

EFFECTS OF A "SHOCK ABSORBING" INSOLE ON OVERLOAD FOOT PATHOLOGIES IN A GROUP OF ITALIAN SPECIAL FORCES

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INTRODUCTION

Lower limb overuse injuries are common problems in athletic and military populations (Sharma2011; Beck 1998). Soldiers are subjected to intense and prolonged training and several studies showed a high incidence of stress diseases caused by overload due to high plantar pressure which can be reduced by insoles (House 2002, Franklyn-Miller 2011). As far as our knowledge there are no studies conducted on the Italian army. Moreover, existing studies focused on plantar pressures analysis during race and march (Richteret 2011, Hinz 2008), with no assessments during other motion tasks typical of military training such as jumps. The purpose of this study was to evaluate effects of a shock absorbing insole on plantar pressure in Italian army soldiers during the execution of a war drill.

MATERIALS AND METHODS

20 volunteer soldiers (mean age 36 ± 6), with an average of 17 years of service (± 7 years) and a BMI of $25.5 (\pm 2.8)$ were included in this study. A clinical evaluation, including comfort investigation, and baropodometric analysis were assessed. Plantar pressure of each soldier was recorded while wearing standard Italian army shoes with and without shock absorbing insoles (Fig.1) during a simulation of a path of war. The path of war was characterized by different motor tasks such as walking, running and jumping (fig 2). The plantar pressures were recorded by using the Pedar insole system (Fig. 2) (Novel GmbH, Munich, Germany).



Fig. 1 "SHOCK ABSORBING INSOLES" (PODARTIS, Treviso, Italy)

Fig 2 Pedar® insoles system (Novel GmbH, Munich, Germany)



RESULTS

Clinical evaluation revealed a high incidence of lower limb diseases related to chronic overloading: 70% had lower limb pain, 26% plantar fasciitis, 22% anterior knee pain, 13% had achilles tendon tendinopathy. 80% of soldiers reported vertebral column pain: 50% had lumbar pain, 20% cervical pain. Mean comfort evaluation score was 4.3 when wearing insoles, 3.5 without insoles.

Baropodometric analysis during walking showed peak plantar pressure at forefoot of 442 KPa (± 56) without insoles and 421 (± 37) KPa while wearing insoles; in the rear foot peak plantar pressure was 323 (± 35) KPa without insoles and 302 (± 26) KPa with insoles ($p < 0.05$). Mean contact area recorded during walking was 49.8 (± 3) cm² without insoles and 53.2 (± 1.7) cm² with insoles ($p < 0.05$); mean contact area during running was 45.1 (± 1.6) cm² without insoles and 56 (± 0.7) cm² with insoles ($p < 0.05$). Pressure/time integral during walking was 80 (± 5.3) KPa/sec without insoles and 68 (± 3.7) KPa/sec with insoles at fore foot; at the rear foot it was 30 (± 8.2) KPa/sec without insoles and 28 (± 5.4) KPa/sec with insoles.

| | Forefoot mean contact area during walking (cm ²) | Forefoot mean contact area during running (cm ²) |
|----------------|--|--|
| Without insole | 49,8 | 45,1 |
| Standard dev | 3 | 1,6 |
| Insoles | 53,2 | 56 |
| Standard dev | 1,7 | 0,7 |

Tab. 1 mean forefoot contact area values with and without insoles

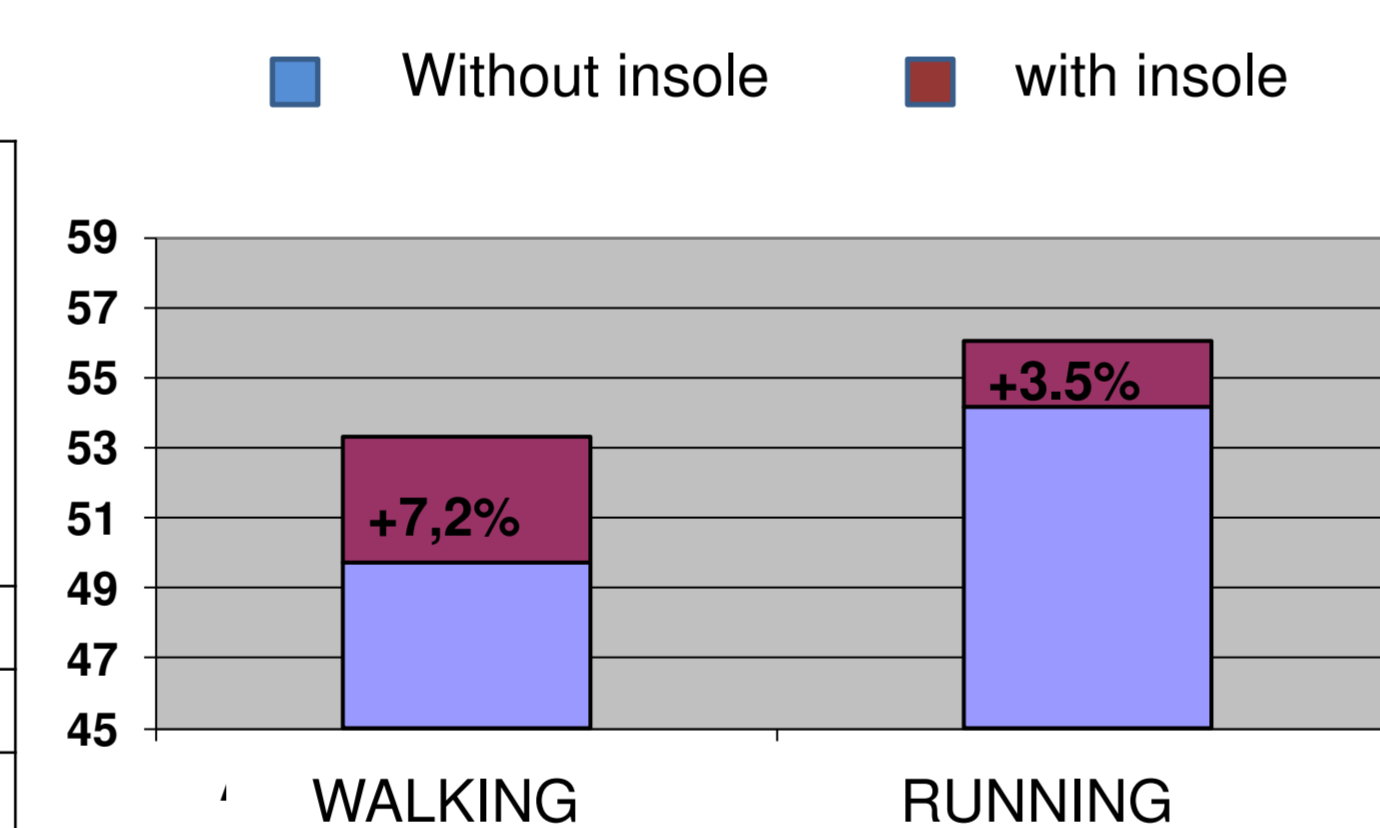


Fig 6 Mean values of forefoot contact area with and without insoles during walking and running

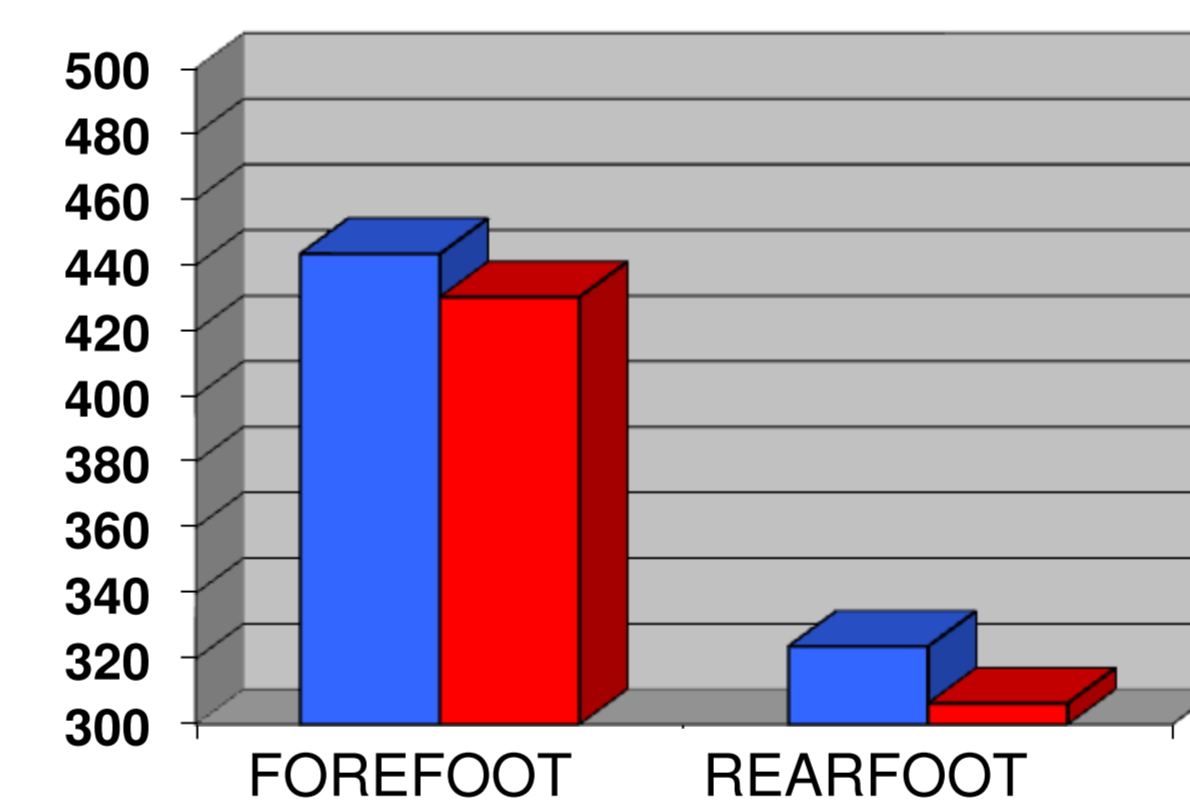


Fig. 3 mean peak plantar pressure at forefoot and rearfoot with and without insoles during gait

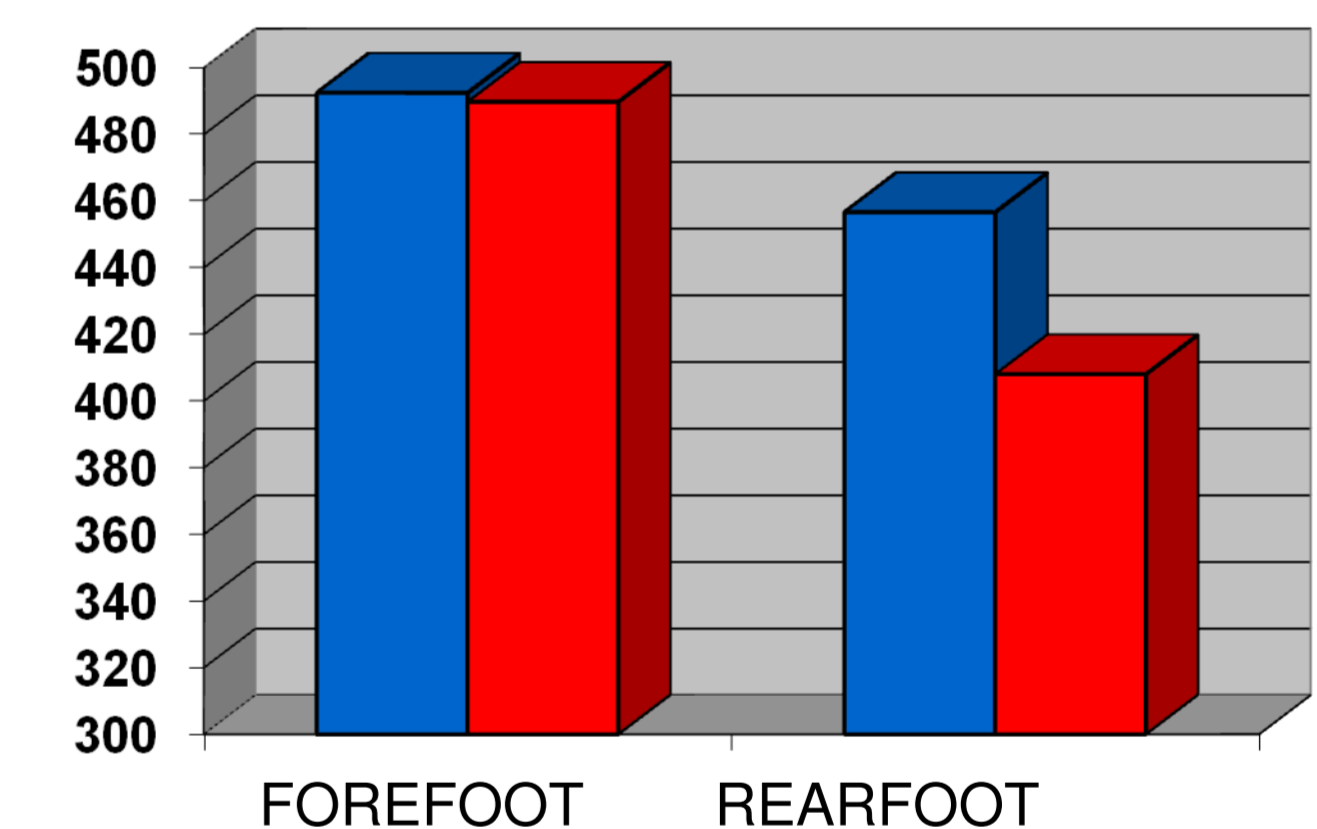


Fig. 4 mean peak pressure values with and without insoles while running

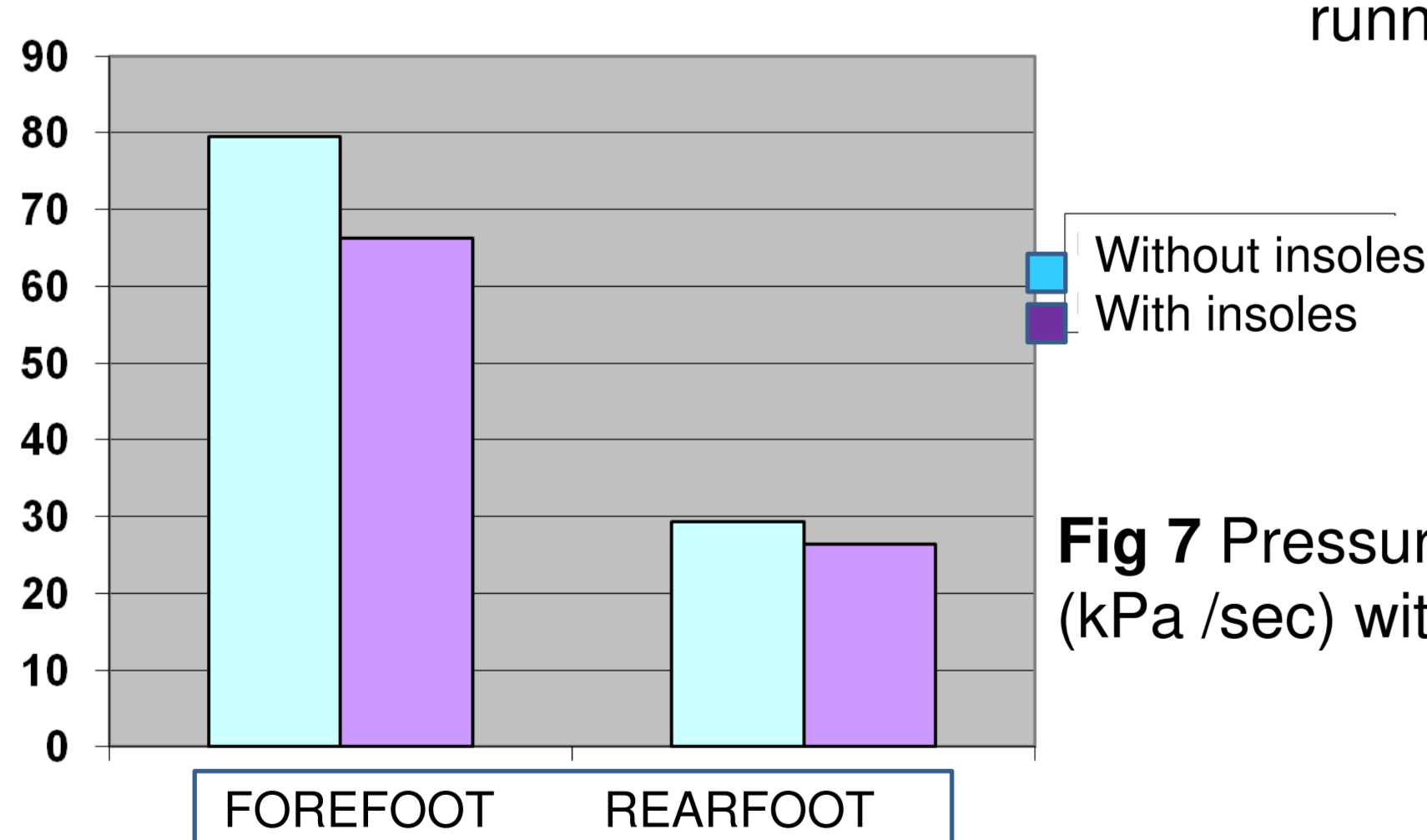
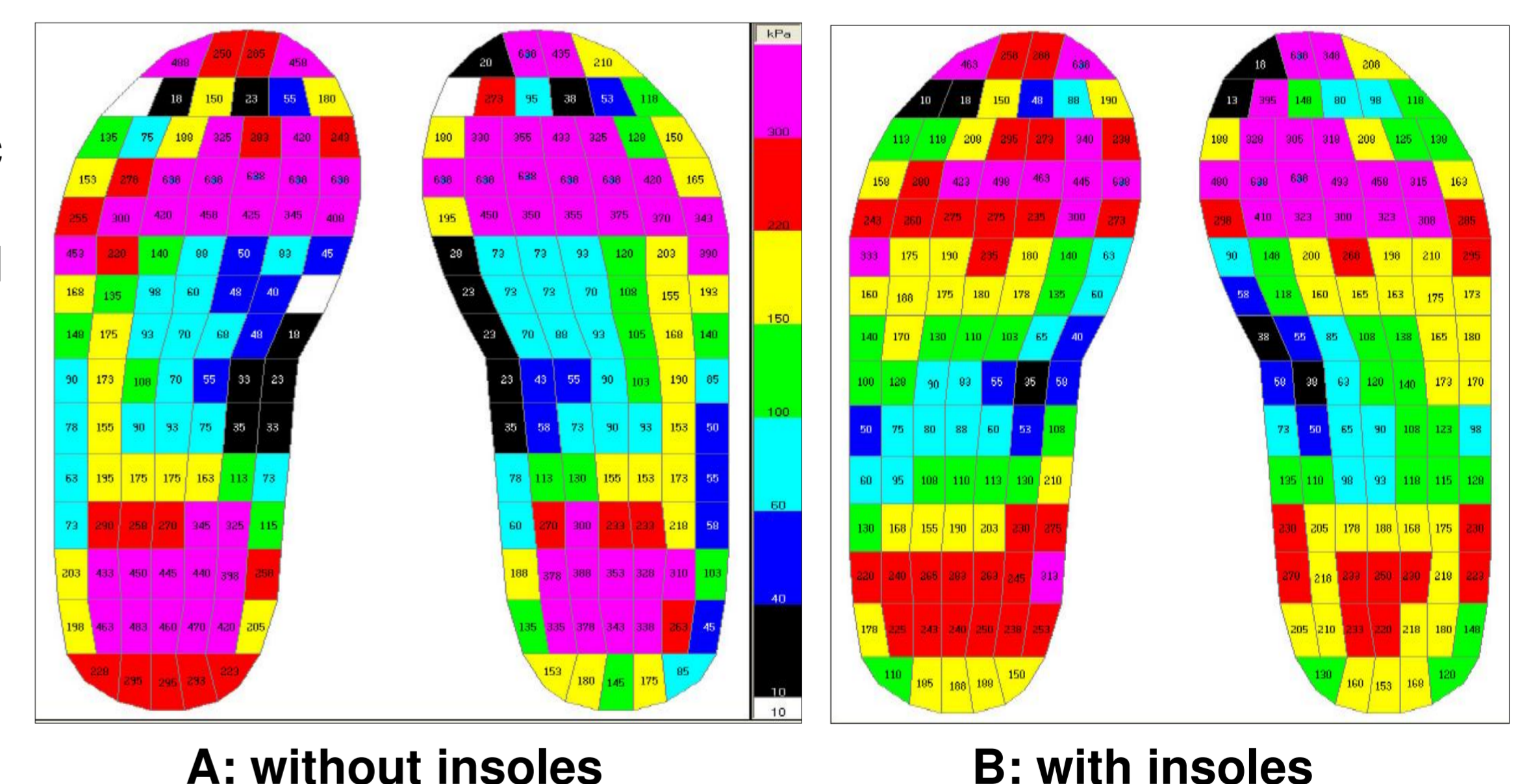


Fig 7 Pressure/time integral during walking (kPa /sec) with and without insoles

Fig 5 Baropodometric analysis during running without insoles (A) and with insoles (B)



A: without insoles

B: with insoles

DISCUSSION

Shock absorbing insoles reduce peak plantar pressures both at rear foot and at fore foot. Moreover insoles increase foot contact area during running and walking allowing a better foot balance and stability; these insoles also permit a decrease of overloads during the entire gait cycle. The use of shock absorbing insoles is therefore a correct strategy in order to reduce overuse foot and lower limb diseases in Italian army soldiers.

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