EFFECTS OF HORMONES ON QUALITY OF PORK CARCASSES

RICHARD F. WHEELER
UNIVERSITY OF ILLINOIS

Sleeth et al. (1953) injected testosterone, estradiol and a combination of the two into growing-fattening pigs, weighing approximately 46 pounds. There were five barrows and five gilts which were subjected to each treatment and five of each sex used as controls. All pigs were self-fed on pasture for a total of 112 days.

"The pigs in Lot I serves as untreated controls, those in Lot II were injected intramuscularly with testosterone propionate semi-weekly at the rate of 0.5 mg. per kg. of body weight, those in Lot III were injected in the same manner with 1.0 mg. per kg. of body weight of estradiol benzoate, while the animals in Lot IV were injected with 0.5 mg. testosterone propionate and 1.0 mg. of estradiol benzoate per kg. of body weights.

"At the level used, neither testosterone, estradiol nor a combination of the two appeared to influence significantly rate of gain, carcass length, carcass grade, dressing percentage, thickness of backfat, palatability of roast or tenderness as measure by the Warner-Bratzler shear. Both treated barrows and gilts exhibited an abnormal sexual behavior and the reproductive tracts showed the effects of marked hormonal stimulation."

Pearson et al. (1952) implanted stilbestrol in two lots of boars, barrows and gilts weighing approximately 35 pounds. The pigs were self-fed in dry lot for 107 days.

"One lot of pigs of each sex was kept as untreated controls while the other was given subcutaneous stilbestrol implants on the jowl. At the beginning of the experiment and at the end of the first month the dosage was one 25 mg. pellet per pig, while at the end of two months two 25 mg. pellets were given per animal. The dosage was increased as it was noted that all external signs of estrus observed in the gilts following stilbestrol implantation disappeared prior to three weeks following treatment.

"Stilbestrol implants did not materially affect gains of either gilts or barrows but apparently caused a growth-depressing action upon young boars. The implants appeared to be without effect on the feed requirement for each hundred pounds of gain. The stilbestrol treated boars were fertile after having periodic implants made over a period of 107 days and manifested normal sexual behavior. Carcass studies indicated that stilbestrol implantation did not materially affect dressing percentage, thickness of backfat, carcass grade, or tenderness. The use of stilbestrol implants appeared to have little influence on organoleptic ratings of loin roasts and did not improve the eating qualities of meat from boars."

Woehling et al. (1951) implanted stilbestrol and testosterone pellets into growing-fattening pigs weighing approximately 43 pounds. The pigs were treated at the beginning of the experimental period and again 12 weeks later. Fifteen mg. pellets of testosterone propionate and 12 mg. pellets of stilbestrol were implanted in the hind flank. The pigs were slaughtered as they reached 210 pounds."
The following characteristics were studied: average daily gain, feed per 100 pounds gain, daily feed consumption, dressing percentage, length of carcass, weight of regular ham, percent of external fat in the regular ham, eye muscle measurement, fatback thickness, length of femur, specific gravity of the femur, weight of leaf fat, and seediness of the fresh belly. Of these characteristics, seediness of the belly in the stilbestrol group is the only one that showed a significant deviation from the control.

Perry et al. (1950) fed thyroprotein to three lots of pigs at the levels of 4, 6, and 8 gm. per 100 pounds feed. One half of each carcass was skinned, boned out and ground. There were 10 pigs in each of the three test lots and 10 pigs in the control lot. A sample from representative carcasses was analyzed for water, protein, fat and mineral matter.

"When compared on the same age basis, hogs receiving thyroprotein had a higher percent of fat and lower percentages of moisture, protein, and mineral matter than animals receiving no thyroprotein."

Terrill et al. (1950) fed thiouracil at the rate of 0.15% of the ration.

"Neither the physical nor the chemical composition of the carcass is modified significantly when fattening barrows are fed thiouracil during a 4 week period. Thiouracil causes partial inhibition of skeletal growth, lowers dressing percentage about 1%, but has no significant effect on thickness of backfat, cutting yields, carcass grade and carcass firmness."

Willman et al. (1949) fed thiouracil at the levels of .1 and .2% of the ration. They reported that the skin and fat of the hams were more highly developed than were the controls.

Acevedo et al. (1948) reported that thiouracil failed to produce any gross differences in the commercial cuts of pork.

McMillen et al. (1947) fed thiouracil at the level of 0.1% of the ration to Chester White, Yorkshire and cross-bred market pigs. They reported no significant differences in the carcasses attributable to the thiouracil treatment.

REFERENCES


---

MR. KLINE: Saturday I received a letter from Professor Loeffel saying that he would be unable to attend these meetings. I shall substitute for him in leading the discussion on these papers.

MR. BUTLER: Mr. Breidenstein, did you come across anything concerning the amino acid balance of proteins and their effect on carcass characteristics? I understand that some of the late work has shown that the protein concentrate amount can be materially reduced if the amino acid balance is maintained or manipulated a little.

MR. BREIDENSTEIN: I did not come across anything relative to the biological value of the protein fed. There might be some indications of that in some of the English work and the American work in which they used fish meal with high biological value, perhaps due to feeding soybean meal. I used as the basis for this study the Journal of Animal Science and all the references cited, and built on that reference list as I went along.

MR. FARWELL: Mr. Hillier, what is the physical nature of these animal fats as they are fed to hogs, for example? For instance, how do you feed lard?

MR. HILLIER: We just took ordinary lard. I don't know how long it had been rendered, probably a couple of weeks. Some of it was probably very fresh. We melted it and used an ordinary auger type mixer, half-ton capacity, that we use in mixing regular rations. On it there is a little gate from which you can sack or you can pull out a spout underneath and make a return on it, you just allow some of the feed to come on down and ladle this fat in it as it goes by.

You won't have any trouble mixing up to as far as we went, which was about 12 per cent added fat. At that point we began to get into trouble. That is why we went no further. The fat will appear quite greasy at that point. It was just melted and then poured into the feed.
We did not add any antioxidants, which I suspect would be done if one were feeding fats regularly. If one were going into the real business of adding fats to grains or mixes in general, the setup that I would think of would be a regular molasses mixer with a heater on it.

MR. PEARSON: We had some experience using waste beef fat. We started about a year ago. Don Kropf has charge of the work and he has used it for his thesis. We mixed ours by hand and we used up to 15 per cent of the ration in one trial.

MR. KROPF: We used raw ground beef fat, not rendered. I suppose that rancidity is one of the first questions in your minds. The feed had somewhat of an anti-oxidant effect on the fat. After we mixed it we did not seem to have much trouble with rancidity, as detected by smelling.

As for the effect of feeding this fat, the one consistent thing we found throughout was increased efficiency of gains, in some cases increased average daily gain. This was not as consistent an effect as efficiency of gain. We did not have significant differences in backfat thickness. We also took iodine numbers from backfat samples and had small differences between the basal ration, which was low in fat, probably 2 or 3 per cent, and our 10 and 15 per cent waste beef fat rations.

MR. ADAMS: We have been feeding beef pellets to steers in Nebraska. For cattle, we have been pelleting along with the famous ground corn cobs from Coon Rapids, Iowa, and urea and a small amount of molasses. We fed it all winter long, right up until April, with no evidence at all of rancidity. We did get some rancidity, though, with the corn oil mix we used.

MR. HILLIER: What percentage did you use?

MR. ADAMS: We used 5 per cent with that. We have some pellets now, I believe 10 per cent.

MR. HILLIER: We tried to interest the mill in pelleting, but they would not touch it. They said if it had over 5 per cent fat they could not run it through their machine. Did you have any difficulty?

MR. ADAMS: No, I have seen the 10 per cent pellets, and you cannot tell very much difference between those and the 5 per cent as far as appearance is concerned. There is quite a little corn cob in that, sort of soaked the oil up.

MR. HILLIER: We have a different consistency. We found that the pig has a tendency to eat about so much energy a day. If we give him a really bulky ration he will extend himself to consume enough of it to get up to this standard energy, and if you give him a concentrated ration he will cut down on his daily intake. So the pig itself makes some adjustment. You don't get energy in the pig in direct relation to the energy in the diet. You make a wide difference in the amount of feed he will eat on these rations, depending on how much energy is in them.
MR. BOREN: In holding feed over in which you mixed animal fat, is there a possibility of rancidity development possible somewhere down the line. Is there anything in the literature that would indicate any effect of this rancidity on carcass characteristics?

MR. HILLIER: I don't know of any myself. I have had a short communication from Dr. Kraybill of the A.M.I.F. and he tells me that the cost of these antioxidants is such that they could easily be used on these surplus animal fats.

MR. SWEIGERT: Yes, the cost for the addition of an antioxidant to stabilize a fat such as that would give no evidence of rancidity for at least one year's storage at room temperature, which is the criteria we have used and would only approximate 80 cents a ton.

MR. PEARSON: We have found that our waste beef fat is worth about 113 per cent of corn. On current prices that made it worth about 7 cents a pound, which might be something of economic consideration at least to our meat packers who I understand at the present time are selling it for something around four cents a pound.

MR. PIERCE: With respect to the physiologist with whom you talked about finding extra water in the interstitial fat with reference to the antibiotics fed to pigs. We have been conducting an experiment in South Dakota and there is a pretty definite trend indicated by data that that might not be just a theory. I am wondering if anyone else has done any work along that line to support it. There is quite a noticeable difference in the readings, although they didn't prove statistically that there is more water in the interstitial fat in the antibiotic-treated hogs.

MR. SOULE: He is the physiologist in the School of Veterinary Medicine. The interstitial water, that is, the water that is in the cell not in the fat, is the water, the protoplasmic water as well as the water that is in the vascular system, between the muscle fibers, etc. That is just a theory yet. We are trying to prove it and it is going to take a while. It may be next year before we have any indication that that theory is true.

MR. KASTELIC: Mr. Kline and I have been very much interested in that because many statements have been made concerning the effect of antibiotics on the water content of tissues. We designed two experiments which we thought were under complete control. We went to the expense and bother of using highly purified rations. We determined the water in the liver, spleen, kidney and loin muscle. There were differences. However, when the fat content of these tissues was obtained and the water figure corrected for the fat content, our data showed no differences between the control animals which had not received antibiotics and the animals which had received antibiotics at a level of 500 milligrams per pound of feed.

We used a mixture of five antibiotics. In that experiment we ran analyses on a number of other constituents in tissue. There were a few statistically significant differences in terms of interaction. While we have an enormous amount of data we have nothing to publish that is worth while.
MR. HECK: I should like to ask if any research has been done on the amount of water intake along with the antibiotics. I know that at our station we have fed some bacitracin and we have gotten some very rapid gains. I am wondering if these pigs do not drink a lot of water which causes them to develop fat, and if any stations have measured the amount of water that they take in along with the feed.

MR. KASTELIC: I think we can report that feeding aureomycin does increase the water intake of the pig. That is what led us into this more active work.

MR. GALLOWAY: Did you check the excretion rate?

MR. KASTELIC: No, we just measured the amount of water that was consumed by the pig. There is some English work, incidentally. I have forgotten the journal in which it is reported. I think it is the Journal of Chemistry and Industry. As I recall, they found that when you limit the water intake of animals receiving antibiotics (and I believe in this case it was penicillin) the gains are no different in the animals that are on controlled rations, but if you allow them unlimited amounts of water increased gains are obtained. I was struck with the idea of one more theory added to the many concerning the mode of action of antibiotics. I concur very heartily with Davey Mackintosh about this problem. Let's sit down and do a little crawling before we walk and nibble at some of these problems, so that we can come back with the results of experimentation and data and compare results and then argue with one another as to what the proper conclusions might be.

MR. HENRICKSON: I should like to ask if you are doing work on the deposition of antibiotics in the tissue and what significance it might have.

MR. KASTELIC: We worked with the bacteriology department on that point. We were concerned with the B12 accumulations in the tissues as affected by these high levels of antibiotics, to determine whether or not any antibiotic residues were present in the tissue which would interfere with the microbiotic level. At levels of 500 milligrams per pound of feed, assuming they ate about 3 pounds of feed per day, they received a gram and a half of a mixture of four antibiotics, aureomycin, streptomycin, terramycin, penicillin, and one sulfa drug. They were maintained on the feed and then slaughtered. There was inhibition of the testes organism when placed on extracts of the tissue. At two days there was little, at three days none. We took them off the antibiotics five days before slaughter. That is as far as we have gone. That is not a very rigorous test, but at least we did check in a preliminary way.

MR. PEARSON: There is some evidence that has come in a fragmentary report from England. It is something to the effect that antibiotics have some influence on color development during curing meat. I have never been able to find a complete reference to it.

MR. SVEIGERT: We have had an opportunity to do some survey work in collaboration with Mr. Doty at AMIF. The question is raised at our place a great many times, and we have a great many inquiries
relative to it. But the chemistry and metabolism of the heme-pigments in meats is very complex and is related to more than just feeding antibiotics, if it is related at all to feeding them. When you are comparing animals that are slaughtered at different ages, if there is a different rate of gain, there is a question of which muscle is used as an evaluation of the myoglobin content. Further, it probably can be influenced by the curing process, although in a rather extensive survey with a number of meat packing companies it is very difficult to get definitive information in terms of specific experimentation.

We are planning to do additional collaborative work with some of the experiment stations where we have controlled feeding and actually measure the quantities of the myoglobin in the tissues. This is essential to get any answer to this question or to any other feeding practice as it influences the color and thereby the amount of nitros myoglobin formed after curing. It is being worked on. We do not have the answers. We can say that there are other things besides antibiotics or feeding regimens of this type that influence color in these muscles. The problem is therefore beyond merely a feeding scope and is an evaluating research program.

Mr. Bratzler: I think we are rather fortunate that the pig has a terrific tolerance for hormones. I am a little concerned about the hormone people and the application and implantation of hormones, particularly in cattle and lambs. It raises quite a problem. In our preliminary work we did not do much with the pig, but of course, we all know what we can do with sheep and cattle. I think it behooves all of us, as meats men, to tone down some of the extravagant claims made for these various hormone treatments.

Mr. Hall: In the remarks that were made about carbohydrate and the effect that it has on meat, something should be said about keeping it in after you feed it to the pig. It is very easy to lose it before it has a chance to be of value in the carcass. It is one of the easiest things a pig gets rid of. In hauling or shipping or various forms of unintentional abuse of the animal before it is slaughtered.

In experiments at Kansas State by Mackintosh and Soule on the retention of the carbohydrate in animals that are affected by shipping, we find great variance in the amount in the liver of the animals and in the tenderloin muscle. There is a corresponding difference in the lactic acid development in the tenderloin muscle which in turn can have a great effect on the firmness or softness of the muscle tissue and the ability of hams, especially, to permit penetration of the curing brine.

In some work that was done in Canada, I cannot recall where, it was found that in feeding sugar to pigs before slaughter the sugar went almost pound for pound into the livers. One can afford to buy sugar and sell it for liver prices at that rate.

I should like to hear Mr. England say something about the method they are using in slaughtering pigs at Hormel. Ordinarily it is a rough kill for the animal, and it is not surprising that the animal loses its glycogen from its liver and anything else that is in it before
it gets to the block. They have a way of running these pigs through a tunnel that is filled with carbon dioxide, just enough to anesthetize the animal and then they finish it off without any further struggle. That ought to have, a great effect on the amount of carbohydrate in the muscle tissue and on the glycogen in the liver.

MR. ENGLAND: I cannot tell you if it affects the amount of carbohydrate retained in the liver or any other tissue. However, the amount of struggling that the pig does is very markedly reduced because the pig, in essence, is merely driven through a tunnel or a chute and it is not constrained at any time other than by the chute. It is more or less pushed along or encouraged to go by means of flexible paddles which merely push rather than paddle it into going. The pig goes through this carbon dioxide chamber and comes out on the other end immobilized by having inhaled a sufficient concentration of the carbon dioxide to keep it immobilized, for about 60 seconds. During that time the pig is shackled without difficulty. It comes out on a roller belt. The shacklers stand there and calmly shackle the pig by one leg. It is moved along the chain and is stuck while still immobilized and then it is revived just enough to bleed out very well, indeed, so that the struggling is kept at a bare minimum. It also helps the sticker and the shackler very much.

CHAIRMAN COLE: We will go right to the next topic which deals with the carbon content and temperature control in the manufacture of cutlery. Most of us who were here last year remember the discussion we had on the manufacture of knives. We have the same gentleman back with us, Mr. J. D. Gallery, General Manager of the Russell Harrington Cutlery Company, who is going to speak to us on this topic.

# # # # # #