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Epidemiology of keloids among university students in Uganda

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Abstract

Keloids are benign yet persistent fibroproliferative disorders characterized by raised, irregular scars that extend beyond the original wound margins. In addition to causing disfiguring scars, pain, and restricted mobility, keloids significantly impact psychosocial well-being, often leading to emotional distress and socioeconomic challenges for the affected individuals.

Although keloids are recognized as being most prevalent among individuals of African descent, there remains a paucity of epidemiological data on their prevalence in African populations.

This gap in knowledge has contributed to the limited prioritization of keloid management in healthcare policies and treatment strategies.

This study aimed to determine the prevalence of keloids among university students in Uganda and analyze the demographic and patient-related factors associated with keloid development, with particular focus on age, sex, ethnicity, family history, blood group, and skin complexion.

A descriptive, cross-sectional study was conducted among 502 university students at Makerere University in Kampala, Uganda. Data were collected using structured questionnaires and direct visual inspection of scars by trained research assistants. Statistical analyses were performed to determine the prevalence and evaluate the associations between keloids and participant characteristics.

The prevalence of keloids among study participants was 4.18%, while hypertrophic scars were observed in 20.32%. A positive family history was identified as the strongest association with keloid development. No significant associations were found between keloid formation and ethnicity, blood group, or skin complexion.

The study provides population-based prevalence data on keloids and emphasizes the role of genetic predisposition in keloid formation. The findings underscore the need for increased awareness, identification of at-risk populations, and strategized preventive interventions for keloid development.

Introduction

Keloids are benign but persistent fibroproliferative disorders that manifest as raised, irregular scars extending beyond the boundaries of the initial injury. Unlike hypertrophic scars, which remain confined to the original wound margins, keloids exhibit uncontrolled extracellular matrix deposition, particularly collagen, resulting in progressive enlargement over time. These keloids disproportionately affect individuals with darker skin tones, with studies suggesting a prevalence estimated between 4-16% in populations of African descent compared to 1-6% in Caucasian populations.

The higher susceptibility is thought to be influenced by genetic predisposition, heightened immune responses, and increased fibroblast activity in melanin-rich skin.

Keloids often cause physical symptoms, including pain, itching, and functional impairment. Beyond the physical burden, affected individuals frequently experience significant psychosocial distress due to the disfiguring nature of these keloids, leading to diminished self-esteem, social anxiety, and, in some cases, depression. These challenges are often more profound in Sub-Saharan Africa, which is described as having the most aggressive forms of the disease, characterized by large, invasive, and treatment-resistant lesions. This burden is further compounded by limited access to specialized dermatological care, a lack of standardized treatment protocols, and financial constraints that hinder early intervention.

Globally, research on keloids has advanced considerably in countries such as the United States, Europe, and China, where extensive studies have provided insights into prevalence, genetic predisposition, and treatment practices. For instance, large-scale genome-wide association studies (GWAS) have been conducted to identify genetic markers linked to keloid formation,[1-4] while in China, researchers are exploring molecular pathways involved in fibroblast dysregulation in keloids.[5]

In contrast, although Africa faces the highest risk of keloids,[6] research studies on keloids in Sub-Saharan Africa have largely fallen behind, with only a few epidemiological studies published in the region.[7-10] The lack of comprehensive research creates critical gaps in the literature, hindering the development of evidence-based clinical guidelines tailored to African populations. Without this essential baseline information, it becomes difficult to conduct in-depth investigations into genetic susceptibility, treatment efficacy, and potential preventive strategies.

It is recognized that keloids are predominantly a disease of young adults, and in an attempt to identify the most at-risk groups, university students stand out as a key population for study. This demographic is particularly relevant due to high exposure to trauma-related risk factors, including acne, piercings, surgical scars, and injuries sustained during sports or physical activities. Additionally, universities in Uganda attract students from diverse ethnic backgrounds, providing a unique opportunity to explore ethnic variations in keloid susceptibility within a relatively controlled environment.

Anecdotal evidence and previous studies suggest a high prevalence among university populations, yet there is limited empirical data to substantiate these claims. The absence of such data not only hinders the development of targeted interventions but also perpetuates a lack of awareness about this condition among health care providers, policy makers, and affected individuals. This lack of awareness contributes to delayed diagnosis, misdiagnosis, inappropriate treatment, and suboptimal patient outcomes. Furthermore, the underrepresentation of keloids in healthcare policies and surgical programs in Sub-

Saharan Africa has led to the condition being classified as one of the often-neglected surgical diseases in the region.

The present study aimed to address these knowledge gaps by determining the prevalence of keloids among university students in a Sub-Saharan African population. Additionally, the study sought to analyze the demographic and patient factors associated with keloid development among the participants, with particular emphasis on age, sex, ethnicity, and history of trauma or scarring.

The findings from this research are expected to provide a foundation for future epidemiological and genetic studies while informing the public health strategies for keloid prevention and management in high-risk populations.

Materials and Methods

Study design and setting

This was a descriptive, cross-sectional study conducted among university students at Makerere University (Kampala, Uganda).

Makerere University is the oldest university in East Africa, established in 1922, and provides both undergraduate and graduate training for Ugandans and other students from Sub-Saharan Africa. As Uganda's premier academic institution, it has historically played a pivotal role in shaping higher education in the region, attracting students from diverse socioeconomic, cultural, and geographical backgrounds.

The university is organized into a collegiate system with nine colleges and one school, offering a wide range of disciplines. The total student population is approximately 40,000, with about 36,000 (90%) enrolled in undergraduate programs across various fields, including health sciences, humanities, engineering, and natural sciences.

The university follows a merit-based admission system, where student selection is based on their performance in the Uganda Advanced Certificate of Education (UACE). This competitive selection process ensures that the institution attracts high-achieving students from all regions of Uganda. Secondly, there is a deliberate quota system where representative proportions of students are selected from each of the districts in Uganda. This ensures sufficient representation of all the populations of Uganda and ensures that all the best-performing students from each district in the different regions of Uganda are selected for enrollment at the campus.

This rigorous mechanism was designed to ensure diversity in the ethnicity and region representation for all Ugandans and therefore makes Makerere University one of the most heterogeneous population groups

in the country. This is one of the key justifications for selecting the university as the study site and enhances the generalizability of the study findings.

The university also enforces a gender equity policy aimed at promoting female education, resulting in approximately 50% of the student population being female. This gender balance allows for an equitable analysis of keloid prevalence among male and female participants, providing insights into potential gender-related variations in keloid development.

With all the measures in place to ensure diversity, inclusiveness, and regional representation, Makerere University provides one of the most ethnically and socioeconomically diverse populations in Uganda. This diversity made it an optimal setting for investigating keloid epidemiology in Uganda.

Study population

The target population comprised all undergraduate students enrolled and actively studying at Makerere University during the study time.

The accessible population included undergraduate students enrolled and physically attending classes at any of the nine colleges and one school (the School of Law) at Makerere University during the study period.

Eligibility criteria

The study included all undergraduate students, regardless of their year of study or academic program, enrolled in any of the schools within the respective colleges at the university. Eligible students were those officially registered in their academic programs at the time of the study and actively attending classes.

Students were excluded if they were not physically present in class during the study period. This includes students on field trips, community placements, local or international educational travel, or those absent for any other reason. Additionally, students who chose not to provide informed consent to participate in the study were excluded.

Sample size

To determine the appropriate sample size for this cross-sectional study, we used the Kish and Leslie formula, widely employed in epidemiological studies to estimate sample sizes based on population prevalence rates. The formula is expressed as follows: $n=Z^2\times P(1-P)/d^2$, where: Z=standard normal deviate at 95% confidence interval, corresponding to 1.96; P=estimated prevalence of keloids in a comparable population; d=acceptable margin of error (5% or 0.05); n=calculated minimum sample size.

A study conducted in Kenya estimated the prevalence of keloids to be 8.5% among normally pigmented Africans.[9] However, multiple studies suggest that the prevalence in Africans is as high as 16%.[6,11,12] To ensure a conservative and robust sample size estimation, we used the highest reported keloid prevalence of 16%, which resulted in a sample size of 207 participants.

However, to further maximize statistical power and account for potential variation, we used a hypothetical prevalence of 50% – a common approach when the true prevalence is uncertain – to obtain the largest possible sample size for meaningful inference.

Using the formula described above, the calculated sample size was 384 participants. After adjusting for the finite university population of 36,000 students and allowing for a 20% non-response rate, we arrived at a final sample size of 475 participants.

This final sample size was determined to be the minimum necessary to ensure the study had sufficient statistical power to detect meaningful associations between keloid prevalence and demographic factors. The adjustments accounted for potential non-response, missing data, and sampling variability, thereby improving the reliability and generalizability of the study findings.

Sampling strategy

We employed a multistage random-cluster sampling method to systematically identify and recruit study participants. This approach ensured that the sample was representative of the university's diverse student population while minimizing selection bias.

Step 1: Selection of colleges

Makerere University has nine colleges and one school of law, totaling 10 units. Out of these, five colleges were randomly chosen to participate in the study.

Step 2: Allocation of participants per college

Each of the five selected colleges was allocated 100 slots for participant recruitment, resulting in a total of 500 participant slots.

Step 3: Selection of schools and programs

Within each of the five selected colleges, all schools were identified, and two schools were randomly selected per college. From each of these schools, the program with the largest number of actively enrolled

students was chosen. Consequently, each selected school had two programs considered for inclusion in the study.

Step 4: Distribution of participants by year of study

For each selected program, 50 participants were distributed across the different academic years. The allocation was structured as follows: i) five-year programs: each academic year received 10 participant slots; ii) four-year programs: each academic year received 12-13 slots (adjusted for an even distribution); iii) three-year programs: first and second year were each allocated 17 slots while 16 slots were allocated to the final year making a total of 50 participants per program.

Step 5: Selection of participants from class registers

Student class registers for each selected program were obtained with official permission from the respective school registrars and overall clearance from the Academic Registrar's Office.

For programs with over 100 students, systematic random sampling was performed, selecting every 10^{th} student (*e.g.*, 10^{th}, 20^{th}, 30^{th}, *etc.*) from the register until the required number of participants was reached. For programs with fewer than 100 students, a sampling interval was determined using the formula: interval = total number of students on the register/number of students allocated for selection per register. The resulting interval was used to select participants systematically. If the interval resulted in a decimal, it was rounded to the nearest whole number for practical selection.

This rigorous, multistage sampling process ensured that the study sample was representative of the university's student body and accounted for academic diversity.

Study variables

Predictor variables

The independent variables considered in this study included: age (in completed years), sex/gender (categorized as male or female), ethnic group/tribe (self-reported by the participant), home district of origin (ancestral district as reported by the participant), skin complexion (categorized along a spectrum from very dark, dark brown, light, to very light) and family history of keloids (self-reported presence of keloids in first-degree relatives).

Outcome variables

The presence or absence of keloids and hypertrophic scars was assessed in the study.

Keloids were defined as excessive fibroproliferative scar formations that are elevated above the surrounding normal skin level and extend beyond the original wound boundaries.[3] The presence of keloids was confirmed through direct visual inspection by the research assistant, who documented their presence or absence.

Hypertrophic scars were defined as raised scars that remain confined within the original wound margins, without extending beyond the original injury site.[13]

Finally, a normal scar was defined as a wound that has healed normally, with the scar remaining flat and confined to the initial wound boundaries.

Scar characterization and assessment

Participants were asked whether they had any scars that concerned them. If they responded affirmatively, they were then assisted in classifying their scar(s) according to the predefined criteria. Keloid (scar extending beyond the wound boundaries), hypertrophic scar (raised but confined to the original wound area), and normal scar (flat, non-elevated, within wound boundaries). The participants' responses were recorded under "self-reported scar assessment".

The observer, who was a trained research assistant, conducted an objective evaluation of all reported scars to confirm the scar classification. The observer assessment was performed to ensure accuracy, minimize reporting bias, and maintain consistency in classification across all participants. The research assistant assessed all scars among participants who reported a scar and classified and reported each accordingly. Photographs of the scars among those who had keloids were also taken.

The observer proceeded to obtain further scar characteristics, including: the location of the scar, as described according to the affected body part; etiology; duration (in years); and symptoms.

Data collection

A structured and pre-tested questionnaire was used to collect data. The questionnaire was designed to capture key demographic details, self-reported keloid characteristics, and other relevant clinical variables.

Data were collected by two research assistants who were extensively trained in administering the questionnaire, obtaining informed consent, and accurately classifying scar characteristics according to predefined criteria. The training emphasized consistency in assessment, ethical considerations, and ensuring participant comfort during the process.

Recruitment was conducted within the university's schools, where research assistants approached students, explained the study, and obtained written consent before participation. The research assistants administered the questionnaire in a one-on-one setting, ensuring that participants fully understood the questions and had the opportunity to seek clarification. Upon completion of the questionnaire, research assistants reviewed participants' responses to verify the self-reported scar characteristics.

Participants who self-reported the presence of keloids underwent an additional assessment by the research assistant for observer characterization to confirm their classification.

For cases classified as keloids, a photograph of the lesion was taken with the participant's consent to aid further verification and documentation.

Data analysis

Descriptive statistics were employed for summarizing participant characteristics and assessing keloid prevalence. Demographic variables (*e.g.*, age, sex, ethnicity, and family history) were summarized using means and proportions, depending on the nature of the variables.

Prevalence of keloids was determined as the proportion of participants with confirmed keloids relative to the total number of recruited participants. Both self-reported and observer-confirmed keloid prevalence were analyzed separately to assess discrepancies between subjective and objective reporting.

Associations between keloid presence and participant characteristics were evaluated using chi-square tests for categorical variables (*e.g.*, sex, ethnicity), and logistic regression for continuous variables (*e.g.*, age).

A multivariate logistic regression model was applied to adjust for potential confounders and identify independent predictors of keloid development.

Data quality control

To ensure data accuracy, reliability, and consistency, the following measures were implemented:

i) Comprehensive training: research assistants underwent rigorous training on proper data collection techniques, participant engagement, and ethical considerations.

ii) Supervision and monitoring: the principal investigator conducted regular supervision to ensure adherence to research protocols.

iii) Immediate questionnaire review: each completed questionnaire was checked for completeness and accuracy immediately after data collection. Any unclear responses were promptly clarified with the participant.

iv) Assisted completion: research assistants were readily available to clarify any ambiguous questionnaire items, ensuring that participants fully understood the questions.

v) Standardized observer assessment: a structured keloid classification protocol was used to minimize variability in observer-reported diagnoses.

vi) Data verification: a random subset of collected data was re-evaluated to assess inter-rater reliability and detect any inconsistencies.

Results

Description of study participants

The study included 502 participants from five different colleges of Makerere University. There was an almost equal gender distribution, with 269 (53.59%) males and 233 (46.41%) females. The mean age of participants was 22.52 (±2.59), ranging from 18 to 46 years.

The ethnic composition indicated that the majority of participants were of Bantu origin, accounting for 426 individuals (84.86%). This was followed by Nilotics, with 61 participants (12.15%), and Central Sudanic, with 9 participants (1.79%), representing the minority ethnic groups. The most predominant tribes were the Baganda (165, 32.87%) and the Banyankole (104, 20.72%), together accounting for 53.59% of the study population.

In terms of the region of origin, the Central 198 (39.44%) and Western 186 (37.05%) regions of Uganda were the most represented, whereas the Northern region had the least number of participants (44, 8.76%). The most common district of origin was Wakiso (61, 12.15%), followed by Kampala and Mbarara, each contributing 27 (5.38%) participants.

Overall, district representation was highly heterogeneous, with more than 50% of the participants originating from districts outside the most represented ones.

A comprehensive summary of participant characteristics, including tribal and regional distributions, is provided in Table 1.

Epidemiology of keloids and hypertrophic scars

The prevalence of keloids and hypertrophic scars was 4.18% (21 participants) and 20.32% (102 participants), respectively, among all study participants. A detailed analysis of prevalence across different subgroups is presented in Table 2.

Clinical characteristics of the keloids and hypertrophic scars

Site distribution

The distribution of keloids and hypertrophic scars was varied across different anatomical sites. Among the 21 participants with clinically confirmed keloids, the most common site was the lower limbs (33.33%; 7 participants), followed by the upper limbs (23.81%; 5 participants). The head and neck region had the fewest keloids, with only 2 cases (9.52%) (Figure 1).

Multiplicity and duration of keloid presence

Among the 21 participants with keloids, the majority (71.43%; 15 participants) had a single keloid, while the remaining participants had two or more keloids.

The majority of participants (42.86%; 9 participants) had keloids for over 10 years, while the rest had keloids for at least 1 year.

Most common symptoms

The most frequently reported symptom was itching, affecting 73.33% (11 participants), while pain was reported by 26.67% (4 participants) (Table 3).

Factors associated with keloids and hypertrophic scars

Several potential factors, including family history, blood group, skin complexion, and ethnicity, were analyzed (Table 4).

Family history was identified as the single most statistically significant factor associated with both keloids and hypertrophic scars ($p=0.028$ and $p=0.000$, respectively).

While no significant association was found between keloids and ethnicity, both the Bantu and Nilotic ethnic groups were associated with an increased likelihood of developing hypertrophic scars.

Regarding blood group, no significant association was found between any specific blood group and the development of either keloids or hypertrophic scars.

Similarly, skin complexion was not found to be associated with the occurrence of keloids or hypertrophic scars.

Discussion

Despite keloids and hypertrophic scars being recognized as some of the most common skin conditions among Africans, their epidemiology remains poorly described in Uganda and Sub-Saharan Africa at large.

In this study, we examined the prevalence of keloids in Uganda using an ethnically diverse cohort of university students from the largest university in the country. Similar research has been conducted in university settings,[14,15] as universities offer a highly diverse population suitable for epidemiological studies. We found a relatively high prevalence of keloids and hypertrophic scars, comparable with other studies conducted in African populations.

Prevalence of keloids

We found a prevalence of 4.18% for keloids and 20.23% for hypertrophic scars in our study population. These findings align with a study by Kouotou *et al.* conducted in Cameroon, which reported a keloid prevalence of 3.5%.[10] Similarly, a study in Kenya comparing keloid prevalence between normal pigmented individuals and individuals with albinism reported prevalence rates of 8.3% and 7.8%, respectively.[9] Another study conducted in the Ivory Coast also reported a prevalence of 3.5%.[8]

A global study on self-reported keloids by Stanley *et al.* found prevalence rates of 11% in Ghana, 7% in England, 6% in Australia, and 2% in Canada.[16] However, because these were self-reported cases, there is a possibility of overdiagnosis bias. Despite anecdotal reports estimating keloid prevalence to be as high as 16% among Sub-Saharan African populations,[6] emerging evidence suggest a lower actual prevalence.

Our findings support the notion that keloid prevalence in Sub-Saharan Africa is generally below 5%, consistent with previous studies. Globally, there is consensus that Africans and individuals of African descent have a higher predisposition to developing keloids compared to other racial groups,[17,18] suggesting a potential genetic linkage.

In contrast, a study among university students in China found a much lower prevalence of 0.6%.[14] Similarly, a Nigerian study among university students who had undergone ear piercing reported a very low prevalence of 0.5%,[15] concluding that keloid formation following ear piercing was uncommon in this population.

Demographic characteristics of the study participants

Among the 502 study participants, gender distribution was balanced, allowing for an appropriate comparison of gender-related differences in keloid development. The relationship between gender and keloid susceptibility remains debated.[19] In our study, there was no significant gender predisposition to keloid development, with a female-to-male ratio of 1:1.125.

As expected, most of the study participants were young, with a mean age of 22.518. This aligns with the age group most at risk for keloid formation and is consistent with findings from several other studies,[7,14,15] although some studies have reported a slightly higher mean age.[18]

The majority of the study participants were Bantu (84.8%), reflecting the national ethnic distribution.[20,21] Similarly, the distribution of tribes within the study population was consistent with the national census data.[21]

Clinical characteristics

Half of the patients with keloids and hypertrophic scars had lesions on the limbs, which aligns with the high likelihood of trauma exposure in these areas. However, this finding differs from a study conducted in Nigeria, where the ears were the most commonly affected site in 35% of the participants.[7] Another study conducted in a clinical setting reported the pre-sternal region as the most frequently affected site.[10] It is important to note that the studies conducted in Nigeria and Cameroon were clinic-based, where individuals with keloids causing significant cosmetic disfigurement, particularly on the face, were more likely to seek medical attention compared to those with keloids on the limbs. Similarly, in clinical settings, keloids are more frequently observed in highly visible areas, such as the face and chest, as these locations are often of greater cosmetic concern.

Factors associated with keloids

A family history of keloids emerged as a significant factor associated with the development of keloids. A positive family history has been identified in several studies as a strong contributing factor, often linked to an autosomal dominant trait.[22,23] This highlights the need to identify and emphasize that keloids are a familial illness and educate at-risk individuals on appropriate practices, such as avoiding ear piercing in families with this risk factor.

Furthermore, it is well-established that keloids have a racial predilection, particularly within the black race.[6,18] Given the ethnic diversity among the Black African population, it was of interest to investigate whether any specific ethnicity in Uganda was more prone to keloids and hypertrophic scar formation. Interestingly, no association was found between keloids and any particular ethnicity in Uganda. In contrast, there was a weak association between hypertrophic scars and the Bantu and Nilotic ethnicities. Studies on scarification among different African ethnic groups[24] do not associate any specific ethnicity with keloid formation. Older studies also fail to establish a significant linkage, particularly with the Bantu.[25]

Several studies have attempted to explore the potential connection between blood groups and keloids. In a study conducted in Syria, blood group A was found to be associated with keloid development.[26] Other studies have also described links between blood groups and keloid formation.[27,28] However, in our study, there was no significant association between any blood group and the development of keloid or hypertrophic scars. Our findings are consistent with similar studies that did not establish any association with blood groups.[29,30]

Among black individuals, to the best of our knowledge, no literature has established a direct link between skin complexion and keloid development. In our study, skin complexion was not found to be associated with the development of keloids or hypertrophic scars.

Limitations and strengths of the study

This study has some limitations. As it was conducted in an urban setting and included highly educated participants, the findings may not be representative of broader population groups. Furthermore, the age range was limited to university students, thereby excluding other age groups, potentially affecting the generalizability of the results.

However, the study also has strengths: the population was ethnically diverse, representative of Uganda's various ethnicities and regions. Similarly, the diversity of regions and districts of origin reflects Uganda's regional distribution, providing a fairly robust representation. As a population-based rather than hospital-based study, this study offers a more reliable estimate of population prevalence than some other studies.

Conclusions

We determined the population-based prevalence of keloids and hypertrophic scars to be 4.18% and 20.23%, respectively, among university students in Uganda. Additionally, this study identified a significant familial association with keloids, highlighting the role of genetic predisposition. A large, nationwide, population-based survey could provide a more accurate estimate of keloid prevalence.

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Table 1. Descriptive characteristics of the study participants.

Variable	Frequency/mean	Percentage/SD
Age	22.518	±2.599
Age categories		
≤20	54	10.76
21-25	420	83.67
26-30	16	3.19
>30	12	2.39
Sex		
Male	269	53.59
Female	233	46.41
Ethnicity		
Bantu	426	84.86
Nilotics	61	12.15
Central Sudanic	9	1.79
Hamites	1	0.20
Non-Ugandan	5	1.00
Tribe		
Baganda	165	32.87
Banyankole	104	20.72
Bakiga	30	5.98
Banyoro	27	5.38
Basoga	26	5.18
Others	138	27.5
Region of origin		
Central	198	39.44
Western	186	37.05
Eastern	69	13.75
Northern	44	8.76
Non-Ugandan	5	1
District of origin		
Wakiso	61	12.15
Kampala	27	5.38
Mbarara	27	5.38
Masaka	20	3.98
Others	339	73.11

SD, standard deviation.

Table 2. Epidemiology of keloids and hypertrophic scars.

Characteristic	**Cases (prevalence)**				
	Total cases	**Hypertrophic scars, n (%)**	**p-value**	**Keloids, n (%)**	**p-value**
Total	502	102 (20.32)		21 (4.18)	
Gender					
Male	269	54 (20.07)	0.884	17 (6.32)	0.010*
Female	233	48 (20.60)		4(1.72)	
Ethnicity					
Bantu	426	79 (18.54)	0.028*	18(4.22)	0.946
Central Sudanic	9	1 (11.11)		0 (0)	
Nilotic	61	19 (31.14)		3 (4.92)	
Hamites	1	1 (100)		0 (0)	
Non-Uganda	5	2 (40)		0 (0)	
Tribe					
Baganda	165	37 (22.4)	0.285	9 (5.45)	0.932
Banyankore	104	18 (17.3)		4 (3.85)	
Bakiga	30	3 (10)		1 (3.33)	
Banyoro	27	4 (14.8)		1 (3.70)	
Basoga	26	4 (15.4)		1 (3.85)	
Others	138	36 (26.1)		5 (3.62)	
Region of origin					
Central	198	44 (22.2)	0.175	10 (5.05)	0.914
Western	186	29 (15.59)		7 (3.76)	
Eastern	69	20 (28.99)		2 (2.90)	
Northern	44	8 (18.18)		2 (4.55)	
Non-Ugandan	5	1 (20)		0 (0)	

*Statistically significant.

Table 3. Clinical characteristics of keloids.

Characteristic	Keloids, n (%)
Site	
Head and neck	2 (9.52)
Upper limb	5 (23.81)
Chest	4 (19.05)
Lower limb	7 (33.33)
Multiple	3 (14.29)
Number of scars	
1	15 (71.43)
2	4 (19.05)
3	1 (4.76)
4	1 (4.76)
Age of the scar (years)	
≤1	2 (9.52)
2-5	6 (28.57)
6-9	4 (19.05)
≥10	9 (42.86)
Common symptoms (15)	
Itching	11 (73.33)
Pain	4 (26.67)
Scar pigmentation (20)	
Hyperpigmented	9 (45)
Hypopigmented	5 (25)
Same color as skin	6 (30)

Table 4. Factors associated with keloids and hypertrophic scars.

Variable	Total cases	Keloid	p-value	Hypertrophic scar	p-value
Family history					
Yes	149	11	0.028*	44	0.000*
No	336	10		52	
Ethnicity - Bantu					
Bantu	426	18	0.911	79	0.019
Non-Bantu	59	4		-	
Ethnicity - Nilotics					
Nilotics	61	3	0.760	19	0.025
Non-Nilotics	441	0		0	
Blood group					
A+	43	2	0.482	10	0.818
A–	2	0		0	
AB+	18	1		4	
AB–	1	0		0	
B+	42	4		6	
O+	109	2		22	
O–	12	0		1	
Complexion					
Very dark	10	0	0.943	5	0.053
Dark	189	8		41	
Medium	167	7		27	
Light skinned	129	6		29	
Very light skinned	6	0		0	

*Statistically significant.

Figure 1. Scars of study participants.