-17 years with a mean of 10.49 $\pm$ 2.64 years. One hundred and fifty-seven (7%) of the schoolchildren had a positive history of previous skin diseases, while the history of skin allergy was positive in 57.3% of the sample. The second and the third common positive past histories of skin diseases were dandruff and acne. Only 134 (6%) of the schoolchildren had a positive history of chronic diseases, 76 (56.7%) of who suffered from bronchial asthma. Three hundred and six (13.7%) of the sample schoolchildren had a family history of skin diseases, and two-thirds of these (70.3%) had a history of skin allergy. However, a family history of psoriasis constituted approximately 8.8% of the positive family history of skin diseases (**Table 1**).

Skin disorders findings. The prevalence of skin diseases and conditions is shown in **Table 2**. A total of 53 skin diseases and conditions were recorded. The overall prevalence was high at 98.6%. Of those studied, 453 schoolchildren (20.2%) had only one skin diseases or condition, 840 (37.5%) had 2, 589 (26.3%) had 3, and 327 (14.6%) had 4 or more skin diseases or conditions. The most common skin diseases and conditions group was the pigmentary disorders, followed by a group of dermatitis/eczema and related

Table 1 - Selected socio-demographic characteristic of the study sample, Al-Khobar area, 2003.

Demographic feature	Number	(%)
Age (years)		
6-8	629	(28.1)
9-11	765	(34.2)
12-14	694	(31)
15-17	151	(6.7)
Nationality		
Saudi	1844	(82.4)
Non-Saudi	395	(17.6)
Educational level		
Primary	1551	(69.3)
Preparatory	688	(30.7)
School type		
Governmental	1944	(86.8)
Private	295	(13.2)
History of skin diseases		
No	2082	(93)
Yes	157	(7)
Types of skin diseases*		
Skin allergy	90	(57.3)
Dandruff	12	(7.6)
Acne	10	(6.4)
Psoriasis	8	(5.1)
Fungal infection	7	(4.4)
Alopecia areata	7	(4.4)
Hair fall	5	(3.2)
Vitiligo	5	(3.2)
Wart	2	(1.3)
Not mentioned	13	(8.3)
Miscellaneous**	6	(3.8)
History of chronic medical diseases		
No	2105	(94)
Yes	134	(6)

*Some students had 2 skin diseases, **Other skin diseases (had one case) include: chicken pox, scabies, pediculosis, herpes simplex, xerosis, pityriasis rose.

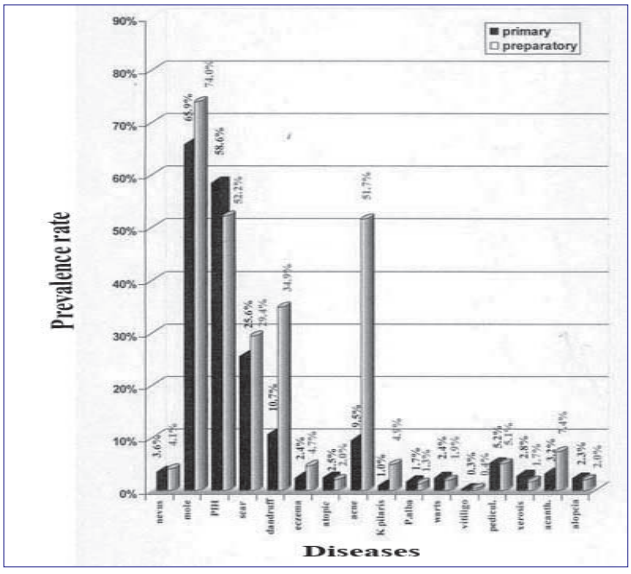

Figure 1 - The percentage distribution of most common skin diseases according to the educational level, Al-Khobar Area, 2003.

Table 2 - Prevalence of skin conditions in schoolchildren, Al-Khobar area, Saudi Arabia, 2003.

Diseases	No. of cases	(%)
Pigmentary Disorder		
Melanocytic nevi	1531	68
Post inflammatory hypo and hyper pigmentation	1268	56.6
Nevi	84	3.8
Café-au- lait / freckles	23	1
Vitiligo	8	0.4
Malagma	1	0.04
Total	**2052***	**91.6**
Dermatitis / eczema and related conditions		
Dandruff	406	18.1
Other types of eczema/dermatitis	69	3.1
Contact dermatitis	50	2.2
Perioral dermatitis	15	0.7
Discoid eczema	3	0.1
Seborrhoic dermatitis	1	0.04
Xerosis	55	2.5
Atopic dermatitis	53	2.4
Keratosis pilaris	50	2.2
Pityriasis alba	35	1.6
Lichen simplex chronicus	1	0.04
Chilitis	1	0.04
Total	**598***	**26.7**
Disorder of skin appendages		
Acne	503	22.5
Alopecia	49	2.2
Nail	23	1
Total	**566***	**25.3**
Infectious diseases	**200***	**8.9**
Parasitic (Pediculosis capitis)	116	5.2
Viral		
Warts	50	2.2
Chicken pox	2	0.08
Molluscum contagiosum	1	0.04
Herpes simple	1	0.04
Total	**54**	**2.4**
Bacterial (Folliculitis)	29	1.3
Fungal		
Onychomycosis	2	0.08
Tinea pedis	1	0.04
Tinea corporis	1	0.04
Tinea capitis	1	0.04
Total	**5**	**0.2**
Mucocutaneous disorders		
Gum / tongue	**30**	**1.3**
Papulosquamous disorders		
Psoriasis	6	0.3
Ichthyosis	2	0.1
Keratoderma	1	0.04
Total	**9**	**0.4**
Vascular disorders		
Port-wine nevus	2	0.1
Telangiectasia	2	0.1
Purpura	2	0.1
Hemangioma	1	0.04
Cherry angioma	1	0.04
Total	**8**	**0.4**
Miscellaneous disorders		
Scar	599	26.8
Acanthosis nigricans	101	4.5
Stria	52	2.3
Insect bite	50	2.2
Milia	40	1.8
Callosity	28	1.3
Skin tag	13	0.6
Keloid	7	0.3
Cautery mark	6	0.3
Bullous disease	2	0.1
Urticaria (Dermographism)	1	0.04
Neurofibromatosis	1	0.04
Granuloma annularia	1	0.04
Total	**814***	**36.4**

* Some students had more than one conditions in the same group.

conditions, and disorders of skin appendages. The common skin diseases and conditions in this study were melanocytic nevi (MN), post inflammatory hyper/hypo pigmentation, scars, acne, dandruff, pediculosis capitis, and eczema.

The pattern of skin diseases and conditions is shown in **Figure 1**. Post-inflammatory pigmentation (PIH) was more common among primary schoolchildren, whereas MN, dandruff, keratosis pilaris, acne and folliculitis were significantly more common among preparatory schoolchildren. Post-inflammatory pigmentation was statistically more common among Saudi schoolchildren, while nevi were more common among non-Saudi schoolchildren.

Discussion. Skin disease is usually the second most common reason for consultation in rural clinics.[22] A comparative study was conducted in prevalence of skin diseases in Romania[3] and India[11] between the community population (schoolchildren) and a hospital-based population. There were significant differences in the prevalence of skin diseases between the 2 populations. Most of the studies in the literature on the prevalence of skin diseases in children were hospital-based, and therefore do not necessarily represent the prevalence in the community. The overall response rate in this study was 100%. The figure is high when compared with similar studies conducted in Riyadh[18] (93.5%), Abha[12] (90.6%), Asir[15] (96%), Romania[3] (88%) and Hong Kong[9] (95%). This might be attributed to continuous follow-up, daily collection of the questionnaire and reminding the non-responders by calling them at home daily. In this study, 53 skin diseases and conditions were recorded. The overall prevalence rate of skin diseases and conditions was high. Due to difficulties in gaining access to male schools, this study focused only on girls. Most of the studies included both boys and girls, so comparison with other studies will be difficult. This prevalence rate is higher than the rate of 64.7% reported in Riyadh schoolchildren comprising males and females,[18] and the rates recorded outside Saudi Arabia,[3-5,7-9,11,22] all these studies included both boys and girls in schools. It should be stressed here that the prevalence of a country should be compared with the same of another, as Al-Khobar prevalence does not represent the whole of Saudi Arabia. The prevalence rate of skin diseases and conditions among schoolgirls in this study was much higher than among boys, for example 25.7% in Asir,[15] 19.8% in Abha,[17]19.2% in Jeddah,[19] 27.3% in Qatar,[14] and 19.2% in Jordan.[13] The differences in the prevalence of skin disorders in the various countries may be attributable to the differences in age group and gender. Also, it could be due to the variation in the methods of diagnosis and inclusion (like in this study) or exclusion of some common benign skin conditions such as MN and PIH. Environmental, socioeconomic factors and accessibility of appropriate medical care can also explain the differences in the prevalence. In this study, the top 7 skin diseases and conditions were MN followed by PIH, scars, acne, dandruff, pediculosis capitis and eczema. These diseases and conditions accounted for more than 95% of the skin disorders. This represents a good example of Pareto's principle that despite the large number of skin diseases only few categories (less than 10) presented the bulk effect.[23] With the exception of MN and PIH, the result in this study was comparable to that reported in the Riyadh study,[18] where the common diagnoses among female schoolchildren were traumatic scars, followed by acne, callosities, MN, dandruff and pediculosis. The high prevalence of scars and pediculosis in both studies reflects the effect of cultural and economic conditions on the prevalence of diseases in society. Other studies have showed that pityriasis alba, keratosis pilaris and warts were among the most common skin disorders in female schoolchildren.[3,5,9,11] The distribution of these common skin diseases and conditions showed the predominance of most of these conditions in the preparatory schools as compared with the primary schools (**Figure 1**). This result reflects the effect of age in the prevalence of skin diseases. Similar results were reported in Hong Kong schoolchildren.[9] Pigmentary disorders in this study formed the bulk of the skin diseases and conditions. This is due to the high prevalence of MN and postinflammatory (hyper and hypo pigmentation) among schoolchildren. The prevalence of pigmentary lesions (vitiligo, MN, other types of nevi, café au lait, freckles, melasma, and PIH) in the present study (91.6%) was higher than what was reported in Riyadh schoolchildren[18] (34%) and other parts of the world.[8,9,11] Melanocytic nevi was the most frequently observed skin condition in our study, with 68% of schoolchildren affected, a very high prevalence compared with female schoolchildren (27.2%) and male schoolchildren (18.6%) in Riyadh[18] and other parts of the world.[4,5,8,9] In this study, moles were more often found in preparatory schoolchildren than in primary schoolchildren. There were similar findings among schoolchildren in Riyadh. This finding supports the results of a study on evolution of MN in British adolescents. The 4 years longitudinal study on adolescents aged 12-14, showed that nevus numbers increased by 47% as the students got older from 12-13 or 13-14.[24] In this study, post inflammatory hyper/hypo pigmentation constituted 61.7% of the pigmentary disorders and the second in order of frequency after MN. The diagnosis was documented after a positive history of past physical trauma,

burns or any type of dermatitis was taken. There was little information in the literature on the prevalence of PIH (hyper and hypo pigmentation) in children. In this study, the prevalence was much higher than recorded of schoolchildren in Riyadh,[18] (2% for girls and 2% for boys) in which only hyperpigmentation was included. It was also higher than the prevalence of 0.1% among schoolchildren in Hong Kong.[9] The prevalence of PIH was statistically more common in the 6-8 year olds and among primary schoolchildren, who are more prone to trauma. There was a similar finding among schoolchildren in Hong Kong,[9] while the opposite was recorded among schoolchildren in Riyadh,[18] where PIH was more common among 13-19 age group. Dermatitis, eczema, and related conditions formed the second in order of frequency (26.7%) after the pigmentary disorders in this study. Dandruff was the highest in prevalence (18.1%) followed by eczema and dermatitis. Its prevalence of 26.7% was lower than (32%) that was reported among schoolgirls in Riyadh,[18] where dandruff constituted the highest prevalence followed by keratosis pilaris. The rate in this study was much lower than (63.3%) in schoolboys in Abha,[17] where dandruff had the highest prevalence rate. The rates in this study were lower than those reported from other parts of the world,[3,4] but higher than that found among Hong Kong schoolchildren.[9] Dandruff in this study constituted the highest prevalence (18.1%) among dermatitis, eczema and related conditions, and it ranked the 5th in order of frequency among the other skin diseases and conditions. Dandruff was more prevalent among 15-17 years old preparatory schoolchildren. This prevalence rate of dandruff was less than the rate of 24% reported among female schoolchildren in Riyadh.[18] This difference could be due to the older age group (6-19 year) in Riyadh study in whom dandruff was more common in the secondary school. However, the overall prevalence of dandruff in both male and female schoolchildren in Riyadh (18.5%) was almost similar to the rate in this study. The Riyadh study had a higher prevalence among females than males in the 13-19 age group. The prevalence of dandruff in this current study is much higher than (3.4%) that recorded in elsewhere,[4] but less than (41.7%) that was recorded in preschool children in Australia.[25] These differences could be due to variations in age groups included, and due to variation between a regional and national based studies. The prevalence of atopic dermatitis (AD) in this study was 2.4%, constituting 8.9% of the total prevalence of the dermatitis and eczema group. This was slightly lower than 3.4% found in female schoolchildren in Riyadh.[18] In the Riyadh study, the overall prevalence (males and females) was 2.5% with a lower prevalence among male schoolchildren (1.7%). The prevalence was 1.7% in adolescent schoolboys in Abha.[17] This result is in accord with other studies, which have shown more females being affected.[26,27] These differences could be due to variations in age groups. The prevalence of AD in this study was also much lower than that reported in the United States,[28] and other countries.[29-33] The variability in prevalence in different countries may be explained by the presence of different exogenous or genetic factors underlying these diseases. In this study, 8% of atopic patients had a family history of skin allergy compared with 70% in Singapore schoolchildren,[34] and 59% in North Europe.[35] This difference could be due to the high prevalence of AD in schoolchildren in Singapore and North Europe. Similarly, 28.9% of atopic patients in the current study were found to have a history of skin allergy. The overall prevalence of bronchial asthma among the schoolchildren in this study was 3.3%. There was a statistical association between the presence of bronchial asthma and AD. The proportion of AD patients with asthma (10.7%) in this study was comparable to (9.5%) that reported from Singapore,[34] but much lower than (46%) that reported in Italian schoolchildren.[36] The prevalence of keratosis pilaris (KP) in this study was 2.2% and it was more common among the 15-17 year olds schoolchildren. In female schoolchildren in Riyadh,[18] the prevalence was 4.4%. Keratosis pilaris was one of the most prevalent skin disorders among adolescent schoolboys in Abha[17] (12.4%), with highest prevalence among the 14-16 year olds. The prevalence of KP in this study was lower than what was recorded among Romanian[3] females and schoolchildren from other countries.[4,29] However, the prevalence in this study was higher than those recorded in some studies.[5,7,9,11] The prevalence of pityriasis alba (PA) (1.6%) in this study was comparable to (1.3%) that reported among females in Riyadh,[18] but much lower than that reported in schoolboys in Riyadh (11.3%),[18] in Asir (5.9%),[15] Abha (9.7%)[17] and Jeddah (41.6%).[19] This variation in prevalence may be attributed to excessive dry skin due to over exposure to sunlight as males are more exposed to sunlight during outdoor play, or to the cold winter winds of the southern region. In this study, the prevalence of PA was higher among the 6-8 years age group although the result was not statistically significant. A similar finding was reported in Romanian schoolchildren,[3] where the result was statistically significant. The prevalence of PA in some other countries was higher than this study.[3,4,11,37,29] In the present study, the group of skin appendages disorders ranked third in order of frequency following dermatitis,

eczema and related conditions. Within the group, acne constituted the highest prevalence (88.9%) followed by alopecia (8.7%) and nail disorders (3.9%). In this study, the prevalence of acne (22.5%) was slightly lower than the rate of 29.7% recorded among schoolgirls in Riyadh.[18] In that study, the acne was more common among females than males (29.7% versus 23.9%). In Abha[17] schoolboys, the prevalence was very high (56.3%) as the sample included adolescents, but the prevalence in Asir[15] and Jeddah[19] primary schoolboys was low. The prevalence rate of acne in the current study was higher than the rates reported in other studies,[3,5,7,9] but was lower than that reported from Sweden (36.5%)[8] and Australian (36.1%)[38] schoolchildren. Some investigators have observed that acne exacerbates in winter and improves during the summer months,[39] so its prevalence in the current study might have been affected by the conduct of the study in winter. The variability in the prevalence of acne among the different studies could be attributed to the hormonal and racial differences as patho-etiological factors of acne vulgaris. Moreover, studies that included all cases of acne (including mild cases) reported a higher prevalence of acne than those that included only acne of clinical significance (moderate and severe). The prevalence peaked in the 15-17 years age group (66.9%), with a mean age of 13 years. Most of the studies showed age-related variation in the prevalence of acne,[15,18,38] most probably due to the hormonal changes of adolescence. Prevalence rate of acne in the 6-12 year-olds (11.5%) in this study was however, higher than that reported in Riyadh males and females schoolchildren (3.6%)[18] and in schoolboys in Asir (0.8%).[17] Similar findings were reported among Swedish[8] and Australian[38] school girls aged 12 years. This supports the fact that acne appears earlier in females than in males, possibly reflecting the earlier onset of puberty.[40,41] The current study has revealed 8.9% as a prevalence rate of skin infections with parasitic infestation being the highest (58%) followed by viral (27%), bacterial (14.5%) and fungal (2.5%) infection. Pediculosis was the most common (5.2%) infestation in this group. This figure may be an underestimation, as the study population was subjected to a regular screening program and treatment. The prevalence of skin infections in the present study was low compared with that (14%) in Riyadh schoolchildren,[18] and adolescent boys in Abha (19.8%)[17], among whom pediculosis infestation was the most common, however, the prevalence in this study was higher than that in the Asir schoolboys (5.24%),[15] among whom warts were the most common. The prevalence in this study was lower than that reported among schoolchildren from other countries,[3-5,7] but was higher than reports among Hong Kong schoolchildren.[9] This difference in the prevalence of skin infections in Saudi schoolchildren may be attributed to the differences in the weather, the nutritional status, personal hygiene and the standard of living. Pediculosis (parasitic infestation) in the present study accounted for 58% of skin infections. Its prevalence (5.2%) was much lower than that recorded in schoolchildren in different regions of Saudi Arabia (28.8% in Makkah, 22.5% in Jeddah, 21.3% in El-Hofof,[42] and 13.8% in Riyadh[18]). The prevalence rate in this study was even lower than among schoolboys in Abha (9.6%).[17] Pediculosis is a public health issue in the Middle East. In Amman,[43] a prevalence of 14.5% was reported among schoolgirls, in Lebanon[44] it was 8%, while it was 88.1% in Libyan[45] and 30.3% in Egyptian[46] schoolgirls. The prevalence rate of pediculosis in the present study was also lower than rates recorded in some developed countries.[47-51] The relatively low prevalence rate of pediculosis in the current study may be attributed to the effective screening program in schools and to the free medication offered to students and their families. Another reason could be due to the timing of the study, which was conducted in winter. Pediculosis is more frequent in the warmer months when the higher temperatures assist in egg laying, hatching and the spread of the infection.[52] The variability of the prevalence among the countries could be due to the differences in the practice of hygiene, socioeconomic status, overcrowding in the school, and differences in age and gender involved in the various studies. The prevalence rate of warts in the present study (2.2%) was lower than the rate reported from Riyadh,[18] Abha,[17] and Jeddah,[19] but was more than Asir schoolboys.[15] The prevalence rate was also low compared with studies from elsewhere.[3,4,8,53] The variation in the prevalence among countries could be due to the differences in the age group and gender involved in these studies.

In conclusion, the prevalence of skin diseases and conditions among female schoolchildren in the Al-Khobar area is very high. The prevalence of several skin diseases and conditions differed significantly among different age groups. Result of this study varied with similar studies from other parts of the Kingdom, and the world. With the high prevalence of skin diseases and conditions among schoolchildren in the Al-Khobar area, the current situation in the schools need to be explored. Steps toward addressing this health problem have to be undertaken through studying its causes and planning for effective management. Health education programs regarding skin diseases should be provided to all schoolchildren, their families and teachers.

Acknowledgment. The authors are grateful to all female schoolchildren, and their families, who participated in the study.

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