Mini Review
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Embryonic mortality due to maladaptation to high ambient temperatures

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Mini review

Adaptation to high ambient temperatures is a key issue in reproductive performance. In the northern part of Colombia ("Sinu Valley"), an important meat type cattle industry is located. There, the ambient temperature ranges along the whole year is 20 to 32 Celsius degrees and relative humidity between 72 to 81% (http://bart.ideam.gov.co/cliciu/monter/temperatura.htm). These conditions can be deleterious for reproductive efficiency in non-adapted bovines. The Creole genotype known as "Romosinuano", which has been settled in the Sinu valley for more than 500 years, shows a minor rate of embryonic mortality as compared to data obtained from non-adapted animals.[1] The Romosinuano showed higher conception rate than Zebu, Zebu x Holstein and Zebu x Simmental cattle.[2]

Another Creole genotype known as "Sanmartinero" (*Bos taurus*), showed a better adaptation to high environmental conditions than a *Bosindicus* genotype.[3] "Sanmartinero" cattle are settled in the eastern planes of Colombia.[4] Reported a greater *in vitro* tolerance to heat in 8 days-old embryos when subjected at 41°C in Romosinuano and Brahman than Angus and Holstein ones. Resistance to 41°C exposure goes up when the zygote passes on to more advanced stages of development.[5] It was argued that resistance is enhanced with hypoxia, which could imply participation of reactive oxygen molecules or hypoxia induced compounds.[6]

Cows exposed to 32°C during 72 hours immediately after artificial insemination had 0% fertility in comparison to cows subjected to temperatures ranging from 7 to 21 °C, which showed 48% fertility.[7] Embryos from Brahman cows were more heat resistant than those from Holstein or Angus ones There was a 72% IFNT reduction of secretion with the consequent deleterious effect on corpus luteum support, certain prostaglandins secretion and embryo viability.[8]

In cattle, the level of adaptation to heat varies according to the genotype and the time of residence in a particular habitat. The association between high readings of relative humidity and high ambient temperatures (temperature: humidity index) originates stress in susceptibility individuals and it induces embryonic decay in cows.[9] Heat stress diminishes oxygen consumption and energy resources, and affects mitotic rate in morula stage embryos.[10] Maladaptation to high ambient temperatures should be taken into account in processes of adapting productively efficient bovine genotypes to geographical zones where genetic constitution is a key point.

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Conflict of interest

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References

1. Hammond AC. Heat Tolerance in Two Tropically Adapted *Bostaurus* Breeds, Senepol and Romosinuano, Compared with Brahman, Angus, and Hereford Cattle in Florida. *J Anim Sci*. 1996;74(2):295–303.
2. Grajales HA. *Comportamientoreproductivo de gruposracialesbovinos en el trópicocálido–húmedocolombiano: pubertad, cicloestral, preñez-temprana, posparto, niveles de hormonasesteroides y surelación con la eficienciareproductiva*. Colombia: Tesis de Doctorado; 2001.
3. Góngora A. *Relación entre factoresmedioambientales y aspectosreproductivos en novillas Brahman y Sanmartineras del trópicocolombiano*. Colombia: Tesis doctoral; 2001.
4. Rivera RM. Actions of Thermal Stress in two–Cell Bovine Embryos: Oxygen Metabolism, Glutathione and ATP Content, and the time–Course of Development. *Reproduction*. 2004;128(1):33–42.
5. Edwards JL, Hansen PJ. Differential responses of bovine oocytes and preimplantation embryos to heat shock. *Mol Reprod Dev*. 1997;46(2):138–145.
6. Hansen PJ. To be or not to be–determinants of embryonic survival following heat shock. *Theriogenology*. 2007;68 (Suppl1):40–48.
7. Diskin MG, Sreenan JM. Fertilization and Embryonic Mortality Roles in Beef Cattle after Artificial Insemination. *J Reprod Fert*. 1980;59(2):463–468.
8. Putney DJ. Heat Stress–Induced Alterations in the Synthesis and Secretion of Proteins and Prostaglandins by Cultured Bovine Conceptus and Uterine Endometrium. *Biol Reprod*. 1988;39(3):717–728.
9. Santolaria P. Effects of cumulativestressful and acutevariationepisodes of farmclimate conditionson late embryo/early fetal loss in highproducingdairycows. *Int J Biometeorol*. 2010;54(1):93–98.
10. Hernández cerónn J. Differences in Heat Tolerance between Preimplantation Embryos from Brahman, Romosinuano and Angus Breeds. *J Dairy Sci*. 2004;87(1):53–58.

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