

Quality of Post-Thawed Spermatozoa and its Overall Antioxidant Capacity in Achai Cattle

Zara Natalia*

Department of Medicine and Health Science, University of Gondar, Gondar, Ethiopia

DESCRIPTION

Achai is a tiny cow breed that is resistant to tough and cold environments. Cryopreservation of Achai bull sperm may aid in genetic improvement and germplasm preservation. The structural and functional integrity of spermatozoa is compromised by Reactive Oxygen Species (ROS). During the freezing and thawing processes, ROS alter spermatozoa quality characteristics and lower Total Antioxidant Capacity (T-AOC) of sperm, which is a sign of oxidative stress. The purpose of this study was to see how glycine and vitamin E affected the quality of post-thawed spermatozoa and overall antioxidant capacity in Achai cattle. Semen was collected twice a week from four mature fertile Achai cattle bulls. Glycine was used at concentrations of 0 mM, 5 mM, 10 mM, 15 mM, and 20 mM, with vitamin E at 2.3 mM given continuously in each concentration. Except for glycine, all extenders were present in the control group. The results showed that post-thawed spermatozoa motility was considerably greater at 10 mM than at 5 mM, 15 mM, or 20 mM. Glycine concentrations of 10 mM and above enhanced progressive and rapid motility (%), curvilinear, straight line, and average route velocity (m/s) when compared to the control group. Furthermore, at 10 mM glycine concentration, beat cross frequency was greater, and post-thaw viability (%), plasma membrane integrity, and mitochondrial membrane potential were considerably higher compared to control and other glycine doses. Furthermore, acrosome integrity (%), DNA integrity (%), and post-thawed T-AOC were considerably greater at 10 mM glycine concentration when compared to other glycine concentrations and the control group. It was determined that glycine at 10 mM and vitamin E at 2.3 mM increased the cryopreserved semen quality of Achai bulls.

Livestock is the most important agricultural subsector, accounting for 58.92% of agriculture and 11.11% of total GDP. The demands for a sustainable livelihood include milk, meat, and skins. Pakistan has the best buffalo and cow breeds, and these animals generate nearly 96% of the milk in the world. Achai cattle are a well-known breed found in the northern parts of the Hindu Kush Mountains. It is raised as part of a subsistence production system in mountainous places where feed is scarce.

This breed has disease resistance and a dairy and mild draught attribute. It has superior raising qualities compared to other cattle breeds and a low ration demand. This breed demands more attention from local authorities because of the traits listed above. More study on Achai cattle is desperately needed to improve their health and reproductive performance.

Frozen sperm aids in genetic research, the preservation of endangered species, and the conveyance of genetic material. Cryopreservation during sperm preservation causes acrosomal destruction and other spermatozoa abnormalities, which is related with worse post-thawed spermatozoa quality metrics. It is believed that 50% of spermatozoa viability is lost during cryopreservation because to several stresses such as osmotic stress, oxidative damage, and cold shock. Semen extenders have long been used to reduce the negative effects on spermatozoa.

Oxidant level is another factor that can affect semen quality. A limited concentration of oxidants is advantageous for spermatozoa's physiological functions. The production of free radicals is associated with the physiology of spermatozoa hyperactivation, capacitation, acrosomal reaction, and fertilization. Similarly, the production of Reactive Nitrogen Species (RNS) is also formed resulting in increased level of these ROS and RNS that damage the spermatozoa due to oxidative stress. A 20% lowered fertilization rate has been reported in AI as compared to fresh semen owing to high level of ROS and RNS. Spermatozoa damage leads to higher rate of fertilization failure, abortion, and decreased fertility in males.

The addition of antioxidants improves post-thawed total motility of spermatozoa and prevents damage when employing a sufficient dose of semen extender for cattle. Through co-enzymes and vitamins, antioxidants such as carotenoids and flavonoids protect spermatozoa against the detrimental effects of cryopreservation and oxidation. Furthermore, antioxidants are said to scavenge free radicals and counteract ROS formation. It was discovered that the addition of glycine at a low dosage of 10 mM coupled with vitamin E increased the post-thaw total motility of Achai bull sperm. The addition of glycine paired with vitamin E increased the total antioxidant capacity of cryopreserved semen, resulting in a higher conception rate.

Correspondence to: Zara Natalia, Department of Medicine and Health Science, University of Gondar, Gondar, Ethiopia, E-mail: zaranatalia@gmail.com

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