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The Ethiopian SORT IT Course

Is vitiligo associated with wearing plastic shoes in a podoconiosis endemic region of Ethiopia?

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Abstract

Introduction: Endemic non-filarial elephantiasis also known as podoconiosis often affects bare footed farmers and is endemic in Ethiopia. The disease is prevented by wearing shoes. We recently observed several patients presenting to a dermatology clinic with skin depigmentation after wearing plastic shoes (“shoe-contact vitiligo”) which may deter shoe-wearing. We report on their sociodemographic and clinical characteristics.

Methodology: This is a retrospective study of 17 months at tertiary level Hospital in Ethiopia. Patient data was retrieved from medical record department. We compared sociodemographic and clinical characteristics of patients presenting with idiopathic and shoe-contact vitiligo. Data was presented descriptively.

Results: Of 460 vitiligo cases, 190 (41%) were shoe-contact vitiligo and the rest, idiopathic. The former was more common in females (Odds Ratio, OR = 2.5, P < 0.001) and those in rural areas (OR = 4.8, P < 0.001). Fifty-five percent with shoe-contact vitiligo had itching and/or burning sensation, compared to just 2% with idiopathic vitiligo (P < 0.001) and some had ulcerations (8%). Idiopathic vitiligo had no such findings.

Skin discoloration occurred within three weeks (on average) after wearing plastic shoes, 91% of lesions were symmetrical and involved areas of the feet covered with plastic shoes. Symmetric lesions were observed in only 11% of idiopathic vitiligo (OR = 81, P < 0.001).

Conclusions: Shoe-contact vitiligo was significantly associated with wearing cheap plastic shoes. The exact chemical culprit(s) needs to be identified. This will allow introducing quality control regulations and rigorous monitoring of shoe production sites.

Key words: Leukoderma; operational research; sustainable development goals; Structured Operational Research and Training Initiative, SORT IT.

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Introduction

Endemic non-filarial elephantiasis also known as podoconiosis often affects bare footed farmers. The disease causes bilateral and asymmetrical swelling of the lower limbs [1]. Although the etiology is not fully understood, existing evidence suggests the important role of exposure to irritant red clay soil in endemic areas, coupled with genetic susceptibility [2-4]. Globally, the disease occurs in more than 32 countries, is related to poverty and affects about six million people, one million of whom are in Ethiopia [5].

In Ethiopia, podoconiosis is endemic in 42% of 827 districts with 35 million people at risk.

Podoconiosis is a preventable non-communicable disease [6,7]. It has been eradicated from northern Africa and Europe since footwear became part of the standard of living [8].

In Ethiopia, personal and socioeconomic barriers hamper shoe wearing. For example, there are established traditions of walking barefoot since communities believe that footwear is for the weak. In addition, cheap, commonly available footwear are often uncomfortable to wear and often heavy, discouraging their use. Economic constraints may also negatively influence shoe ownership [9].

Over the last few years, the dermatology consultation clinic of the Felege Hiwot Referral

Hospital, Bahir Dar in the Amhara region of Ethiopia has observed growing numbers of patients presenting with vitiligo-like depigmentation of skin associated with wearing locally manufactured cheap flexible Polyvinyl Chloride (PVC) plastic shoes. The skin depigmentation occurs in areas which are in direct contact with the plastic material. Patients also complain that the symptoms begin soon after wearing these shoes. These anecdotal findings make us believe that there might be an association- “contact exposure”- to some material(s) in the plastic. This may include heavy metals, and/or specific chemicals such as monobenzylether of hydroquinone (MBH), alkyl phenols and catechols used in the manufacturing of PVC plastics and rubber. These chemicals have been reported to produce skin depigmentation in susceptible persons [10,11,12].

Vitiligo is a disease which causes loss of skin color in blotches and is a highly stigmatized condition, especially in Africa. This is because the society associates vitiligo with curses and supernatural causes including punishment from God [13]. As shoe wearing is the pillar of the national strategy to eliminate podoconiosis by 2030 [6] any association between shoes wearing and vitiligo may be deterrent to advocacy by the Ministry of Health to use shoes in podoconiosis endemic areas.

A PubMed search revealed only two studies from India that described plastic and rubber contact vitiligo associated with various chemicals. This involved 50 patients, of whom eight were associated with footwear, but no further information on type of the plastic in literature [10,11]. There are no published studies from the African region describing foot-wear associated vitiligo.

Among clinically diagnosed vitiligo patients attending an outpatient dermatology clinic in Felege Hiwot Referral Hospital, we performed a comparative study and the specific objectives were to report on the a) number (and proportion) of shoe-contact vitiligo cases b) their sociodemographic and clinical characteristics c) risk-factors associated with this condition.

Methodology

Study Design

Retrospective cross-sectional comparative study using dermatology clinic data.

General setting

Ethiopia is located in the horn of Africa with a population of about 99 million. The country is a federal

state with nine regional states and two special administrations [14], and is challenged with limited health coverage (39% of the population) [15].

Specific setting – Amhara region

The Amhara regional state lies in the north west of the country and is the second most populated (21.2 million), with 85% of the population living in rural settings [14]. The region is divided into 13 administrative Zones and 137 districts (called Woreda’s). The relief is variable with plains, gorges, plateaus, hills and mountains [16]. This region has a podoconiosis prevalence of 3.7% and shoe-wearing is strongly advised [6,17]. Local plastic shoe production is a flourishing business with eight factories in the Amhara region importing raw materials for the large scale production of shoes. These shoes are locally manufactured, made of flexible PVC plastic materials and cost a maximum of 25 birr (approximately 1 USD)

The Felege Hiwot hospital dermatology clinic

The study site was the Felege hospital which is a referral hospital for seven million people with about 1200 outpatient consultations daily. There are two specialized dermatology clinics accepting referred cases from district hospitals in the region and neighboring areas. Diagnosis of idiopathic vitiligo and shoe-contact vitiligo is based on clinical features.

Idiopathic Vitiligo and Shoe contact Vitiligo/Chemical leukoderma

Idiopathic Vitiligo is loss of skin color in blotches with no identified cause. Shoe-contact vitiligo is similar, but there is a preceding history of exposure to plastic shoes, made of flexible PVC. Chemical leukoderma represents an acquired vitiligo-like hypomelanosis induced by repeated exposure to specific chemical compounds [10].

Treatment of vitiligo is long-term application of topical steroid creams and/or 1% topical 8-methoxypsoralen with sun exposure and advice to avoid exposure to the identified vitiligo inducing agent(s).

Study population and period

The study included all individuals presenting with vitiligo (idiopathic and shoe-contact related) from April 2017 to August 2018. The diagnosis of idiopathic and shoe contact Vitiligo was clinical.

Data collection and statistical analysis

Information on socio-demographic and dermatological features as well as exposure to plastic

Table 1. Sociodemographic characteristics among patients presenting with vitiligo attending an outpatient dermatology clinic in Felege Hiwot Referral Hospital, Amhara region, Ethiopia (April 2017-August 2018).

Characteristic	Type of vitiligo		OR*	CI**	P-Value
	Shoe-contact n (%)	Idiopathic n (%)			
Sex					
Male	38 (20)	103 (38)			
Female	152 (80)	167 (62)	2.5	1.6-3.8	< 0.001
Age group (years)					
< 20	55 (29)	78 (29)	Reference		
20-29	83 (44)	113 (42)	1.1	0.7-1.6	< 0.3
30-39	31 (16)	40 (15)	1.1	0.7-1.9	< 0.3
≥40	21 (11)	39 (14)	0.7	0.4-1.3	< 0.1
Residence					
Urban	25 (13)	42 (42)	Reference		
Rural	165 (87)	58 (58)	4.8	2.9-7.7,	< 0.001
Total	190	270			

*OR = odds ratio; **CI = 95% Confidence Interval.

shoes were sourced from patient files and entered into an excel database (Microsoft excel) by the treating dermatologists. A second dermatologist validated data entry by systematically cross-checking entries with patient cards.

Data was presented descriptively and measures of risk were determined using crude odds ratios (OR). Differences between groups were assessed using the Chi-square test. Level of significance was set at $P \leq 0.05$ and 95% confidence intervals (CI) were used throughout.

Ethics considerations

Permission to conduct the study was obtained from the Felege Hiwot Referral Hospital management. Local ethics approval was received from the Bahir Dar University College of Medicine and Health Science Ethics review board, Bahir Dar, Ethiopia. The study

was also approved by the Ethics Advisory Group of the International Union against Tuberculosis and Lung Disease, Paris, France. As this was a record review study without patient identifiers, the issue of informed patient consent did not generally apply. For photos showing shoe-associated vitiligo oral informed consent was obtained, and any form of patient identification avoided.

Results

Socio- demographic characteristics of patients with shoe-contact and idiopathic vitiligo

Of a total of 460 cases of vitiligo, 270 (59%) were idiopathic while 190 (41%) were shoe-contact vitiligo. The latter was more common in females (OR = 2.5, 95% , CI = 1.6-3.8, $P < 0.001$) and those in rural areas (OR = 4.8 CI: 2.9-7.7, $P < 0.001$) (Table 1).

Table 2. Clinical characteristics of shoe-contact vitiligo and idiopathic vitiligo among patient attending outpatient dermatology clinic in Felege Hiwot Referral Hospital, Amhara region, Ethiopia (April 2017-August 2018).

Clinical characteristics	vitiligo	
	Shoe-contact n (%)	Idiopathic n (%)
Median duration of illness in months (range)	10 (1-36)	11 (1-60)
Symptoms/signs		
Itching	82 (43)	5 (2)*
Burning sensation	2 (1)	0
Itching and burning sensation	21 (11)	0
Skin ulceration	15 (8)	0
Patient relates disease with plastic shoes	159 (84)	0
Onset in days after shoe wearing (range)	21 (7 - 90)	Not applicable
Location of the skin lesion(s) (Figures 1 and 2)	Parts of the feet covered by shoe	Anywhere on the body
Symmetrical	173 (91%)	30 (11%)
Total	190	270

*Chi-squared P value < 0.0001.

Clinical presentation of shoe-contact vitiligo and idiopathic vitiligo

The majority (82%) of shoe-contact vitiligo had itching compared to just 2% with idiopathic vitiligo ($P < 0.001$). Shoe-contact vitiligo patients had burning sensations (12%) and some had ulcerations (8%). Idiopathic vitiligo had no such findings (Table 2).

Skin discoloration occurred within an average of three weeks of wearing plastic shoes, the depigmentation was in 91% symmetrical and involved parts of the feet covered with plastic shoes. Symmetrical lesions were seen in only 11% of idiopathic vitiligo. (OR = 81 CI: 43-152, $P < 0.001$).

Figures 1 and 2 shows two patients with shoe-contact vitiligo.

Discussion

This is the first study from a podoconiosis endemic area in Africa reporting on shoe-contact vitiligo. Compared with idiopathic vitiligo, the condition was significantly associated with being female and being resident in rural areas. Depigmented lesions were symmetrical, symptomatic, restricted to areas in direct contact with the shoe material and occurring on average, three weeks after wearing plastic shoes.

This study is important as shoe wearing is the principal intervention for eliminating podoconiosis in Ethiopia [17]. As vitiligo is stigmatizing, there is a real risk that communities may be discouraged from wearing shoes. This has public health implications on podoconiosis control and prevention of soil-transmitted helminths.

The study strengths are: that the diagnosis of both idiopathic and contact vitiligo was made in two

Figure 1. A female aged 42 years, showing symmetrical skin depigmentation on the dorsum of the foot starting within two weeks of wearing orange plastic shoes. (left image = Shoes on; right image = Shoes off).



Figure 2. A female aged 18 years showing well demarcated symmetrical skin depigmentation on the dorsum of the foot starting within two weeks of wearing yellow plastic shoes (Left image = Shoes on; right image = Shoes off).



specialized dermatologic clinics; clinical data was cross-validated and we compared data on idiopathic and shoe-contact vitiligo. The study also adhered to STROBE guidelines on the reporting of observational studies in epidemiology [18].

The main limitation is that we did not know which type chemicals are exactly responsible. Research to identify the possible chemical or other culprit(s) is urgently needed. The second limitation is the diagnosis of shoe contact Vitiligo is done clinically as a result we are not able to claim with certainty whether the contact depigmentation is Vitiligo or Leukoderma.

The study has policy and practice implications. First, women and those from the rural areas were more affected. Possible reasons for this finding might be that more women than men use cheap plastic shoes. Those from the rural areas being predominantly farmers might be relatively more exposed to higher levels of friction between the plastic material and skin which may increase skin absorption of toxic material. Furthermore, they do not generally wear socks implying that there is no barrier between the plastic material and the skin. This is an area that merits qualitative research.

Second, shoe-contact vitiligo was associated with itching, burning sensations and skin ulceration suggesting some sort of chemical burn. The skin discoloration occurs rapidly and may imply direct suppression or damage to melanocytes (pigment producing cells in the skin). Anecdotal observations from our clinic suggests that the condition is reversible on prolonged treatment with topical steroids and/or topical lotions that stimulate pigment production (8-methoxypsoralen). Unfortunately, we did not systematically capture follow-up data in this regard and cannot substantiate this claim. For the future, we have already modified the clinic data collection system to include new variables that will throw more light on this issue. Other studies have actually reported reversal of skin changes after avoiding exposure to incriminated chemicals [12,19,-20]. An urgent area for immediate research is histopathology and toxicology to better understand skin changes associated with shoe-contact vitiligo. There might also be occupational and environmental risks of plastic shoes. Exposure by factor workers may result in other un-noticed health effects and plastic shoes left in the environment may contaminate water sources and food. There may be longer-term health implications.

In conclusion, shoe-contact vitiligo is significantly associated with wearing cheap flexible PVC plastic shoes/chemical(s) or other toxic additive agents are perhaps responsible. We need to identify the exact

culprit(s) so as to introduce quality control regulations and rigorous monitoring of shoe production sites. This may put an end to this problem.

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