

# Effects of Vitrification on Cumulus Expansion and Nuclear Maturation of Abattoir Derived Cattle Oocytes

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## INTRODUCTION

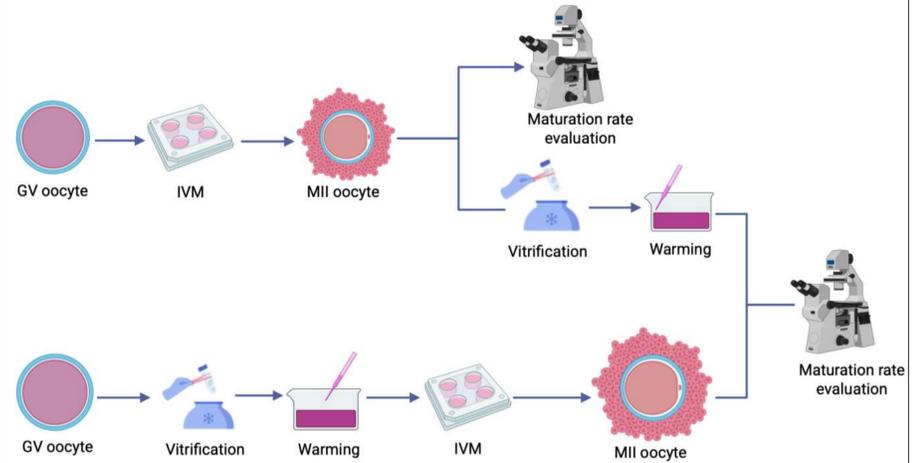
- Oocyte vitrification is an essential technology that facilitates fertility preservation, integration with other assisted reproductive techniques, and the global transfer of genetic material (García-Martínez et al. 2022).
- The cryopreservation of female gamete facilitates the preservation and transport of superior genetics; however, cryoinjury and cryoprotectant (CPA) toxicity frequently compromise the oocyte viability that endure the procedure, owing to the employment of suboptimal protocols intended for embryo cryopreservation (Brewer et al., 2025).
- Nonetheless, there are constraints regarding the recovery and eventual viability of oocytes subjected to this treatment.
- Morphological and nuclear assessments are crucial for evaluating vitrification-induced changes in oocyte quality.

## AIM

- The present study aimed to assess the impact of vitrification on cumulus cell growth and nuclear maturation in cattle oocytes at different meiotic stages.

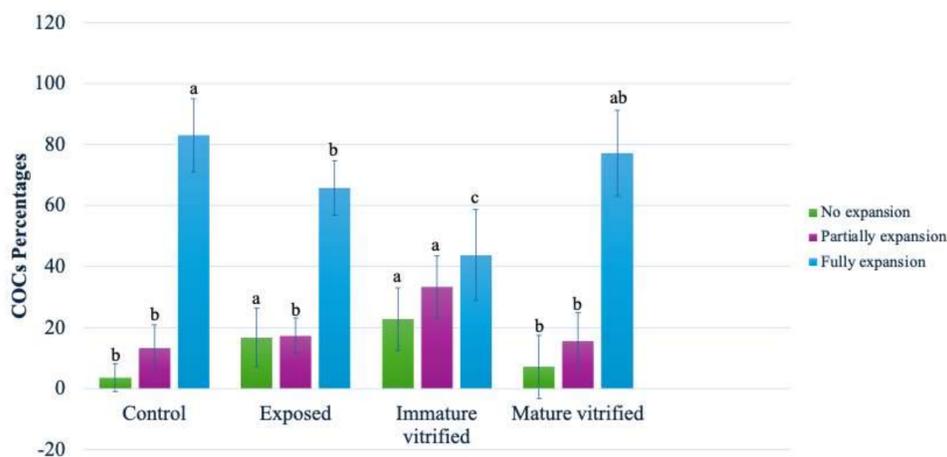
## METHODOLOGY

- The study was carried out under the guidelines of the Agricultural Research Council, Animal Production Animal Ethics Committee (APIEC 23/03) and under Section 20 of the Animal Diseases Act, 1984 (Act No 35 of 1984): with reference 12/11/1/15 (5017NT).



**Figure 1:** Schematic illustration of vitrification of immature cattle oocytes. Created with <https://BioRender.com>

## RESULTS AND DISCUSSION



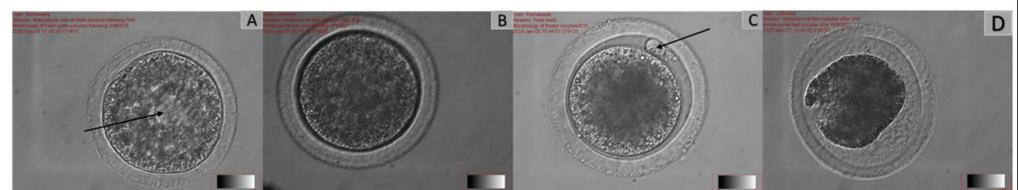
**Figure 2:** Distribution of vitrified and non-vitrified cattle oocytes according to cumulus cell expansion. Data are presented as percentages. Different lowercase letters (a-b) indicate significant differences between the groups ( $P < 0.05$ ).

- A high percentage of oocytes with fully expanded cumulus cells was recorded on control ( $83.1 \pm 12.0$ ) and mature vitrified ( $77.2 \pm 14.0$ ) groups as compared to the immature vitrified ( $43.8 \pm 15.0$ ;  $P < 0.05$ ) group.
- Immature oocytes exposed to CPA ( $16.7 \pm 9.6$ ) and immature vitrified group ( $22.8 \pm 10.3$ ) recorded high percentage of oocytes with no cumulus cells expansion following maturation ( $P < 0.05$ ).

**Table 1:** Distribution of vitrified and non-vitrified cattle oocytes according to nuclear maturation stages (Mean  $\pm$  SD).

Treatment group	No. oocytes (n)	Nuclear maturation stages (%)			
		GV	MI	MIII	Degenerated
Control	148	7.5 $\pm$ 6.4 <sup>b</sup>	37.3 $\pm$ 9.5 <sup>b</sup>	48.5 $\pm$ 6.0 <sup>a</sup>	6.6 $\pm$ 4.3 <sup>b</sup>
Exposed	138	5.7 $\pm$ 4.5 <sup>b</sup>	54.2 $\pm$ 19.3 <sup>a</sup>	37.2 $\pm$ 17.7 <sup>ab</sup>	2.7 $\pm$ 4.1 <sup>b</sup>
Immature vitrified	150	14.2 $\pm$ 4.8 <sup>a</sup>	28.1 $\pm$ 9.7 <sup>b</sup>	42.3 $\pm$ 7.8 <sup>a</sup>	15.2 $\pm$ 10.8 <sup>a</sup>
Mature vitrified	123	6.7 $\pm$ 4.9 <sup>b</sup>	60.3 $\pm$ 12.4 <sup>a</sup>	29.2 $\pm$ 13.2 <sup>b</sup>	3.6 $\pm$ 3.0 <sup>b</sup>
<b>Total</b>	<b>559</b>	<b>8.5 <math>\pm</math> 5.1</b>	<b>44.9 <math>\pm</math> 12.7</b>	<b>39.3 <math>\pm</math> 11.1</b>	<b>7.0 <math>\pm</math> 5.5</b>

<sup>a-b</sup> Values with different superscripts in a column differ significantly ( $P < 0.05$ ). GV= germinal vesicle; MI= metaphase I; MIII= metaphase II; n= number of oocytes examined.



**Figure 3:** Nuclear maturation stage (with arrows) of cattle oocytes observed by inverted microscope (40x magnification). (a) Oocyte at GV stage, (b) oocyte at MI stage, (c) oocyte at MIII stage and (d) degenerated oocyte.

## CONCLUSION

- The results demonstrate that vitrifying oocytes during the immature stage results in a better maturation rate post-warming, indicating that the immature stage is more suitable to effective oocyte cryopreservation in cattle.

## RECOMMENDATIONS

- It is recommended that cattle oocyte cryopreservation be performed at the immature (germinal vesicle) stage, as they exhibit superior post-warming maturation competence.
- These initiatives will enhance oocyte banking methodologies and assisted reproductive success in cattle.

## ACKNOWLEDGEMENTS



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