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Comparison of febrile responses, thermoregulation and skin morphology in the local Kolbroek, Windsnyer and exotic Large White breeds of pigs in South Africa

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ABSTRACT

Smallholder agriculture may be particularly vulnerable to the increased temperatures, reduced water availability and increased risk of disease anticipated under future climate change scenarios. Pigs may be particularly sensitive to the increased heat stress as they do not sweat. Local pigs are said to be better adapted than the exotic breeds and therefore may be better able to withstand some of the negative impacts of climate change however, there is not much scientific support for that claim. I therefore compared the febrile and thermoregulatory responses and skin characteristics of local (Kolbroek, Windsnyer) and exotic (Large White) pigs.

Pigs were implanted with intra-abdominal tags for measuring core body temperature and activity. Terminally, skin samples were collected from the interscapular, lateral thoraco-abdominal and ventral abdominal regions. Six week old boars of the (Kolbroek (5.4 ± 1.4 kg; n = 8), Windsnyer (8.1 ± 1.6 kg; n = 8) and Large White (6.0 ± 1.5 kg; n = 8) were used to determine the febrile responses and sickness behaviours. The pigs were injected intravenously with polyinosinic acid: polycytidylic acid (poly I:C) (0.5 mg/kg); lipopolysaccharide (LPS) (2 µg/kg) and *Staphylococcus aureus* (*S. aureus*) (1.7 x 1010 cell walls/kg) or saline (control). The exotic Large White pigs had a significantly greater ($F_{2,20}$ = 13.70; P = 0.0003) Thermal Response Index (TRI) after receiving poly I:C but a lower ($F_{2,21}$ = 6.22; P = 0.009) TRI in response to LPS than the local pigs. All pigs displayed anorexia and lethargy in response to poly I:C, but only the Large White and Windsnyer displayed anorexia and lethargy to LPS. Febrile temperature responses were similar between the breeds of pigs after injecting *S. aureu*s. The Large White and Kolbroek were more sensitive to *S. aureus* and had severe clinical signs when compared to the Windsnyer pigs. Following LPS and *S. aureus* administration, the Large White and Kolbroek pigs showed no body mass reduction 22 h after pyrogen administration unlike the Windsnyer which lost body mass. There were slight differences in febrile responses between the breeds; however the Large White pigs had more severe clinical signs than the local breeds of pigs after injection of the bacterial mimetics.

Four month old boars of Kolbroek (n=6; 40 ± 1.3 kg); Windsnyer (n=7; 46 ± 7.7 kg) and Large White (n=7; 60 ± 1.3 kg) pigs (Sus scrofa domesticus) were used to

determine thermoregulatory responses. The pigs were exposed to 5°C (92% RH), thermoneutral (20°C) with 40% RH, 30°C with drinking water with 40% RH, 30°C with high relative humidity (60%) and 30°C with 48 h water deprivation except for the cold and thermoneutral treatments where pigs were kept for 48 h. The pigs showed remarkably similar patterns in core body temperature under all the treatments. At 5°C, local pigs employed primitive behaviours to maintain core body temperature while the exotic pigs increased activity. At 30°C compared to TNZ all pigs reduced physical activity, however, the Large White and Kolbroek had higher change in respiratory rates ($F_{4,68} = 14.96$; $P < 0.0001$) than the Windsnyer which maintained constant respiratory rates when compared to TNZ. On exposure to 30°C with 48 h water deprivation, the local breeds conserved their plasma volume unlike the Large White. The lower respiratory rates in the Windsnyer pigs may reflect their being less dependent on panting than the other breeds. Their skin histology provides support for that hypothesis as they had large ($F_{2,13} = 52.48$; $P < 0.0001$) and more superficial ($F_{2,13} = 125.60$; $P < 0.0001$) sweat glands, thin total skin layer, thinner hypodermis than the Large White pigs and Kolbroek pigs. The skin of the Windsnyer also had more melanin visible than the Kolbroek whilst the Large White had none.

Although the differences between the breeds were subtle, the Windsnyer pigs had some physiological, behavioural and morphological traits that might make them more adaptable to the changing environmental conditions than the Kolbroek and Large White pigs.