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MODERN REPRODUCTIVE METHODS FOR GOAT PRODUCTION (Experiences in Pakistan)

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Introduction: In the year 1996 the total goat population in Pakistan was estimated to be 41,166,000 heads, of which 9,734,000 heads were in Sindh. Between 1999 and 2000 the total goat population in the country increased to 47,426,000 heads. Of these, the proportion of the male population aged one year and above was 6,010,000 heads, while females aged one year and above were 25,755,000 heads. Young stock less than one year was 15,661,000 heads. In the same year (1999-2000), the gross goat milk production in Pakistan was 31,804,000 tonnes, while consumption was 25,566,000 tonnes. Goat meat production in the same period was 218,000 tonnes, goat skin production was 23.3 million and goat hair production was 18,000 tonnes. Total fodder production area in the whole country was 2,64,900 hectares out of which 365,700 hectares was in Sindh. The average national yield was 22.7 tonnes/ha of fodder, with Sindh having an average of 25 ton/ha

The goat is a source of meat, milk, skin and fibre. Cross breeding among Angora for Mohair production, Saanen, Alpine, Logenberg, Boee, Anglonubium, for milk and meat, are common practice. With improved management, nutrition, selection during breeding and disease control, goat farming can be highly profitable. Reproductive efficiency, which strongly determines the economic viability of a goat enterprise, depends on the gestation period, litter size, embryo/foetal development, survival and growth of new born, suckling period, puberty age and duration of reproductive life. These factors can be improved by the use of modern reproductive tools which results into more kids from each of the genetically superior bucks and does. Some of these modern discussed below.

Synchronisation of oestrus/ovulation cycle in cyclic (oestrus) goats.

Synchronisation of the oestrus cycle is a technique which is used to bring large number of animals in a flock into overt heat at a predetermined time. The technique offers an opportunity to increase the efficiency of animal production in different ways, including:

(a) It reduces the time needed for detection of oestrus.

- (b) It enables planning and timing of insemination including use of embryo transfer technique.
- (c) It enables the feeding of goats into uniform groups.
- (d) It helps in synchronising breeds to shorten the duration of kidding in a flock.
- (e) It reduces mortality at the time of parturition by avoiding breeding during extreme seasons.

- (f) After successful breeding, the flock can be weaned, fattened and marketed together.

Progestogens alone and progestogen/gonadotropin combination have been used for a long time but recently prostaglandin and its analogues have been found to be very effective for synchronising oestrus. Keeping males with the females to induce synchronised oestrus and ovulation has also been used. Oral, subcutaneous, intra-muscular or intra-vaginal routes can be used to administer these hormones.

Attempts have also been made to synchronise oestrus in Barbari, Black Bengal and Jamunapari does by administering progesterone, progesterone/gonadotropin combination, and prostaglandin by using different routes (oral, subcutaneous, intramuscular or intra-vaginal pessaries). When Melengestrol acetate (mGA) was used at 0.15 mg/animal for 16 days in Barbari and Black Bengal goats, 80 - 95% of the synchronised animals showed oestrus signs within 4 days and the fertility of the goats was not affected. Research is needed to find cheap, simple and effective heat synchronising techniques.

Induction of oestrus/ovulation in acyclic (anoestrus) goats: Delayed puberty, prolonged lactation and seasonal anoestruses in goats ultimately increases the age at first kidding and the inter-kidding period, resulting into low life time production. Productivity in goats can be increased if the age at puberty and seasonal/lactation anoestrous period can be reduced. Inducing oestrus in anoestrous females increases the overall production efficiency, and it can be accomplished using gonadotropins and steroid hormones. Progesterone alone and/or in combination with Follicle Stimulating Hormone and oestradiol for induction of oestrus in anoestrous Barbari, Black Bengal and Jamunapari goats has been tried. An oestrous induction rate of 80-90% and a conception rate of 90% was achieved after use of mGA at 0.15 mg/animal for 16 days.

Superovulation: The objective of superovulation is to increase the yield of viable ova so as to get the

maximum number of kids. Several methods that are used for inducing superovulation are:

- (a) Flushing for some weeks before mating.
- (b) Selection based on litter size.
- (c) Use of hormones.

Hormones, e.g. gonadotropins of pituitary origin (FSH and LH) or from the serum of pregnant mares (PMSG) are used to induce superovulation. Gonadotropins in combination with progesterone or prostaglandins can also be used to induce superovulation.

Artificial insemination (AI): AI has been used successfully in goat production, but the technique requires an understanding of applied reproductive physiology, e.g. selection of breeding goats, semen collection methods and frequency, semen evaluation, diluents and dilution rates, optimum number of live and normal spermatozoa, oestrous behaviour, stage of heat and insemination technique.

- *Sexual maturity in males:* Sexual activity in males is determined by placing them in the same pen with oestrous females daily during morning and evening hours from the age of 6 months and onwards. Males showing active courtship tendency, e.g. sexual mount or natural service are separated from the rest of flock. The remaining males are given more time to express sexual desire, until the majority have shown complete sexual mounting.
- *Training of goats:* Sexually active goats should be trained for semen ejaculation in artificial vagina, daily, during morning hours by exposing them to an oestrous female fixed in a service crate.
- *Methods of semen collection:* Artificial Vagina (A.V) and electro-ejaculation are the most common accepted methods for collecting semen from goats. Artificial Vagina is a universal method for routine semen collection, whereas electro-ejaculation is generally used for collecting semen from untrained but valuable sires that are incapable of service. Good quality semen samples from breeding goats should be made by

collecting semen once daily from native and half breeds and once or twice is quick succession (3 - 5 minutes) after every alternate day from exotic and higher cross-bred goats.

- *Semen evaluation:* Irrespective of the semen collection procedure and frequency of collection, each ejaculate is examined for its quantity and quality in terms of volume, colour, consistency, motility, sperm density, total sperm number per ejaculate, per cent live/dead and normal/abnormal spermatozoa. These parameters are positively correlated with fertility. A good quality semen is cream coloured with thick consistency containing excellent wave motion. Sample containing less than +4 motility, 3000 million sperm density and 80 per cent live spermatozoa should not be used for breeding purposes.
- *Dilutors and dilutions rate for semen:* Immediately after collection and physical evaluation, semen samples are diluted with suitable diluents, e.g. processed cow milk, egg yolk citrate glucose. The dilution rate is adjusted in such a way that a minimum of 60 - 80 million live and normal spermatozoa are available per inseminating dose (0.1 ml). This is easily met with a dilution rate between 1:1 - 1:5, depending upon the sperm density per sample.
- *Preservation of semen:* Goat semen can be stored successfully for upto 48 hours at 4 -7°C with satisfactory sperm motility and fertility. Semen preservation by this procedure is done carefully until the entire cooling process is completed within 1.5 to 2 hours.
- *Frozen semen:* Long term storage of goats' semen is possible through deep freezing technique. Milk tris and egg yolk citrate glucose diluents containing glycerol as a cryoprotective agent are suitably used to extend freezing of semen either by straw or pollet method. Straw method is more common. Straws

filled with diluted semen and frozen over liquid nitrogen vapour can be stored for years in liquid nitrogen (-196°C). However, post-thawing motility and fertility of frozen goats' semen is relatively lower than the freshly diluted semen.

- *Detection of heat:* Oestrous goats in a breeding flock are detected by parading an active teaser/approned goat for about half to one hour daily, during morning and evening hours. Females allowing males to mount quietly should be separated from the flock. Oestrous goats detected during evening and morning hours should be inseminated twice in same oestrous period.
- *Insemination technique:* Insemination is done by lifting the hind legs of females at an angle of 60° from the ground. Locate the split like opening of the cervix with the help of sterilised glass speculum lubricated with liquid paraffin and deposit the semen over opening of the cervix with the help of inseminating pipes fitted with rubber bulb at the top. The speculum and pipette should be removed together.
- *Fertility:* With freshly diluted semen the overall conception rate varies from 60 - 85% in 2 - 3 oestrus cycles. Deep cervical and intra-uterine insemination has given about 15-20 % higher conception rate. Relatively lower conception rates are reported with chilled and frozen goats' semen. It should be noted that goat semen is highly susceptible to cold shock.

Embryo transplantation: Embryo transfer refers to a technique by which embryos are collected from a female called the donor and then transferred, for development, to another female known as the recipient. This technique permits exploitation of superior female genotypes, giving more off-springs from the same genetic donor than would arise under

normal breeding conditions. This technology can be economically viable as it enables:

- (a) Development of a simple non-surgical embryo collection and transplantation technique.
- (b) Oocyte and embryo culture.
- (c) In-vitro fertilisation.
- (d) Long-term preservation of embryos under liquid nitrogen.
- (e) Import of exotic germ plasma in the form of embryo.
- (f) Production of kids of desired sex.

- (g) Production of identical kids.
- (h) Production of chimera.
- (i) Production of hybrids.
- (j) Production of clones of genetically superior animals.

A number of tests are used for detecting pregnancy at an early age. The choice of the technique depends on the species, stage of gestation, cost, accuracy and speed of diagnosis. More details are summarised in table 1.

Table 1: Pregnancy detection techniques

No.	Technique	Description
a)	Non-return to oestrus.	Post breeding/insemination non-return to oestrus gives an idea of pregnancy setting. During the breeding season, most of the animals return to oestrus within 17-23 days after fertilisation failure. At the end of the breeding season, non-returns to oestrus are no longer used to detect pregnancy.
b)	Rectal palpation.	Not possible in goat due to small size of pelvis.
c)	Visual assessment.	Visual assessment through abdominal 'bloat' shows advance stage of pregnancy.
d)	Laparotomy.	Needs surgery. It gives 90-95% accuracy in goats of 5 weeks gestation.
e)	Laparoscopy/Endoscopy.	Presence or absence of pregnancy can be detected by direct observation of the uterus and ovaries through laparoscopy/endoscopy. Pregnancy can be detected at 40 days of gestation in goats.
f)	Radiography.	It has limitation since it can only be performed in a hospital.
g)	Ultrasonic technique.	It is good and produces immediate results and can be adopted for field use.
h)	Vaginal cytology.	It is impracticable under field conditions pregnancy diagnosis. Although pregnancy can be detected up-to 95% of animals at 40 days of gestation.
i)	Hormonal assay.	This test is based on the level of pregnancy dependent hormones in blood, milk or urine. Radio immunoassay and competitive protein binding and ELISA techniques are used for detection of hormones. With this technique pregnancy is diagnosed at earlier stage and has an accuracy of 95%.
j)	Administration of hormones.	Costlier with physiological side effects, it is accurate and detects pregnancy at an early stage.

The best way to diagnose pregnancy with a 60 - 100% accuracy after 30 - 60 days post conception is done with the help of ultrasonic equipment. This

technique is simple and can be applied under field conditions at a relatively low cost.

Induction of parturition: The technique that is used to induce parturition must be compatible with the survival and normal development of the

newborn kid, and without deleterious effects on lactation and maternal behaviour. The various chemicals used for this purpose are cortico-steroid, oestrogens or prostaglandins. Vetesterol alone, Vetesterol/oxytocin, dexamethasone alone and dexamethasone/vetesterol can be used at full term as well as 3 - 4 days before term in goats.

Infertility problems: Infertility problems in goats can be due to various reasons. Some are:

Infertility in males: Infertility in males is mostly due to an abnormality of the testes. The main abnormalities of the testes are testicular atrophy, testicular degeneration, cryptorchidism, orchitis and epididymitis. A male suffering from any of these diseases shows inability to serve the female and absence of sperm in the ejaculate. The genital tract of a male can be infected with many different bacterial, viral, and chlamydial agents. Brucellosis is one of the major bacterial infections, which results into infertility in males. This disease can be transmitted from one male to another through copulation with a female previously served by an infected male. Animals suffering from such a disease should be segregated immediately and treated with antibiotics, e.g. chloromycetin and aureomycin. Infertility can also occur due to nutritional deficiency of protein, phosphorus, copper, iodine and vitamin A leading to retarded sexual development, delayed puberty and low level of semen production.

Infertility in females: In females, the problems of infertility are anoestrus, repeat breeders, embryonic mortality, genital defects and abortions.

Anoestrus: When a female does not exhibit heat, the condition is known as anoestrus. This happens due to change in environment, nutritional deficiencies, lactational stress and age. Low level of energy (nutrition) suppresses oestrous activity causing anoestrus. Mineral deficiencies like phosphorus, manganese also cause anoestrus. Vitamin A and/or E deficiency can also lead to anoestrous conditions. Goats showing anoestrous symptoms can be cured by the use of:

- a) Extra nutrition.
- b) Cobalt-Cooper tablets at 1 tablet/day for 15 days followed by tonophosphan

injection at 2.5 ml.1/M alternate day for 10 days.

- c) Fertivest tablet 1 tablet/day for 5 days.
- d) Hormonal treatment with 0.15 mg. mGA orally per day for 12 days followed by Antex® injection 48 hours after the last day of feeding.

Repeat breeder: This is a goat which returns to service repeatedly after being bred to a fertile male. There are two reasons for this: fertilisation failure or early embryonic mortality. It can also happen due to genital tract abnormalities, infections, hormonal imbalances, hereditary and management related factors. Treatment is by intra-uterine injection of streptomycin before service. Sometimes tonophosphan injections on alternate days for 5 days also shows improvement.

Infections of genital tract: Genital tract of goats can be infected by bacterial, viral, mycotic and chlamydial agents. Some of these pathogens cause abortion and may subsequently lead to infertility. Some of the common infectious diseases are Brucellosis, Vibriosis and Chlamydial abortion.

Brucellosis: Brucellosis causes abortion between the third and fourth month of pregnancy. In such case vaccination of all female kids at 6-12 months of age, at least one month or more, before the first breeding.

Vibriosis: It is not common in goats although abortions occur in late stages of pregnancy.

Salmonellosis: It is an acute contagious disease characterised by metritis and abortion. Abortions occur during the third trimester of pregnancy.

Foot and Mouth Disease: Food lesions occur with bacterial infection. The infection of foetus with virus results in death of the foetus and animal becomes infertile.

Chlamydial abortion: It is viral disease that causes abortion among pregnant animals.

Mycoplasmosis: Mycoplasma infections cause abortions which lead to infertility.

Nutritional deficiency: The deficiency of protein, minerals, phosphorus, cobalt, manganese, and copper causes infertility problems.

Conclusion: Use of modern reproductive methods can help to (1) increase the number of kids in a lifetime, (2) reduce mortality, and (3) produce genetically superior breeds. They should be applied to increase the economic benefits of goat farming.