

Plantar pressure patterns in people with gout and diabetes

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## **ABSTRACT**

### **Background:**

Gout and hyperuricaemia have been associated with an increased risk of diabetes and cardiovascular disease. Gout commonly affects the foot with a predilection for the first metatarsophalangeal joint and diabetes is frequently associated with foot ulceration. However there are limited studies that explore associations between altered mechanics in those with gout/diabetes. We aimed to determine whether plantar pressure significantly differed between patients with diabetes, gout and age-matched controls.

### **Methods:**

Using a Tekscan™ pressure mat, peak plantar pressures and pressure time integrals were calculated for seven predetermined regions of the foot. Participants comprised: gout n = 25, diabetes n=21, concomitant gout & diabetes n= 17 and n=33 healthy age/sex matched control subjects

### **Results:**

Compared to controls, all patient groups demonstrated reduced heel, increased midfoot and reduced second metatarsal peak pressure. The diabetes and diabetes plus gout groups demonstrated increased first metatarsal peak pressures. Whereas the diabetes and gout group demonstrated increased hallux peak pressures and increased third to fifth metatarsal peak pressures compared to the gout group (all  $p < 0.05$ ) (Table 1).

Compared to controls, participants with gout demonstrated increased midfoot pressure time integrals. Whereas those with diabetes demonstrated increased hallux pressure time integrals. Patients with diabetes plus gout demonstrated increased hallux and toe pressure time integrals. Finally, Participants with gout also demonstrated increased midfoot and reduced hallux pressure time integrals compared to diabetes and diabetes plus gout groups (all  $p < 0.05$ ).

### **Conclusion:**

The current study provides insights into the dynamic function of the foot in gout and diabetes as well as how plantar pressures can vary between pathologies

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**Table 1:** Mean, adjusted (SE) peak pressure (normalised to BMI) (kPa)

	<b>Control</b>	<b>Diabetes</b>	<b>Gout</b>	<b>Diabetes &amp; Gout</b>
Heel	282 (11)	243 (13) <sup>a</sup>	234 (12) <sup>a</sup>	233 (16) <sup>a</sup>
Midfoot	75 (12)	228 (14) <sup>a</sup>	183 (13) <sup>a, b</sup>	239 (17) <sup>a, c</sup>
First metatarsal	206 (12)	269 (13) <sup>a</sup>	236 (13)	260 (17) <sup>a</sup>
Second metatarsal	310 (10)	136 (12) <sup>a</sup>	134 (11) <sup>a</sup>	131 (14) <sup>a</sup>
Third to fifth metatarsals	246 (13)	245 (14)	209 (14)	272 (18) <sup>c</sup>
Hallux	232 (16)	293 (18) <sup>a</sup>	293 (17) <sup>a</sup>	275 (23)
Toes	103 (8)	118 (9)	109 (9)	120 (11)

<sup>a</sup> Significant difference compared to control group,  $p < 0.05$ ; <sup>b</sup> Significant difference compared to diabetes group,  $p < 0.05$ ; <sup>c</sup> Significant difference compared to gout group,  $p < 0.05$ .

**Table 2:** Mean, adjusted (SE) pressure time integrals (normalised to BMI) (kPa\*s)

	<b>Control</b>	<b>Diabetes</b>	<b>Gout</b>	<b>Diabetes &amp; Gout</b>
Heel	63.1 (4.7)	59.3 (5.2)	64.7 (5.0)	59.4 (6.5)
Midfoot	31.8 (2.7)	32.9 (3.1)	43.1 (2.9) <sup>a, b</sup>	33.5 (3.8) <sup>c</sup>
First metatarsal	51.4 (3.8)	44.8 (4.2)	48.3 (4.0)	53.9 (5.2)
Second metatarsal	86.9 (5.8)	93.0 (6.5)	88.8 (6.2)	81.5 (8.0)
Third to fifth metatarsals	72.6 (4.4)	73.1 (4.9)	70.7 (4.7)	67.4 (6.1)
Hallux	36.4 (4.5)	55.2 (5.1) <sup>a</sup>	40.3 (4.8) <sup>b</sup>	56.3 (6.2) <sup>a, c</sup>
Toes	23.2 (2.2)	27.6 (2.5)	28.0 (2.4)	31.4 (3.1) <sup>a</sup>

<sup>a</sup> Significant difference compared to control group,  $p < 0.05$ ; <sup>b</sup> Significant difference compared to diabetes group,  $p < 0.05$ ; <sup>c</sup> Significant difference compared to gout group,  $p < 0.05$ .