

Introduction while pork is the most widely eaten meat in the world, pig production is continually threatened by changing climate conditions resulting in poor reproductive performance, particularly in the tropics. The boar's inefficient capacity to sweat; non-pendulous scrotum and high susceptibility of boar sperm to temperature shock makes this species particularly vulnerable to the effects of heat stress. While DNA-damaged sperm may fertilize normally, key genes involved in early embryo development may be severely affected inducing early embryo loss as shown in the mice. Our study demonstrates that tropical summer significantly increases DNA damage in populations of sperm within the ejaculate without necessarily affecting sperm motility. Moreover, supplementing boars with antioxidants during summer could potentially reduce the negative impact of heat stress on sperm DNA integrity.

Materials and Methods Five mature Large White boars were housed individually in open gable pens at JCU in the dry tropics of Townsville, Queensland, Australia. Semen was collected by the gloved-hand technique using a dummy sow during spring (Oct 2014), summer (Feb 2015) & early winter (end May 2015) and diluted 1:3 in BTS media. Boar feed was supplemented with 100g/boar/day custom-made antioxidant formulation during summer (Jan - Apr 2016) and semen was collected after 42 & 84 days treatment. Sperm concentration was determined by haemocytometer and motility of 20×10^6 sperm/ml at 38°C was analyzed using CASA (Hamilton Thorne). Sperm DNA damage in 20,000 Percoll-purified sperm per boar per treatment was evaluated using TUNEL (Roche) & flow cytometry (Dako Cytomation; Fig. 1).

Results Sperm motility was similar in summer to winter & spring ($P > 0.05$) but total motility was lower in spring than winter ($P \leq 0.05$). Antioxidant supplementation for 42 & 84 days during summer did not affect motility of spermatozoa ($P > 0.05$). Sperm DNA damage was more than 16-fold higher in summer than winter & nearly 9-fold higher than spring ($P \leq 0.05$; Fig. 2). Antioxidant supplementation during summer reduced sperm DNA damage after 42 & 84 days antioxidant treatment ($P \leq 0.05$; Fig. 3).

Conclusions and discussion Sperm DNA integrity is compromised in boars during summer, suggesting boar factors may contribute to embryo loss in sows. Moreover, such damage appears undetectable using traditional measures of sperm motility. Antioxidant therapy during summer appears to significantly alleviate heat stress-induced DNA damage in boar sperm, which may provide one solution to the problem of summer infertility in the pig.