# The effect of hexoestrol implantation on the fattening of lambs

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The subcutaneous implantation of stilboestrol pellets in ewe and wether feeder lambs has been shown to result in a faster rate of gain in weight (Andrews, Beeson & Harper, 1949; Jordan, 1950; O'Mary, Pope, Wilson, Bray & Casida, 1952; Means, Andrews & Beeson, 1953; Andrews & Beeson, 1953; Bell, Smith & Erhart, 1954; Clegg, Albaugh, Lucas & Weir, 1955). With from 12 to 36 mg stilboestrol the increase in the daily gain in weight ranged from 0·024 to 0·255 lb. Stilboestrol was usually given by one implantation; when a second implantation was made there was no significant additional increase in the rate of gain in weight.

The object of the present trial was to find the effect on the gain in weight of fattening lambs of a single subcutaneous implantation of 15 mg hexoestrol, another synthetic oestrogen closely related to stilboestrol.

## EXPERIMENTAL

Two trials were conducted, one on privately owned farm flocks and the other on individually penned animals under carefully controlled conditions of environment and of feeding at the Rowett Research Institute.

### *Farm trial*

A total of 524 lambs on six farms, around 8 months of age at the beginning, were studied. They were being fattened by methods representative of practice in north-east Scotland and, though the breeds differed from farm to farm, they were typical of those fattened in the area. Management varied slightly, but all lambs were run on grass and given turnips *ad lib.* supplemented with concentrates during the final stages of fattening. On each farm the lambs were randomly divided into two groups, control and treated. In each lamb of the treated group a 15 mg pellet of hexoestrol was implanted subcutaneously in the left ear. All lambs were weighed at the time of implantation and monthly thereafter. The lambs from five of the farms were slaughtered when considered by the farmers to be in fat condition; on the remaining farm they were sold for further feeding.

Details of breed, sex and management of each flock are shown in Table 1. The lambs were identified as groups on farms A, B and C by a paint mark and individually on farms D, E and F by a system of ear notching.

Table 1. *Hexoestrol implantation in farm flocks: breed, sex and management of lambs*

| Farm | No. of lambs | Breed | Sex | Period of trial (days) | Daily ration per lamb |
|---|---|---|---|---|---|
| A | 104 | Cheviot | Wether | 29 | 2 to 4-year old pasture; turnips *ad lib.*; 1 lb. of a mixture of oats, distiller's grains (fresh), proprietary protein-rich meal and barley |
| B | 108 | Cheviot | Wether | 29 | |
| C | 70 | Suffolk × Halfbred | Ewe and wether | 29 | Limited area of pasture (moved to fresh run as required); turnips *ad lib.*; equal parts of oats and distiller's grains (fresh) in amounts increasing to 2 lb. daily |
| D | 94 | Cheviot | Wether | 58 | 2 to 4-year old pasture; turnips *ad lib.*; ½ lb. oats for final 28 days |
| E | 20 | Various crosses | Wether | 58 | 2 to 4-year old pasture; turnips *ad lib.*; oats increasing to a limit of 1 lb. for final 28 days |
| E | 30 | Various crosses | Wether | 105 | 2 to 4-year old pasture; turnips *ad lib.*; oats increasing to a limit of 1 lb. for final 75 days |
| F | 98 | Halfbred | Wether | 163 | 2 to 4-year old pasture for 140 days; first-year grass for final 23 days; turnips *ad lib.* from 23rd day onwards; ½ lb. oats from the 76th day |

### *Rowett Research Institute trial*

Thirty Greyface lambs (a Border Leicester–Scottish Blackface cross), 9 months of age, were randomly divided into two groups of six wethers and nine ewes each. One group was implanted with hexoestrol as in the farm trials, and the other acted as control. Each lamb was penned separately and fed on a daily ration of ½ lb. hay and up to 2½ lb. of a mixture of four parts maize, one part crushed oats, one part bran, one-half part white-fish meal and one-half part linseed cake. All lambs were given as much as they would readily eat. Weights were recorded weekly during the 68 days of the trial. The lambs were than slaughtered, carcass weights and grades obtained, and some carcass measurements made. Ears of treated lambs were dissected, and any unabsorbed portion of the pellet was removed, oven dried and weighed.

## RESULTS

### *Farm trial*

*Absorption of the hexoestrol pellet.* Lambs on farms A, B and C were on the trial for 29 days only, and those on farm D, and twenty on farm E, for 58 days. On these farms examination of the ears of the treated lambs by palpation indicated that a considerable amount of the implanted pellet still remained at the end of the trial. In the lambs on farm F there was no trace of the pellets at the end of the 163-day trial. Ears from six treated lambs from farm E, slaughtered 105 days after implantation, were removed and dissected. Only in one lamb was an unabsorbed portion of the pellet found; it weighed 2 mg after oven drying.

*Live-weight gain.* Values for weight changes are summarized in Table 2. Statistical analysis of the mean daily gains of all groups, whether weighted according to the number in each group or unweighted, revealed no significant difference attributable to treatment. Further analysis of the individual final weights of the lambs on farms A, B and C and of the individual gains of the lambs on farms D and E revealed no significant difference due to treatment on any one of these farms. On farm F the treated lambs made significantly greater gains ($P < 0.01$) than the controls, not only over the whole period of the trial but also over the first 4 weeks and during the period from the 8th to the 14th week.

Table 2. *Hexoestrol implantation in farm flocks: changes in weight of treated and control lambs*

| Farm | Treatment | No. of lambs | Period of trial (days) | Initial weight (lb.) | Final weight (lb.) | Gain per lamb (lb./day) |
|---|---|---|---|---|---|---|
| A | Hexoestrol* | 52† | 29 | 91·8 | 84·8 | −0·241 |
| | None | 52† | 29 | 89·2 | 86·8 | −0·083 |
| B | Hexoestrol* | 54† | 29 | 94·9 | 95·9 | +0·034 |
| | None | 54† | 29 | 94·5 | 95·7 | +0·041 |
| C | Hexoestrol* | 35† | 29 | 105·6 | 117·2 | +0·400 |
| | None | 35† | 29 | 104·8 | 115·4 | +0·365 |
| D | Hexoestrol* | 47 | 58 | 61·3 | 69·7 | +0·145 |
| | None | 47 | 58 | 61·4 | 68·3 | +0·119 |
| E | Hexoestrol* | 11 | 58 | 86·3 | 97·9 | +0·200 |
| | None | 9 | 58 | 91·4 | 99·8 | +0·143 |
| E | Hexoestrol* | 14 | 105 | 76·9 | 92·5 | +0·149 |
| | None | 16 | 105 | 78·5 | 89·7 | +0·107 |
| F‡ | Hexoestrol* | 49 | 163 | 95·9 | 147·2 | +0·315 |
| | None | 49 | 163 | 95·2 | 141·8 | +0·286 |

* 15 mg.
† Identified as groups only.
‡ Difference in daily gain between treated and untreated lambs significant at 1 % level.

*Effect of sex on response to treatment.* Only on farm C was the flock made up of ewe and wether lambs. The increase in weight for the 29-day period was 15 lb./head for seventeen treated wethers and 11·9 lb. for fourteen controls; eighteen treated ewe lambs gained 8·7 lb./head, and twenty-one controls gained 9·5 lb. Since the lambs in this flock were not identified individually no test of significance could be applied to the gains in weight. A study of final weights, which could be analysed, revealed no influence of sex on the outcome of treatment.

*Carcass weight and grade.* Information about carcasses was obtained only for farm E lambs. The lambs were slaughtered when in the farmer's opinion they were in fat condition. Thus twenty were slaughtered 58 days after implantation and sixteen 105 days after implantation (Table 3). The remaining fourteen lambs (eight treated and six controls) were not followed through to slaughter. There was no significant difference between control and treated animals in length of time to slaughter, dressing out percentage and carcass weight or grade. The dressing out percentage is the weight,

as a percentage of the live weight at slaughter, of the cold dressed carcass after bleeding and the removal of the feet, head, hide, abdominal viscera, lungs, liver, heart, windpipe, and the thyroid and thymus glands.

Table 3. *Hexoestrol implantation in farm flocks: mean values for gain in weight and details about carcasses of lambs from farm E*

| Treatment | No. of lambs | Period of trial (days) | Gain in weight during trial (lb.) | Dressing out percentage* | Carcass weight (lb.) | No. of carcasses graded†: A | B | Reject |
|---|---|---|---|---|---|---|---|---|
| Hexoestrol‡ | 11 | 58 | 11·5 | 47·5 | 46·5 | 10 | 1 | — |
| None | 9 | 58 | 8·4 | 47·2 | 47·2 | 9 | — | — |
| Hexoestrol‡ | 6 | 105 | 19·3 | 45·6 | 44·1 | 2 | 3 | 1 |
| None | 10 | 105 | 13·1 | 48·4 | 46·3 | 6 | 4 | — |

* Dressing out percentage was calculated on the latest available live weight, taken 10 days before slaughter. The term is defined on p. 228.
† Carcass grade was assessed by graders of the Fatstock Marketing Corporation.
‡ 15 mg.

*Rowett Research Institute trial*

*Absorption of the hexoestrol pellet.* The mean weights of residual pellets are shown in Table 4. Examination revealed that the pellet was lost from lamb no. 334 within a fortnight of implantation; from the remaining fourteen lambs an average of 60% of the pellet was recovered.

Table 4. *Hexoestrol implantation in indoor flocks: mean weight gains of treated and control ewe and wether lambs, and mean weights of unabsorbed hexoestrol*

| Treatment | No. of lambs | Sex | Initial weight (lb.) | Gain in weight (lb./day) | Excess gain of treated animals over control* (lb./day) | Weight of hexoestrol recovered (mg) |
|---|---|---|---|---|---|---|
| Hexoestrol† | 8‡ | Ewe | 85·5 | 0·61 | 0·16§ ± 0·034 | 8·4 |
| None | 9 | Ewe | 83·7 | 0·45 | | |
| Hexoestrol† | 6 | Wether | 81·5 | 0·61 | 0·12‖ ± 0·040 | 9·4 |
| None | 6 | Wether | 84·0 | 0·49 | | |
| | | Results for ewe and wether lambs combined | | | | |
| Hexoestrol† | 14‡ | Ewe and wether | 84·0 | 0·61 | 0·14§ ± 0·026 | 8·9 |
| None | 15 | Ewe and wether | 84·0 | 0·47 | | |

* Value with its standard error.
† 15 mg.
‡ Hexoestrol pellet was lost from lamb no. 334 and values for this lamb were excluded from means.
§ Significant at 0·1% level.
‖ Significant at 1·0% level.

*Gain in weight.* Mean gains in weight are shown in Table 4. Results for lamb no. 334 were not included in the means. Over the 68 days of the trial the treated lambs gained weight more rapidly than the controls. The difference was highly significant ($P < 0{\cdot}001$). On the average the treated lambs ate the same amount of food as the controls.

*Effect of sex on response to treatment.* No significant difference in gain in weight between ewe and wether lambs resulted from the treatment (Table 4). By the end of the 68-day period all the treated ewe lambs, with the exception of no. 334 already mentioned, showed considerable development of the udder, and a milky fluid could be expressed from the teats. The carcasses of these lambs were similar to those of in-lamb animals, and consequently the meat inspectors could not class them as carcasses of 'clean' sheep.

*Carcass weight, grade and dressing out percentage.* Treatment produced no significant difference either in carcass weight or in dressing out percentage, but carcasses of

Table 5. *Hexoestrol implantation in indoor flock: carcass weights and grades of lambs*

| Lamb no. | Sex | Starved weight* (lb.) | Carcass weight (lb.) | Dressing out percentage† | Butcher's grading‡ | Inspectors' grading‡ |
|---|---|---|---|---|---|---|
| | | Lambs treated with hexoestrol§ | | | | |
| 321 | Wether | 125 | 62 | 49·6 | B | A− |
| 322 | Wether | 115 | 53 | 46·1 | B | A |
| 323 | Wether | 86 | 37 | 43·0 | B | C |
| 325 | Wether | 126 | 62 | 49·2 | — | A |
| 329 | Wether | 121 | 56 | 46·3 | — | A |
| 331 | Wether | 123 | 58 | 47·2 | A | A |
| 334‖ | Ewe | 103 | 42 | 40·8 | A | B |
| 335 | Ewe | 124 | 63 | 50·8 | B | A |
| 337 | Ewe | 113 | 52 | 46·0 | B | B |
| 338 | Ewe | 120 | 58 | 48·3 | B | A− |
| 341 | Ewe | 104 | 45 | 43·3 | B | B |
| 343 | Ewe | 123 | 59 | 48·0 | B | A |
| 345 | Ewe | 129 | 56 | 43·4 | B | B |
| 346 | Ewe | 128 | 57 | 44·5 | B | A |
| 348 | Ewe | 124 | 60 | 48·4 | — | A |
| Mean (14) | | 118·6 | 55·6 | 46·9 | | |
| | | Control lambs | | | | |
| 320 | Wether | 108 | 49 | 45·4 | A | A |
| 324 | Wether | 107 | 46 | 43·0 | A | A |
| 326 | Wether | 116 | 54 | 46·6 | A | A |
| 327 | Wether | 111 | 52 | 46·8 | A | A |
| 328 | Wether | 127 | 55 | 43·3 | — | A |
| 330 | Wether | 102 | 49 | 48·0 | A | A |
| 332 | Ewe | 115 | 57 | 49·6 | A | A |
| 333 | Ewe | 121 | 60 | 49·6 | A | A |
| 336 | Ewe | 92 | 43 | 46·7 | A | A |
| 339 | Ewe | 112 | 51 | 45·5 | A | A |
| 340 | Ewe | 111 | 53 | 47·7 | A | A |
| 342 | Ewe | 110 | 53 | 48·2 | — | A |
| 344 | Ewe | 99 | 53 | 53·5 | A | A |
| 347 | Ewe | 112 | 59 | 52·7 | A | A |
| 349 | Ewe | 112 | 56 | 50·0 | — | A |
| Mean (15) | | 110·3 | 52·7 | 47·8 | | |

* After starvation for 20 h.
† Based on starved weight.
‡ See p. 231.
§ 15 mg.
‖ Hexoestrol pellet was lost from lamb no. 334; all values for this lamb were excluded from means.

control animals of both sexes graded significantly higher than those of the treated animals (Table 5). For grading, the carcasses were hung up in random order and were then assessed by a butcher and by a team of meat graders, none of whom was aware of any treatment. The butcher examined the first twelve slaughtered of each group and assessed all the carcasses of the untreated animals as grade A. Of the treated animals, he placed ten in grade B and two in grade A, one of which was no. 334, the lamb from which the pellet had been lost. The meat graders placed all carcasses of the control group in grade A; of the treated group they placed eight in grade A, two in grade A−, four in grade B and one in grade C.

Table 6. *Hexoestrol implantation in indoor flock: measurements of legs and gigots of control and treated lambs*

| Lamb no. | Length of leg (cm) | Width across both gigots (cm) | Depth of gigot (cm) | Weight of gigot (lb.) |
|---|---|---|---|---|
| | Lambs treated with hexoestrol* | | | |
| 321 | 28·3 | 25·8 | 12·7 | 6·7 |
| 322 | 28·3 | 25·5 | 12·1 | 6·0 |
| 335 | 27·8 | 26·5 | 12·4 | 6·0 |
| 338 | 28·2 | 26·8 | 12·0 | 6·7 |
| 341 | 27·9 | 24·5 | 11·4 | 4·7 |
| 345 | 29·4 | 26·2 | 12·8 | 6·0 |
| 346 | 28·4 | 26·9 | 12·5 | 6·0 |
| Mean | 28·3† | 26·0 | 12·3‡ | 6·0 |
| | Control lambs | | | |
| 320 | 25·2 | 24·2 | 13·2 | 5·2 |
| 332 | 28·0 | 27·1 | 13·4 | 6·2 |
| 333 | 28·7 | 25·7 | 14·4 | 6·5 |
| 339 | 26·5 | 25·4 | 13·0 | 5·7 |
| 340 | 26·8 | 26·0 | 13·5 | 5·7 |
| 347 | 27·6 | 26·3 | 13·2 | 6·0 |
| Mean | 27·1† | 25·8 | 13·4‡ | 5·9 |

* 15 mg.
† Difference significant at 5 % level.
‡ Difference significant at 1 % level.

Table 6 shows the leg length and gigot measurements in seven treated and six control lambs selected at random. These measurements were made in accordance with the definitions laid down by Pálsson (1939).

Compared with the controls the treated lambs had a thinner layer of external fat on the gigots and less fat on the kidneys. The legs of the treated lambs were significantly longer and the gigots leaner. Although there was no group difference between gigot weights, those of the controls, being plumper and having firmer fat and muscle, were preferred by the butcher.

## DISCUSSION

The farm trials were conducted during an unusually wet season, and in general the gains in weight were below average. However, these circumstances provided an opportunity to demonstrate that the response to hexoestrol implantation in fattening lambs was

significant only when the rate of gain in weight was relatively high. This observation is confirmed by the concurrent indoor trial at this Institute, but is apparently contrary to the finding of Clegg *et al.* (1955), who noted that the extent of the effect of stilboestrol treatment was the same whether the sheep were on pasture alone or on pasture and supplements, and that it was not influenced by rate of gain in weight. However, since most of their animals made higher daily gains than the outdoor lambs in our trials, it is probable that the level of feeding was sufficiently high to allow the animals to react fully to the treatment. In the present farm trials no significant difference resulted from treatment on four of the farms, including two where the lambs could be identified individually, and where the results were therefore subjected to more critical analysis. On these four farms the mean daily weight changes varied from a loss of 0·24 lb. to a gain of 0·20 lb. per lamb. On a fifth farm (farm C) the daily gain of the treated lambs was 0·40 lb. and of the controls 0·36 lb. These lambs, however, were identifiable by groups only, and the limited statistical analysis that could be applied showed that this difference was not significant. On farm F, where the lambs were identified individually, the difference between the daily gain in weight of 0·315 lb. for the treated and 0·286 lb. for the controls was highly significant. The lambs on this farm were on the trial for 163 days, a much longer period than any of the others, and not only was there a significant difference over the whole period but also over the first 4 weeks and for the period between the 8th and 14th weeks of the trial.

It is of interest to note that in the 68-day indoor trial an average of only 6 mg of the 15 mg hexoestrol implant was absorbed. In this trial, where the food consumption was the same for both groups and the daily gains were relatively high, there was a highly significant difference in favour of the treated lambs. When the gains in weight were further examined the difference between the treated and control groups appeared to move in a 3-weekly cycle, with the greater advantage to the treated group at weeks 2 and 3, 5 and 6, and 8 and 9. When the results for the sexes were plotted separately a greater relative gain was noticeable in the second and third of these periods for the males, and in the first and second for the females. These cycles may not be of significance. They have not been reported in other trials, but the weighings in these other trials may have been too infrequent to demonstrate a cycle.

The response to the hormone was not affected by sex, which is in agreement with the finding of Clegg *et al.* (1955). However, in the indoor trial, udder development in the treated ewe lambs was considerable, with the result that their carcasses could not be classed as those of 'clean' sheep. In consequence, the net returns for the carcasses of all the treated ewe lambs, with the exception of no. 334, were 5*d.*/lb. less than for the controls, a difference of 23*s.*/lamb. Treated wether lambs showed only slight enlargement of the teats which did not affect carcass classification.

No prolapse of the rectum or uterus or any signs of discomfort during urination were observed in any of the trials.

Though the number of carcasses examined was small, there was a strong indication that the carcasses of treated animals were inferior to those of the controls. In the indoor trial the dressing out percentage of the control lambs was slightly, but not significantly, higher than that of the treated. Probably of more importance was the carcass

grading by the butcher and by meat inspectors, who put all the controls in grade A and most of the treated in grade B. This finding is in agreement with those of Andrews *et al.* (1949), Andrews & Beeson (1953), Jordan (1950, 1953), Pope, O'Mary, Batterman, Bray & Casida (1950), O'Mary *et al.* (1952), Means *et al.* (1953), Bell *et al.* (1954) and Wilkinson, O'Mary, Wilson, Bray, Pope & Casida (1955). Compared with those of the control lambs the carcasses of the treated were not so well filled out, the muscle and fat less firm and the gigots less plump. The lack of finish might have been made good if the treated lambs had been kept longer on the trial (see Wilkinson *et al.* 1955).

The results suggest that, for the same amount of food, hormone implantation will produce a heavier sheep, but this sheep will not reach the same degree of finish in the same time as an untreated one. The present market demand appears to be directly opposed to the larger carcasses produced by such hormone implantation.

## SUMMARY

1. The influence of hexoestrol implantation on the rate of weight gain of fattening lambs was determined in trials with six farm flocks totalling 524 lambs, and in an indoor trial with thirty lambs penned individually.

2. On one farm and in the indoor trial, in both of which the rates of gain were relatively high, there was, in terms of weight gain, a significant difference in favour of the lambs with implants. On the remaining five farms, where the rates of gain were low, there was no significant difference due to treatment.

3. Sex did not affect the rate of gain in weight, but in the indoor trial mammary development in the treated ewe lambs was considerable and, in consequence, their carcass classification was lowered. Also, in the indoor trial, the carcasses of treated ewe and wether lambs were of a lower grade than those of the controls.

4. No instance of prolapse of the rectum or uterus or other ill-effect was observed in any of the treated lambs.

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