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REPRODUCTIVE BIOTECHNOLOGIES IN SHEEP AND GOATS - FROM ARTIFICIAL INSEMINATION TO NANOBIOTECHNOLOGY

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ABSTRACT

Reproductive biotechnologies are playing an increasing important role in the production and management of farm animals, particularly sheep and goats. In general, these technologies include three main generations: 1) artificial insemination and gamete and embryo cryopreservation, 2) multiple ovulation and embryo transfer (MOET) and 3) *in vitro* fertilization procedures. Of these, artificial insemination has been the most successful and efficient reproductive technology that proved much valuable in reducing venereal diseases, increasing genetic merits of animals through selective breeding and eliminating lethal alleles. In conjunction with technologies of the first and second generations, sperm sexing in sheep has developed during the last two decades with a sorting success greater than 90%. Nevertheless, because of the relatively high cost and limited efficiencies, the potential benefits of utilizing sex-selecting techniques would most likely be realized in programs where the procedural cost would not outweigh the ability to disseminate the elite genetic potential. However, this technology has added a new dimension to livestock production. Implementing an embryo transfer program along with artificial insemination appeared to yield a substantial improvement. Furthermore, methods have been developed to circumvent the problematic anatomy of the ovine and caprine cervix, which prevents the widespread application of transcervical AI and ET in these species. As in other domestic animals, diagnostic procedures as ultrasonography and laparoscopy have been used as additional tools for monitoring the ovarian response to superovulatory treatment in sheep and goats as well as for laparoscopic ovum pick-up (LPOU), collection and transfer of embryos as well as intrauterine insemination.

Novel fourth generation-biotechnologies that aimed at accelerating progress by allowing animals of high genetic merits to produce more offspring than would be possible by natural breeding have lately emerged. These included cloning by nuclear transfer of embryonic or adult somatic cells, gene transfer, genomic selection and use of embryonic stem or germ cells. Cloning, in particular, has instigated great interest because the promise it holds of bypassing conventional breeding procedures to allow creation of precise duplicates of genetically engineered animals. In addition, studies have, recently, been initiated to investigate the effect of this biotechnology on sex ratio of the young born and the safety of products from cloned animals for human consumption. Risk Assessment studies by the FDA's Center for Veterinary Medicine concluded that edible products derived from either juvenile or adult clones pose no additional risk(s) relative to corresponding products from contemporary conventional comparators.

Nanotechnology, that allows researchers to handle biological materials in minute quantities, is a recent advancement in cellular and molecular biotechnology which bears enormous potential to revolutionize agriculture and livestock sector. In this context, microfluidics and nanofluidics are being researched as tools for simplifying traditional procedures of *in vitro* fertilization and *in vitro* embryo production.