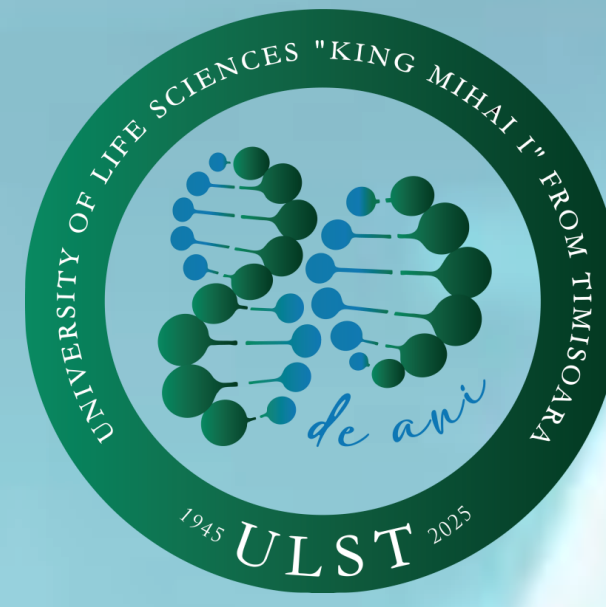




UNIVERSITY OF LIFE SCIENCES "KING MIHAI I" FROM
TIMISOARA
"YOUNG PEOPLE AND MULTIDISCIPLINARY RESEARCH
IN APPLIED LIFE SCIENCES"



"Young people and multidisciplinary
research in applied life sciences"

13-14 November, 2025

STRATEGIES TO ENHANCE IN VITRO FERTILIZATION EFFICIENCY IN BOVINE: A REVIEW

Ingrid Maria PLOPEANU¹, Mariam KADAM¹, Taras PRODANIUC¹, Beatrice Ana-Maria
SÎRBU^{1*}, Cătălin Bogdan SÎRBU¹

¹University of Life Sciences "King Mihai I" from Timisoara, Faculty of Bioengineering of Animal Resources, Department of Biotechnology

Abstract: Along the years, the In Vitro Fertilization (IVF) in bovine has faced several challenges and developments and science is actively trying to find new ways to improve this process. Problems based on intrinsic and extrinsic factors that affect the oocyte competence and embryo quality are now more easily manageable with the help of supplements, more specifically antioxidants (such as α -tocopherol ((Vitamin E)) and Vitamin C). Administering those antioxidants will help improve maturation, cleavage and blastocyst development, especially under heat stress. In addition, the donor physiology (age, nutrition, body condition, health status) also plays a key part in the ruminants reproduction because it directly affects the oocyte quality and the In Vitro Embryo production. The embryo production can be significantly enriched if we mitigate oxidative stress, mimic in vivo conditions and carefully select the donors because the way in which the donors are raised and prepared before collecting the oocytes will directly affect the quality of the oocytes and the number of embryos that will be obtained. Furthermore, using AI and machine learning models to assess sperm and the quality of the embryos we can analyze the competence and anticipate the quality and integrity of the oocyte.

• Introduction

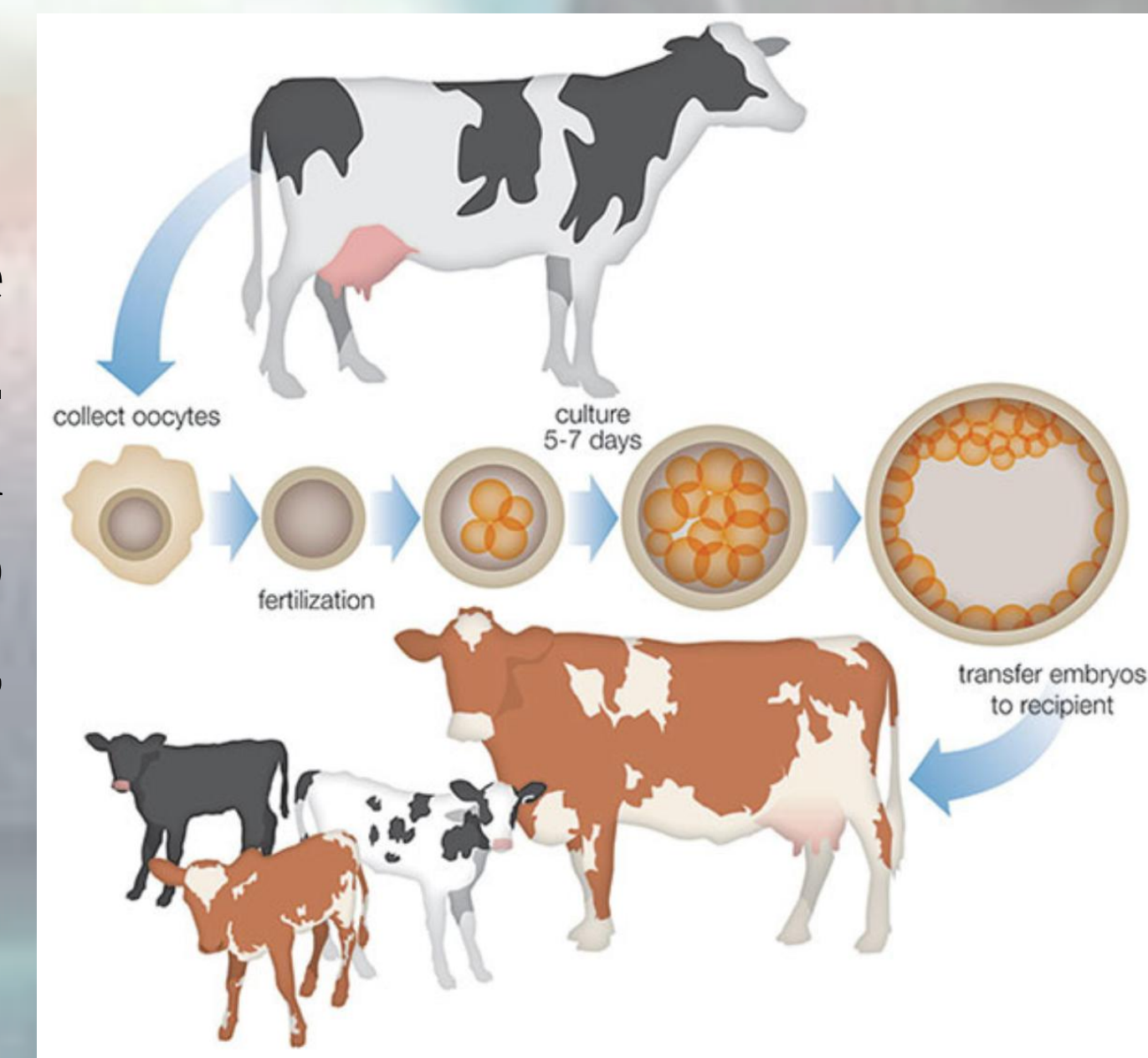
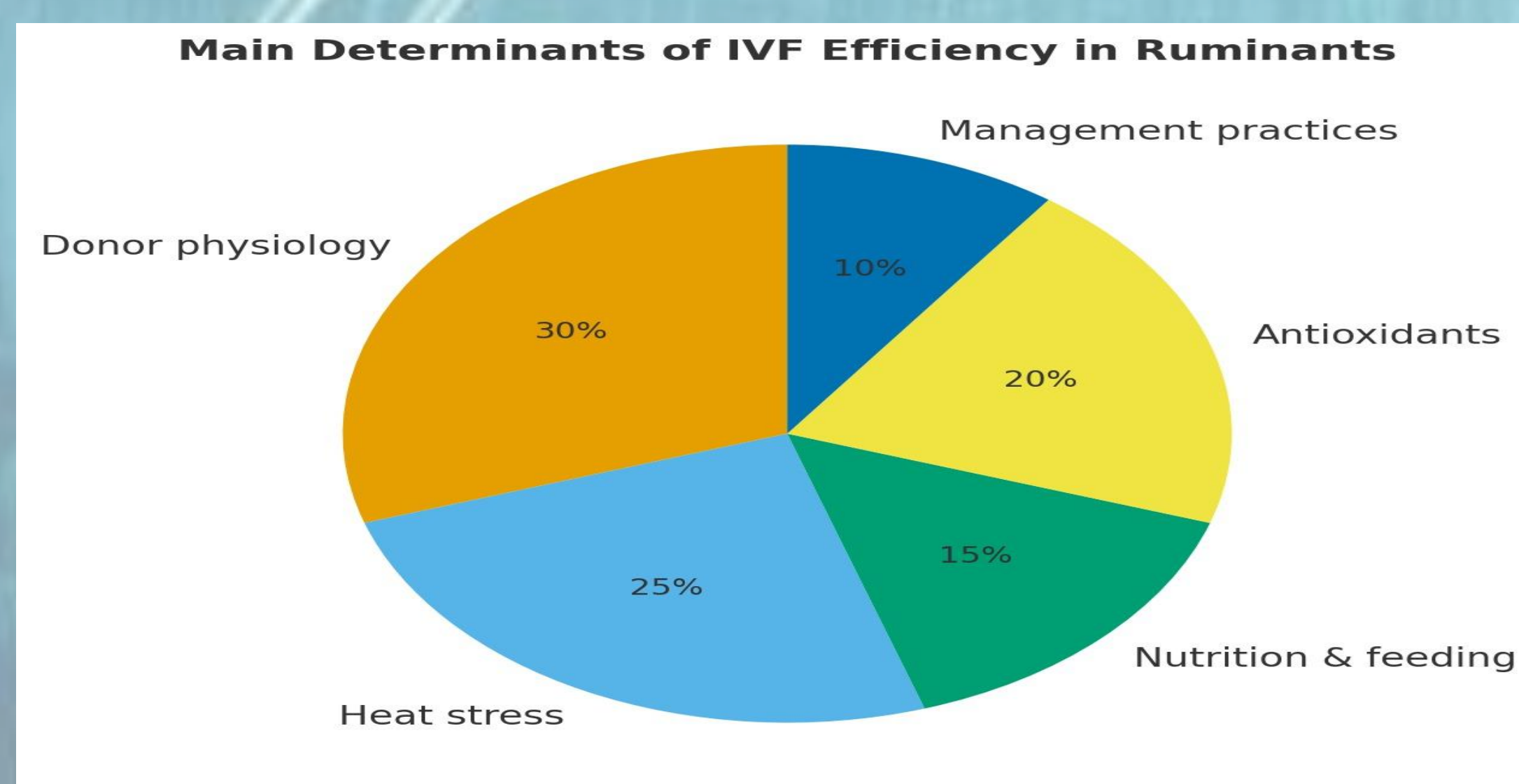
During the past 50 years technological advances in the field of bovine reproduction have led to some dramatic changes in the way cattle look, reproduce, perform, and even taste. Artificial Insemination (AI) and In Vitro Fertilization (IVF) are two of the main tools used by progressive producers to accelerate genetic improvement within their herds. In-vitro fertilization (IVF) has emerged as a transformative technology in animal breeding, particularly in the livestock industry.

• Heat stress. What do we do about it?

The rising temperatures resulting from global warming will only make it difficult for breeders to have successful and healthy embryos. Animals can experience hormonal imbalance, the quality of oocytes and embryos will be reduced, the conception rate will suffer and the process of spermatogenesis will be affected because the sperm will have a low motility rate, as well as the number of viable sperm will be reduced. What we should do is focus on selecting more heat resistant species for breeding programs, collect the oocytes when temperatures are lower, provide shade, cooling (such as sprinklers or fans) for animals and even modify the feeding schedule for when it's cooler in order to reduce heat production from digestion.

We have to carefully monitor hormonal/metabolite levels, body temperature, food intake, and look into behavioural and biochemical markers.

In addition, the first 7 days of the embryonic period are critical and highly influenced by the temperature. Afterwards, embryos tend to become more resistant, meaning we can avoid unsuccessful embryo transfers.



• Donor physiology. Does it matter?

Researching donor physiology we came to the following conclusions: donors which are not in good shape, age, and are not fed with quality food will result in having poor oocytes. The hormonal balance is extremely important in how the oocyte will develop. If the LH/FSH hormones are in the right parameters they will raise the quantity of the follicles and they will be in good shape and prepared for harvest. If the ovulatory cycle is not regulated and within normal parameters, the fertilization process as well as the oocyte will present developing risks.

• Antioxidants and how do we use them?

We can reduce ROS damage by supplementing the blastocysts with Vitamin E & Vitamin C. Vitamin E helps stabilize the cellular membrane (it traps free radicals before they can affect the membrane lipids) while vitamin C regenerates oxidized Vitamin E and enhances the redox balance during IVM and embryo development.

It's very important to administer the right dosages of the antioxidants in order to prevent opposite reactions or secondary effects.