



# Analysis of Association Between Keloids and Other Medical Conditions

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## Abstract

Using the Genetic Causes of Keloid Formation Study, associations between keloids and hypertension and obesity were assessed to better understand systemic influences on keloids. The analysis showed an association between hypertension and keloids, particularly in individuals under 30. Obese participants had an association with increased prevalence of multiple keloid lesions and keloids on multiple anatomical sites.

## Introduction

Keloids are an exaggerated response to cutaneous wound healing. Keloids negatively affect patients' quality of life and there is not an entirely effective treatment to prevent occurrence or recurrence. Previous results from the Genetic Causes of Keloid Formation Study (GCKFS), an IRB-approved keloid registry, showed that hypertension and obesity may be more prevalent in African-Americans with keloids versus the general African-American population. This suggests possible common mechanisms between keloids and comorbidities.

## Methods and Materials

Seventy-nine African-American GCKFS participants with diagnosed keloids were matched to controls from the Dallas Heart Study (DHS) at an approximate 1 GCKFS:7 DHS ratio. Participants were categorized into hypertensive and obese cohorts using objective recorded measurements and calculations made using Fisher's exact test (significance  $P < 0.05$ ). Subanalyses were assessed among the GCKFS cohort using number of keloids, location, and number of anatomic sites involved.

Table 1. Demographic Data.

	GCKFS, n=79 (%)	DHS, n=521 (%)
Men	26 (33)	161 (31)
Women	53 (67)	360 (69)
Age Range [Median]	20-64 [42]	20-64 [42]

Table 2. Association of Hypertension and Obesity with Keloids, Overall

	GCKFS, n=79 (%)	DHS, n=521 (%)	P Value
Hypertension	30 (38)	138 (26.4)	0.043*
Obesity	36 (45.6)	229 (44)	0.809

## Results

Thirty out of seventy-nine (38%) GCKFS participants were hypertensive compared to 138/521 (26.4%) of controls; thirty-six (45.6%) GCKFS participants were obese compared to 229 (44%) of controls. The GCKFS participants showed an association with hypertension ( $p=0.043$ ) but not with obesity ( $p=0.809$ ). Keloid-affected individuals under age 30 had a higher prevalence of hypertension ( $p=0.042$ ).

There were 504 total keloids distributed among six designated anatomical sites: ears, neck and superior (excluding ears), extremities, trunk, abdomen, and other. Subanalyses were assessed among the GCKFS cohort using number of keloids, location of keloid, and number of keloid-affected anatomic sites. Subanalyses showed participants with greater than one keloid had a higher prevalence of obesity ( $p=0.007$ ). Similarly, obese participants had a higher association with multiple sites affected by keloids versus just one site ( $p=0.024$ ).

Table 3. Hypertension and Obesity Association with Keloids by Age

Age Subanalysis	Hypertensive/Total			Obese/Total		
	GCKFS	DHS	P Value	GCKFS	DHS	P Value
18-30	2/20	1/139	0.042*	7/20	40/139	0.604
31-40	3/18	15/119	0.707	/18	51/119	0.306
41-50	10/22	45/139	0.236	13/22	73/139	0.649
51-60	12/16	64/103	0.408	9/16	54/103	0.796
61+	3/3	13/21	0.526	2/3	11/21	1
Total	30/79	138/521	0.043*	36/79	229/521	0.809

\* Indicates  $P < 0.05$

Table 4. GCKFS Hypertension and Obesity Subanalysis based on Keloid Location and Number

GCKFS Keloid Location and Number Subanalysis	Hypertension P Value	Obesity P Value
Ears Only vs. Ears & Trunk	0.244	0.036*
At Least Ears vs. No ears	0.781	0.052
Trunk Only vs. Trunk & Ears	1	0.017*
Trunk Only vs. Trunk & Other Locations	1	0.042*
One Site vs. Multiple Sites	0.168	0.024*
One Keloid vs. Multiple Keloids	0.411	0.007*

## Discussion

An association between hypertension and keloid formation has been reported in the literature.

- Hypertension and keloid size/number have a statistically significant positive correlation.<sup>1</sup>
- Hypertensive patients are more likely to develop keloids after surgery than normotensive patients.<sup>2</sup>
- Angiotensin-converting enzyme inhibitor, an anti-hypertensive medication, has been shown to reduce keloid symptoms and lesion progression/worsening.<sup>3</sup>
- Individuals under age 30 with keloids had a higher incidence of hypertension.<sup>4</sup>
- Early onset hypertension has been reported in teens with keloids.<sup>5</sup>

Our results are consistent with previously reported findings and invite further inquiry into the systemic similarities between hypertension and keloid pathogenesis.

Skin manifestations are often clinically considered risk factors for certain comorbidities. For example, acanthosis nigricans is considered a risk factor for type 2 diabetes.<sup>6</sup> The findings from this GCKFS study indicate a predilection for developing multiple keloids and/or having multiple anatomical sites affected by keloids in obese individuals. Perhaps a systemic effect may be influencing obese patients to be more prone to developing keloids and, thus, obesity also may be a risk factor for developing keloids.

## Conclusions

The results are consistent with hypertensive associations with keloids found in literature. Data collection will continue to increase the GCKFS cohort to strengthen results for clinical significance. Further research is encouraged to delve into the mechanisms between the association between hypertension and/or obesity and keloids.

## References

- Arima, J., Huang, C., Rosner, B., Akaishi, S., & Ogawa, R. (2015). Hypertension: a systemic key to understanding local keloid severity. *Wound Repair Regen*, 23(2), 213-221. doi: 10.1111/wrr.12277
- Ogawa, R., Arima, J., Ono, S., & Hyakusoku, H. (2013). CASE REPORT Total Management of a Severe Case of Systemic Keloids Associated With High Blood Pressure (Hypertension): Clinical Symptoms of Keloids May Be Aggravated by Hypertension. *Eplasty*, 13, e25
- Ardekani, G. S., Aghaei, S., Nemati, M. H., Handjani, F., & Kasraee, B. (2009). Treatment of a postburn keloid scar with topical captopril: report of the first case. *Plast Reconstr Surg*, 123(3), 112e-113e. doi: 10.1097/PRS.0b013e31819a34db
- Woolery-Lloyd, H., & Berman, B. (2002). A controlled cohort study examining the onset of hypertension in black patients with keloids. *Eur J Dermatol*, 12(6), 581-582.
- Snyder, A. L., Zmuda, J. M., & Thompson, P. D. (1996). Keloid associated with hypertension. *Lancet*, 347(8999), 465-466.
- Kong, A. S., Williams, R. L., Smith, M., Sussman, A. L., Skipper, B., Hsi, A. C., . . . Clinicians, R. N. (2007). Acanthosis nigricans and diabetes risk factors: prevalence in young persons seen in southwestern US primary care practices. *Ann Fam Med*, 5(3), 202-208. doi: 10.1370/afm.678