EFFECTS OF HORMONES ON LAMB CARCASS QUALITY[1]

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The topic assigned to me for presentation during the 1955 lamb carcass evaluation section of the conference is of great current interest. Hormones are being talked about in the barnyard, feed lot, livestock exchanges, and experiment stations.

I shall limit my remarks so we may have ample opportunity to discuss this particular subject. Many of you may have pertinent facts, which will contribute to our knowledge as to the effects of hormones on lamb carcass quality, to present during the discussion period.

One can study at length about various actions of the secretions from the endocrine glands on our classical laboratory animals by reading about the untold number of experiments cited in the Journal of Endocrinology. As an outcome of these experiments and assay techniques that have been developed, both natural extractives and synthetic chemical hormones have been produced commercially. These endocrine substances, classified as biological pharmaceuticals, are being used with success in both human and animal therapeutics.

The sex hormones have been used during the past several years by research workers with the female ovine in trying to produce estrus in seasons other than the normal fall breeding season. From this work we have seen hormones used for purposes which no one would have been able to envision 10 years ago. A list of the common sex steroid hormones and their actions are listed as follows:

Hormone	Actions of Female Hormones
Estradiol (natural)	Stimulates development of female secondary sex characteristics and sex organs.
Estrone (natural)	
Estriol (natural)	Producers estrus with or without ovulation depending upon status of estrus cycle.
Diethylstilbestrol (synthetic)	
Dienestrol (synthetic)	Inhibits FSH production.

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Hormone	Actions of Female Hormones
E.C.P. - estradiol - cyclopenthylpropionate (synthetic)	Stimulates LH production.
Progesterone (natural)	Sensitizes mammary glands, uterus, and accessory sex organs.
Synovex (10 mg. estradiol) (250 mg. progesterone)	Increases sex drive in females.
Testosterone	

There are various methods of administering these hormones. They are as follows:

1. Oral
2. Topical application
3. Absorption directly from skin
4. Intravenous
5. Intramuscular
6. Subcutaneous

The two methods most widely practiced today are the oral and the subcutaneous routes of administration.

Diethylstilbestrol may be defined as a synthetic estrogen-like compound which is supposed to produce estrogen-like effects. This is the most commonly used hormone at the present time either as an additive to the ration or implanted as a pellet. A recent new pellet is estradiol-progesterone known commercially as "Synovex" and containing 10 mg. of estradiol and 250 mg. of progesterone which have been approved by the Food and Drug Administration.

I shall not cite various experimental results concerning the rate of gain and feed efficiency due to the response from sex hormone feeding or implantation. However, I believe that we can make this general statement and base it upon facts from research findings: that lambs receiving the above mentioned sex hormones do show, in the majority of the experiments, an increase in rate of gain from 5 to 15 percent accompanied by greater feed efficiency. This is profitable from the producer's standpoint, if the lambs do not receive abnormal side effects which I shall mention later.

Hormones have not been found in appreciable quantities in tissue samples assayed from lambs receiving the sex hormones. Stob, et al. (1954) stated that in all probability the amount of hormone present in beef muscle and liver does not exceed 0.01 ug. per gram of dried tissue or 0.1 ug. per gram of dried tissue in sheep and chicken muscle. He further states that there was no consistent evidence to indicate that the type of hormone used affected residual amounts in muscle tissue. It has been stated that a

female meat animal killed during estrus would produce considerably more estrogens in the meat than would feeding or implanting at present dosage levels.

Bell, et al. (1953) implanted wether lambs with one 15 mg. pellet of diethylstilbestrol at the beginning of a 112 day feeding period. After 70 days on test one-half the lambs received another 15 mg. pellet of diethylstilbestrol. Adverse symptoms were produced. There was a prolapse of the rectum (piles) and excessive swelling in the rectal region. Losses were incurred resulting from these conditions. An examination of the reproductive organs revealed a distinct hypertrophy of the bulbo-urethral glands, urethra, and prostatic tissue. The straining of the lambs during defecation no doubt caused the prolapse of the rectum while the pressure upon the urethra probably caused the urinary calculi (water belly) symptoms.

These particular sex accessory organs are considerably larger than the control wether lambs as I shall show in the slides. Treated wether lambs develop secondary sexual characteristics. There is a pronounced spread at the tuber coxae. The tail head rises considerably accompanied by a relaxation of the pelvic ligaments. The rudimentary teats become elongated. The results from ewe lambs do not show adverse side effects; however, due to the inhibiting effect on the follicle development of the ovaries by these estrogen-like hormones, they should never be fed or implanted in ewe lambs kept for replacements in breeding flocks. The ram lambs should never receive the female sex hormones.

Acker, et al. (1955) state that the ease of removing pelts during the slaughtering operations was more difficult from lambs implanted with estradiol-progesterone pellets than from those untreated. They further state that the 0.5 mg.-stilbestrol-fed lambs were more difficult to pelt than the controls. The skin was thicker in the treated groups. This difficulty in pelting was also noted by Bell, et al. (1953) both at the Kansas State College Meat Laboratory and at the commercial packing plant.

Bell, et al. (1954); O'Mary, et al. (1952); Means, et al. (1953); R. M. Jordan (1950 A), (1950 B); and Anderson, et al. (1949) presented evidence in their various investigations that the particular sex hormone that they were using lowered carcass grade. Consistent lowering of quality was reported in these hormone-treated lambs. Carcasses were soft and watery with less finish.

What is the mechanism concerning the action of these sex steriod hormones? One leading endocrinologist stated that they stimulate the growth or somatotropic hormone of the anterior hypophysis. Others believe that these sex hormones may stimulate the luteinzing and follicle-stimulating hormones of the anterior pituitary. However, I should like to give you reasons, I think, that refute those conclusions. Whitehair, et al. (1953) stated that there was a marked increase in the retention of calcium, phosphorous, and nitrogen in stilbestrol-treated lambs in their digestion trial studies. Marked nitrogen retention was also reported by Clegg, et al. (1954). Considering this and the reports of watery carcasses, leads one to believe that these sex hormones may act directly through the adrenocortical steroid hormones or indirectly through the adreocorticaltropic hormone of the anterior pituitary. Experiments with laboratory animals and in human

therapy have shown that desoxycorticosterone, 17 hydroxy desoxycorticosterone, and limited action by corticosterone, do have some action on water and electrolyte metabolism as well as retention of sodium, elimination of potassium, increased plasma volume, and nitrogen retention. There are any number of possible actions that may be taking place throughout the endocrine system. One can only theorize in explaining the mode of action of hormones used in lamb feeding or implanting.

I wish to make this point in closing. One of the great problems in using these hormones is size of the dosage. Research workers in pharmacology, when experimenting with new drugs, must first find the dosage level that gives the greatest therapeutic response without developing synergistic reactions and adverse side effects. This appears to be the problem in using these hormones in lamb feeding and implantation. Apparently the dosage administered has been too high. One to three mg. per pound of total ration per head per day or one 6 mg. pellet implanted before going into the feed lot appears to be about the dosage that will develop no side effects or lower carcass quality. The rate of gain and feed efficiency will not be so great with the smaller dosages as they would using larger dosages.

I will appreciate very much having members of this conference call attention to any invalid conclusions or "tear this report apart" during the discussion period.

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