# THE EFFECTS OF DIETHYLSTILBESTROL PLUS METHYLTESTOSTERONE ON SWINE PERFORMANCE AND COMPOSITION

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ABSTRACT

THE EFFECTS OF DIETHYLSTILBESTROL PLUS METHYLTESTOSTERONE ON SWINE PERFORMANCE AND COMPOSITION

by Thomas D. Bidner

Sixty-four pigs weighing approximately 100 lb. were randomly assigned to a 2 x 2 x 2 factorial experiment (12% and 16% protein, barrows and gilts, and with and without 1 mg. diethylstilbestrol plus 1 mg. methyltestosterone, DES + MT, per lb. of ration) and fed to slaughter weight of approximately 210 lb. The experiment was initiated to study the effects of DES + MT, protein level and sex group upon: (1) Feedlot performance; (2) Carcass characteristics; (3) Right ham composite analysis including percents moisture, fat and protein; (4) Blood analysis including hematocrit, hemoglobin, total serum protein, electrophoresis of serum proteins, serum calcium and phosphorus; (5) Femur analysis including weight, calcium, phosphorus, percent ash, moment of inertia, maximum load, bending moment and breaking stress; (6) Some endocrine gland weights; and (7) Organoleptic analysis. The DES + MT treated pigs gained 1.68 lb./day compared to 1.67 lb. for untreated pigs. Pigs receiving DES + MT consumed 0.3 lb. less feed per day and also required less feed per pound of gain. Hormone treated pigs were longer (0.3 in.), leaner (0.15 in. less backfat) and heavier muscled (0.44 sq. in. more _l. dorsi_ muscle area) than controls. The DES + MT treatment also increased ham and loin by 2% and lean cuts by 2.6% compared to untreated controls. Composite ham samples from treated pigs had significantly ($P < .01$) more moisture (3.8%), protein (1.14%) and less fat (4.68%) than controls.

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Hormone treatment had no significant effect upon hematocrit, hemoglobin, serum calcium, serum inorganic phosphorus, or total serum protein, but the serum protein components were significantly altered. The DES + MT treated pigs had 3.3% more albumin and 1.3% less $\beta$-globulin than untreated controls. The $\alpha$- and $\gamma$-globulins were also reduced but the differences were not significant ($P > .05$). The femur from treated pigs weighed 20 gm. more than that from the controls. These bones also had significantly ($P < .01$) larger moment of inertia, maximum load and bending moment compared to controls. The pituitary gland from the treated and control pigs weighed 0.3201 and 0.2907 gm., respectively.

Identical taste panel scores (6.5) were observed for the loin roasts from control and treated pigs. Three independent taste panelists detected an undesirable odor in seven loins from among the hormone treated pigs. The DES + MT treated loins required 0.5 lb. less shear force than controls.

Protein level had no significant influence on feedlot performance. Significantly ($P < .01$) larger *l. dorsi* muscle areas (4.14 sq. in.) at the 10th rib were found among the 16% protein ration than the 12% protein ration (3.79 sq. in.). Higher protein level also tended to increase percent ham and loin and lean cuts but these differences were nonsignificant ($P > .05$). Composite ham analysis of the 16% protein level had significantly ($P < .05$) more moisture and less fat than the 12% level. None of the blood components were influenced by protein level fed except serum calcium which was decreased from 10.8 mg./100 ml. to 10.3 mg./100 ml. by the higher protein level. The 16% protein ration also significantly ($P < .05$) increased femur moment of inertia and maximum load.

No differences in feedlot performance were observed between barrows and gilts. Gilt carcasses had significantly more _l. dorsi_ muscle area, ham and loin, lean cuts and less fat trim than barrow carcasses. Gilt carcasses also had less backfat thickness and were longer but these differences were nonsignificant. Ham composition analysis was similar between barrows and gilts. Barrows had significantly ($P < .05$) heavier pituitary glands (0.3184 gm.) than gilts (0.2925 gm.). All blood components measured were similar for barrows and gilts except for serum calcium. Gilts had serum calcium levels of 10.8 mg./100 ml. compared to 10.3 mg./100 ml. for barrows. Gilt femur bones also had significantly larger moment of inertia than barrows.

There was a significant ($P < .01$) interaction between DES + MT x sex for daily gain. Hormone treatment reduced the rate of gain among barrows while it enhanced gilt daily gains. The interaction of DES + MT x protein level was also significant ($P < .05$) for gain per day. The hormone treated pigs gained faster on the 16% protein ration (1.71 vs. 1.65 lb./day) while the untreated pigs gained faster on the 12% protein ration (1.72 vs. 1.63 lb./day). The DES + MT treated pigs were also significantly ($P < .05$) leaner on the 16% protein ration when compared to the 12% protein ration.

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# INTRODUCTION

Todays swine producing industry requires rapid growing and efficient hogs which will yield carcasses with a minimum of backfat and a maximum of muscle. In recent years, great strides have been made through selection and testing programs to improve these desirable characteristics in swine. However, it has been repeatedly shown that gilts yield leaner, heavier muscled carcasses than barrows. Barrows usually gain more rapidly but gilts are more efficient. It is evident that differences between barrows and gilts are associated with their sex hormonal activities which in turn influence the performance and carcass traits of swine.

Numerous studies have reported an anabolic effect with diethylstilbestrol feeding in ruminants and with testosterone or some of its derivatives in rats. Recent work has suggested that feeding a combination of diethylstilbestrol and methyltestosterone to swine may exert a similar anabolic effect especially among barrows.

The protein content of the ration has also been reported to exert an influence on swine carcass quantitative characteristics especially leanness and amount of muscle.

This experiment was initiated to study the effects of feeding a combination of diethylstilbestrol and methyltestosterone upon swine performance and composition.

The specific objectives of this study were as follows:

1. To study the effect of these hormone-like compounds upon feedlot performance, carcass qualitative and quantitative

characteristics, some blood and bone components, and some endocrine gland weights.

2. To study the influence of ration protein levels and the possible interactions with hormonal treatment.
3. To determine possible differences in response between barrows and gilts to the hormonal treatment and/or protein levels.

## REVIEW OF LITERATURE

The effect of diethylstilbestrol, methyltestosterone or a combination of these hormones on swine as measured by the following parameters:

### Performance

Numerous workers have shown that diethylstilbestrol exerts an anabolic effect in ruminants. Additionally, rate of gain and feed efficiency have been significantly improved by either feeding or implanting diethylstilbestrol. Few such data are available for swine.

Dinusson *et al.* (1951) observed no growth stimulation from stilbestrol implants, but treated gilts required 5.2 to 13.7% less feed per hundred pounds of gain than controls. Woehling *et al.* (1951) found that two 12 mg. implants had no significant effect upon rate of gain, daily feed consumption, or feed efficiency.

Pearson *et al.* (1952) conducted three separate experiments and concluded that stilbestrol implants did not materially affect gains of either gilts or barrows but apparently caused growth depression among young boars.

Perry *et al.* (1954) fed 2.5 mg. of stilbestrol daily from 45 lb. to 125 lb. and then increased the level to 5 mg. daily; however, no significant improvement of either growth rate or feed efficiency over that exerted by antibiotic feeding was observed. Beeson *et al.* (1955) reported similar results from hogs fed 2 mg. of stilbestrol daily. Taylor *et al.* (1955) fed 0, 5, 10, 20, 40, 80, 160, 320, 640, and 1280 mcg. of stilbestrol per pound of ration but none of these levels had an effect upon the rate of gain or feed efficiency. In a similar experiment, Sewell _et al._ (1957) fed 0.5, 2.0, and 2.5 mg. of stilbestrol per pound of feed with no consistent growth stimulating effect. However, they noted a trend toward more efficient feed utilization among pigs which received a combination of the high level of stilbestrol and antibiotics.

Tribble _et al._ (1958) used intact and castrate males and females to determine the effect of added hormones. Their data indicated that neither sex nor stilbestrol caused significant differences in rate of gain. However, they observed a sex-stilbestrol interaction in that the males increased and the females decreased in rate of gain when stilbestrol was fed.

Hale _et al._ (1960) fed pigs both high and low energy rations which were supplemented with 2 mg. of stilbestrol per day and they observed no significant difference in rate of gain. The best feed efficiency was obtained on the high energy-low protein ration containing stilbestrol.

Cahill _et al._ (1960) implanted both barrows and gilts with stilbestrol pellets of 1.5, 3.0, and 6 mg. at 150 lb. They noted decreased growth rate among the implanted barrows while the gilts receiving the 3 mg. implant gained more rapidly and consumed less feed per unit of gain than the control gilts. Day _et al._ (1960) also reported that stilbestrol implants had no significant effect upon growth rate of barrows and that high levels of stilbestrol tended to reduce growth.

Beacom (1963) reported that a single 12 mg. stilbestrol implant had no influence on rate of gain among barrows. The hormone treated barrows showed reduced average feed consumption of 0.52 lb./day and improved feed efficiency when the protein level was increased from 14 to 16%. The latter author also observed a protein X hormone interaction which indicated that the major improvement due to implantation occurred when additional protein was fed. Gorrill et al. (1964) also implanted hogs with 12 mg. of stilbestrol and they observed reduced average daily gain for barrows from 1.53 to 1.36 lb., but increased gilt gains from 1.26 to 1.34 lb. The daily feed intake of the barrows was decreased from 6.0 to 5.3 lb. while feed intake of the implanted gilts increased from 5.0 to 5.4 lb.

Sleeth et al. (1953) conducted two trials in which they injected hogs with 1 mg. of testosterone propionate per kilogram of body weight once weekly for six weeks and then semi-weekly for 115 days. They observed that treatment reduced the gain per day but had no effect upon feed efficiency.

On the other hand, Perry et al. (1954) fed 20 mg. testosterone daily from 45 lb. to 125 lb. and then 40 mg. daily to the finish of the test. They noted no significant improvement on growth rate or feed efficiency over that exerted by antibiotic feeding alone. In a similar experiment, Beeson et al. (1955) fed 20 mg. of testosterone throughout the experiment but in this case the hormone reduced the rate of gain but had no effect upon feed efficiency. Perry et al. (1956) fed pigs 9, 17, 27, 34, 47, 52 and 62 mg. of testosterone per day. They observed that 9 mg. per day had no effect on growth rate, but the higher levels reduced growth rate. The pigs that received 17 mg. or more had lower feed consumption and greater feed efficiency.

Johnston *et al.* (1957) in a summary of five experiments reported that there were no differences between feeding 9 mg. or 15 mg. of methyltestosterone per pound of feed. In both cases, the data showed that methyltestosterone decreased rate of gain, daily feed consumption and feed efficiency. However, Noland and Burris (1956) found no apparent effect upon weight gain, feed consumption or feed utilization for either intact males, castrated males, intact females or castrate females when methyltestosterone was fed at rate of 0, .015, 0.15, and 1.5 mg./kg. of body weight.

Whiteker *et al.* (1959) found that providing 20 mg. of methyltestosterone per head daily had no significant effect on rate of gain. Hale *et al.* (1960) fed barrows 20 mg. of methyltestosterone per day from 60 to 205 lb. They found that testosterone reduced the gains on a high energy ration but had no effect on low energy rations.

In a more recent experiment, Henry (1962) reported that feeding 3 levels (2, 4, and 8 mg./lb.) of 4-hydroxy-17-alpha-methyltestosterone had no significant influence upon feedlot performance.

Since neither estrogenic nor androgenic compounds have had a significant effect on feedlot performance alone, combinations of sex hormones have been studied.

Thrasher *et al.* (1959) studied various combinations of feeding and implanting stilbestrol and testosterone but none of their treatments had a significant effect upon growth rate. Jordan *et al.* (1965) reported a study in which they fed pigs a combination of diethylstilbestrol and methyltestosterone (2.2 mg. per kilogram of ration) from 48.8 to 99.8 kg. When the combined data for barrows and gilts were compared, the latter authors found that the hormones reduced rate of gain and feed consumption while feed efficiency was increased by 5%. This increase in feed efficiency was largely attributable to the barrow performance.

Baker et al. (1967) fed 2.2 mg. of methyltestosterone and diethylstilbestrol per kilogram of ration in three separate experiments and found that the hormones tended to increase feed efficiency especially among barrows but no significant effect upon rate of gain was observed.

Wallace and Lucas (1969) also conducted 3 experiments to determine the influence of feeding either 1 or 2 mg. of methyltestosterone and diethylstilbestrol per pound of ration. They reported that while gains were less among the hormone treated pigs they were not significantly different from controls. Hormone treatment also resulted in greater feed intake reduction among barrows than for gilts. In experiment 2 the treated hogs also gained more efficiently but these effects were not observed in the other experiments.

## Physical appearance

It has been reported that hormone administration may have undesirable side effects. Woehling et al. (1951) reported that reproductive organs from hogs implanted with diethylstilbestrol or methyltestosterone showed evidence of hormonal stimulation. Dinusson et al. (1951), Pearson et al. (1952), Perry et al. (1954), Beeson et al. (1955), Swell et al. (1957), Thrasher et al. (1959), and Gorrill et al. (1964) found that stilbestrol treatment caused teat development in both barrows and gilts and swelling of external genitalia of gilts. Taylor et al. (1955) fed levels of 0, 5, 10, 20, 40, 80, 160, 320, 640, and 1280 mcg. of stilbestrol per pound of ration but only those fed 320 mcg./lb. or more showed enlargement of teats and gilts also showed enlargement of the vulva.

Fewer instances of side effects have been reported for testosterone administration. Beeson et al. (1955) observed no side effects when barrows and gilts were fed 20 mg. of testosterone per day. Henry (1962) also reported no viriligenic effects when hogs were fed 2, 4 or 8 mg. of 4-hydroxy-17-alpha-methyltestosterone per pound.

On the other hand, Perry et al. (1956) fed 9, 7, 27, 34, 47, 52 and 62 mg. of methyltestosterone per day and observed that high levels of methyltestosterone caused the vulva to assume a fish hook shape. Whiteker et al. (1959) reported that 20 mg. of testosterone per day caused both barrows and gilts to show masculine behavior and characteristics.

To date no one has reported undesirable side effects from feeding a combination of diethylstilbestrol and testosterone.

## Carcass merit

Pearson et al. (1952) reported that stilbestrol implants had no effect upon dressing percent, backfat thickness or tenderness of swine. Sleeth et al. (1953) observed that testosterone propionate reduced backfat but they indicated this could have been due to their slower gains. Noland and Burris (1956) also reported that 1.5 mg. of methyltestosterone per kilogram of body weight produced carcasses with less backfat and higher percent of primal cuts.

Beeson et al. (1955) indicated that carcasses from pigs fed 20 mg. of testosterone had heavier weights of ham, loin, picnic and boston butt which were accompanied with lighter fat cut weights. The hormone increased the percentage of four lean cuts from 58.8% to 62.4% in the latter study and physical composition analyses of these carcasses showed 5% less fat and a concomitant 5% increase in lean compared to controls. The latter authors also observed a trend toward leaner carcasses among stilbestrol treated animals but the effect was nonsignificant.

Perry et al. (1956) also observed that 9 mg. and higher levels of methyltestosterone increased carcass leanness with a concomitant significant decrease in backfat. Heitman and Clegg (1957) reported that implants of 30 mg. of stilbestrol or more at light weights (58-73 lb.) yielded leaner carcasses which were shorter, had less backfat, and a greater lean cut percent. They concluded that the leaner carcass may have resulted from reduced gains since implants at heavier weights had no effect upon gains and there were no differences in backfat thickness or percent four lean cuts.

Johnston et al. (1957) in summarizing five experiments reported that either 9 or 15 mg. of methyltestosterone reduced backfat thickness in four experiments; but in the fifth experiment, when the animals were confined to metabolism cages with practically no activity, there was no decrease in backfat thickness.

However, Tribble et al. (1958) observed that feeding 0.25 mg. of stilbestrol per pound of feed had no significant influence upon carcass characteristics of gilts, spayed gilts, boars, or barrows.

Thrasher *et al.* (1959) reported that methyltestosterone or 11 beta-hydroxy-17 alpha-methyltestosterone improved carcass leanness but various combinations of feeding or implanting stilbestrol and testosterone had no significant effect upon live backfat probes of growing-finishing swine. Whiteker *et al.* (1959) also observed carcasses with significantly higher percents of lean cuts than controls from feeding swine 20 mg. of methyltestosterone per head daily. Cahill *et al.* (1960) showed a positive relationship between amount of stilbestrol implanted and both size of *longissimus dorsi* muscle and percent four lean cuts. Day *et al.* (1960) reported that stilbestrol and progesterone-estradiol implants significantly reduced backfat. In a similar experiment, Hale *et al.* (1960) observed a decrease in backfat thickness of pigs which received testosterone but stilbestrol exerted no effect on backfat thickness. Neither stilbestrol nor testosterone had any effect on carcass length or area of *longissimus dorsi* muscle.

Beacom (1963) implanted barrows with 12 mg. of stilbestrol and observed less backfat, larger areas of the *longissimus dorsi* muscle, and greater net returns among treated pigs than controls.

More recently, Jordan *et al.* (1965) reported that a combination of 2.2 mg. of diethylstilbestrol and methyltestosterone per kilogram of ration increased lean cuts and reduced backfat and fat trim. Baker *et al.* (1967) obtained similar results by feeding the combination of 2.2 mg. of diethylstilbestrol and methyltestosterone per kilogram of ration. The latter authors observed that regardless of sex or protein level of the ration, carcass leanness was improved with hormone treatment but the response tended to be greater among barrows than for gilts. The criteria they used to measure carcass leanness were: backfat thickness, percent lean cuts, percent fat trim plus leaf fat, area of the longissimus dorsi muscle and length.

Wallace and Lucas (1969) fed the same combination of diethylstilbestrol and methyltestosterone as mentioned in the latter two experiments. They reported that hormone treatment significantly reduced backfat thickness in all experiments and this observation was much more pronounced among barrows than for gilts. The treatment also significantly increased the percent lean cuts; however, longissimus dorsi muscle area was not increased by hormone feeding.

Chemical analysis

Clegg and Carroll (1956) showed that stilbestrol implants in cattle significantly increased the percent moisture and reduced ether extract content of a rib steak. Ogilvie et al. (1960) observed a significant increase in percent protein and moisture and a decrease in fat among carcass composite samples from steers fed either 10 or 30 mg. of stilbestrol per day. Wallentine et al. (1961) obtained similar results when steers received 10 mg. of stilbestrol per day.

Henry (1962) observed that three levels of 4-hydroxy-17-alpha-methyl-testosterone significantly increased the protein content of the untrimmed, boneless wholesale cuts of swine. On the other hand, Whiteker et al. (1959) reported the protein content of pork loin was not increased by feeding methylandrostenediol, methyltestosterone or thyroprotein but in fact tended to decrease.

Bone

Numerous studies with the rat, dog, and guinea pig have shown that testosterone and certain of its derivatives exert an anabolic effect upon these animals. However, Turner _et al._ (1941) found that even with prolonged injections of large amounts of testosterone propionate the skeletal structure of rats was not affected. O'Mary _et al._ (1952) also observed that western lambs treated with stilbestrol had a higher percent of bone plus connective tissue but there was no significant difference in percent bone alone. Clegg and Carroll (1956) also observed a nonsignificant trend toward increased percent bone in cattle implanted with stilbestrol.

Bell _et al._ (1957) fed lambs 4 mg. of stilbestrol daily and showed that treatment increased body retention of calcium, phosphorus and nitrogen. Wallentine _et al._ (1961) found that bone from stilbestrol fed steers contained a lower percent ether extract and a higher percent ash than untreated controls.

Blood components

Gardner and Pfeiffer (1943) observed that injection of estrogenic hormones increased levels of serum calcium and accelerated the formation of endosteal bone in birds. Whitehair _et al._ (1953) noted that lambs implanted with stilbestrol retained 60% more calcium, 30% more phosphorus, and 83% more nitrogen than the control group. Wilkinson _et al._ (1954) also reported that lambs treated with stilbestrol had a significantly lower hematocrit than controls. The latter authors observed that treated lambs had a significantly higher quantity of plasma globulins and total proteins than controls. Shroder and Hansard (1958) observed similar results from lambs fed 2 mg. of stilbestrol per day. Their data revealed that fecal endogenous calcium was reduced approximately 20% with little apparent influence upon calcium absorption. Phosphorus absorption was increased but fecal endogenous phosphorus was only slightly decreased by hormone treatment.

## Endocrine gland weights

Clegg and Cole (1954) showed that the pituitary glands of the stilbestrol treated steers were in all cases significantly larger than controls. The adrenal glands showed a similar response. Cahill *et al.* (1956) reported similar findings when either bulls or steers were implanted with 84 mg. of diethylstilbestrol. In the latter study the hormone treated cattle had significantly heavier pituitary and adrenal glands at the end of the experiment compared to controls. Struempler and Burroughs (1959) observed an increase of the anterior pituitary of cattle fed diethylstilbestrol. Preston and Burroughs (1958) also observed heavier anterior pituitary weights from lambs fed stilbestrol.

Johnston *et al.* (1957) observed that feeding methyltestosterone sometimes reduced adrenal gland size of swine but at other times it had no such effect.

## Pork palatability

Pearson *et al.* (1952) reported that the administration of stilbestrol implants appeared to have little influence on organoleptic rating of loin roasts. Sleeth *et al.* (1953) found similar results with injections of testosterone propionate. They observed no differences among roasts from hormone treated and control groups in palatability scores or Warner-Bratzler shear values. However, Wallace and Lucas (1969) reported that feeding 1 mg. of methyltestosterone and diethylstilbestrol per pound imparted an undesirable aroma and flavor to the pork as determined by taste panel evaluation of roasts. They observed considerable variability between samples from treated pigs with some showing little or no objectionable odor and flavor. However, the objectionable roasts were invariably observed among both treated barrows and gilts.

## The effect of protein level on swine performance and carcass traits

Robinson et al. (1952) reported that when swine were fed rations containing approximately 10, 12, 15 and 20 percent protein the resultant carcasses from the higher protein levels yielded more lean cuts and less fat trim than those from lower protein levels. Ashton et al. (1955) observed similar results on carcass leanness in their studies of protein level.

Catron et al. (1952) fed protein levels that varied from 8 to 20% on a corn-soybean oil meal ration. Levels of protein had no significant effect upon rate of gain, feed efficiency or any of the carcass traits measured.

Tribble and Pfander (1955) compared 12 and 16% protein levels for pigs being full-fed and limited fed. Their data indicated no differences in feed economy between protein levels; however, the carcasses of pigs fed the high protein rations contained 1.6% more lean cuts and 4.5% less fat than the low protein fed pigs. In contrast, Jensen et al. (1955) observed a significant effect of protein level on rate of gain, with the 16 and 18% protein level yielding maximum gains.

Baird et al. (1958) in comparing high levels of protein (17, 19, and 21%) to low levels (11, 13, and 15%) noted that there was no effect upon daily gain and feed efficiency; in fact, the high protein levels were negatively correlated with these traits. When high quality protein rations were fed, Kropf et al. (1959) also found that both 12 and 16% total protein were able to support good growth from weaning to 200 lb. In their studies, the carcasses from pigs fed the 16% protein ration had greater cross sectional areas of the longissimus dorsi muscle, increased carcass specific gravity, higher levels of carcass protein, and decreased backfat thickness as compared to those fed the 12% protein ration.

Stevenson et al. (1960) fed levels of 14 and 18% protein up to 125 lb. and then the levels were reduced to 11 and 15% protein until slaughter. Their data showed the higher protein rations significantly increased feed efficiency, carcass grade, and preferred cuts while backfat thickness and total carcass fat were significantly reduced. On the other hand, both Braude et al. (1960) and Hudman and Peo (1960) were unable to show that protein level had a significant effect upon any of the carcass traits measured.

Aunan et al. (1961) reported that initial protein levels of 14, 16, and 18% did not significantly affect daily gains. Their data supported the thesis that genotype of the animal is the important factor in carcass leanness and that initial protein level for weanling pigs, within the range of 14 to 18% had only minor influence on carcass quality.

Clawson et al. (1962) fed rations containing protein levels from 10 to 18% formulated so that a similar ratio of amino acids was maintained. They observed that feed efficiency was more closely associated with energy level of the ration than with the calorie-protein ratio. A constant calorie-protein ratio was maintained as energy and protein levels were increased in the rations; however, the feed per pound of gain decreased consistently with increasing protein levels. In their studies, the physical measurements and chemical determinations made on the carcasses were not significantly influenced by rations. Jones et al. (1962) found when the total digestible nutrients were held constant and the protein level was increased from 12 to 21% that the 18% ration yielded the highest average daily gain and feed conversion. Supplementation with lysine also stimulated gain and feed efficiency.

Wagner et al. (1963) fed pigs three levels of protein (13, 19, and 25%) and two productive energy levels (950 and 1170 Kcal./lb.). They showed that as protein levels increased above 13% average daily gain and feed required per hundred pounds of gain decreased. The latter authors also found that as protein level increased carcass backfat decreased and percent lean cuts increased. Additionally, higher protein levels increased tissue nitrogen in one experiment but not in a second trial.

Dukelow et al. (1963) self-fed a corn-soybean oil meal ration containing 12, 14, and 16% protein and the 12 and 14% protein rations were supplemented with L-lysine and L-lysine plus methionine to equal the amino acid level of the 14 and 16% protein corn-soybean meal rations. They noted that neither the higher protein levels nor amino acid supplemented rations had a significant influence on rate of gain, feed efficiency, or any of the carcass traits measured.

Crum et al. (1964), Robinson et al. (1964), and Seymour et al. (1964) reported that pigs fed high protein rations grew more rapidly and produced leaner carcasses with less backfat and larger longissimus dorsi muscle areas. Crum et al. (1964) also observed that the higher protein levels decreased carcass firmness and degree of marbling. Similar results were obtained by Holme and Robinson (1965).

Meade et al. (1966) were unable to obtain a significant response in growth rate, feed efficiency or carcass leanness with increased protein content of the ration or amino acids supplementation. Hale and Southwell (1967) found that pigs fed rations containing either a 18 to 15 or 16 to 13% protein sequence were more efficient and had higher lean cut yields than pigs fed the 14 to 11% protein rations.

Jurgens et al. (1967) observed that average daily gain and feed efficiency were increased by feeding 16% protein as compared to 12% but these traits were not significantly affected by supplementation with 0.1% L-lysine. They also reported that the higher protein level increased protein and reduced fat content of the longissimus dorsi muscle. In a similar experiment, Lee et al. (1967) reported that higher protein levels increased rate of gain, feed efficiency, and carcass leanness. They also indicated that protein level had no effect upon panel juiciness, tenderness, flavor or overall acceptance score.

Some compositional and feedlot performance differences between barrows and gilts

Bruner et al. (1958), Cameron (1960), Mulholland et al. (1960), Wagner et al. (1961), Waldren (1964), Crum et al. (1964), McCampbell and Baird (1965), Hale and Southwell (1966) and Hines (1966) found that barrows grow faster than gilts. Comstock et al. (1944) also reported that barrows grow faster than gilts and this difference in growth rate increased with age.

Bell et al. (1958), Cameron (1960), Hines (1966), and Hale et al. (1968) reported that barrows consumed more feed per day than gilts. Bowland and Berg (1959), Wagner et al. (1961) and Hale et al. (1968) observed that barrows required more feed per unit of gain than gilts. However, Hines (1966) noted no difference between barrows and gilts in feed efficiency.

McMeekan (1940) described the intact female as having less fat, more bone and more muscle than barrows.

Self et al. (1957) obtained data on 584 gilt and barrow carcasses which indicated that gilt carcasses contained more muscle and less fat than barrows. Additionally, gilt carcasses had significantly larger longissimus dorsi muscles than barrows (3.81 and 3.49 sq. in., respectively).

Bruner et al. (1958) published data obtained on full sib pairs (barrows and gilts) at the Ohio Swine Evaluation Station over a period of five seasons. They reported that gilt carcasses had 2.3% more lean cuts, 0.41 in. greater length, 0.51 sq. in. larger longissimus dorsi muscles, and 0.1 in. less backfat than littermate barrows.

Kropf et al. (1959) concluded that gilt carcasses contained more muscle and less fat than barrow carcasses. They also noted that gilt carcasses had greater specific gravity values, higher percents lean cuts, and larger longissimus dorsi muscle areas. In addition, chemical analysis of a carcass composite sample showed that gilt carcasses contained less fat, more protein and moisture than barrows. Cahill et al. (1960) obtained similar results and concluded that differences in leanness became obvious after the pigs reach 150 lb. Handlin et al. (1961) also reported that gilt carcasses were superior in most quantitative characteristics to barrow carcasses.

Salmela et al. (1963) and Cahilly et al. (1963) concluded that gilts were superior to barrows in all attributes of carcass leanness. Cox (1963) observed that barrows had a slightly higher proportion of fat over the shoulder and a smaller proportion over the loin than gilts.

Fletcher et al. (1963) compared barrow and gilt carcasses as to wholesale cuts, edible portion, fat, and bone. Their data showed that gilts had a significantly greater ham and loin edible portion as well as greater total percent of edible portion. The latter authors also found that gilts possessed significantly greater percents of bone and less fat than barrows.

Waldren (1964) reported female carcasses had significantly less shoulder and middle cuts, less backfat, and greater longissimus dorsi muscle areas than male carcasses. Judge (1964) also found that weight of edible portion of hams was significantly greater in gilts than barrows. Crum et al. (1964) reported similar results but they also noted that barrows had more marbling than gilts.

Rahnefeld (1965) reported results summarizing the effect of breed and sex and contrary to the findings of most workers, they found no breed or sex differences in backfat thickness.

Hale and Southwell (1966) and McCampbell and Baird (1965) observed that gilt carcasses were leaner and heavier muscled than barrow carcasses. Hale and Southwell (1966) also reported that gilt carcasses had a significantly higher dressing percent as compared to barrows.

Hines (1966) showed that gilts yielded carcasses with less backfat (0.11 in.), larger *longissimus dorsi* muscle areas (0.52 sq. in.) and greater length (0.2 in.) than barrows when slaughtered at similar weights. In addition, gilts cut a higher percentage of ham and loin (1.7%) as well as lean cuts (1.8%) than barrows. Dressing percentage usually favored barrows which was consistent with greater backfat depth among barrows.

Recently, Hale *et al.* (1968) found gilt carcasses were longer, contained larger loins and yielded higher percentages of lean cuts as compared to barrows.

## EXPERIMENTAL PROCEDURE

Eighty-six crossbred weanling barrows and gilts were obtained from a Michigan feeder pig sale and fed the standard M.S.U. 16% protein growing ration until they reached 100 lb. live weight. At 100 lb., 64 pigs were randomly divided among eight treatment groups of 8 pigs each as shown in table 1.

TABLE 1. EXPERIMENTAL DESIGN

| Lot number | | Number of | |
|---|---|---|---|
| Gilts | Barrows | hogs/lot | Treatment |
| 7 | 7A | 8 | 12% protein plus DES + MT[a] |
| 8 | 8A | 8 | 12% protein ration |
| 9 | 9A | 8 | 16% protein plus DES + MT[a] |
| 10 | 10A | 8 | 16% protein ration |

[a]DES + MT = 1 mg. of diethylstilbestrol per lb. and 1 mg. of methyltestosterone per lb. of ration.

Composition of the rations is shown in table 2. Barrows and gilts were fed separately in 10 ft. x 15 ft. concrete floor pens. Automatic water fountains and self-feeders were located in each pen to provide *ad libitum* water and feed, respectively.

The experiment was started May 1, 1967, and the last group of hogs was taken off test July 21, 1967. Feedlot data were obtained by weighing the animals every two weeks for the first six weeks and weekly thereafter.

TABLE 2. COMPOSITION OF THE RATIONS

| | Lot | | | |
|---|---|---|---|---|
| | 7 & 7A | 8 & 8A | 9 & 9A | 10 & 10A |
| Ingredients | lb. | lb. | lb. | lb. |
| Corn | 891.2 | 891.2 | 795.1 | 795.1 |
| Soybean meal (50%) | 80.0 | 80.0 | 177.0 | 177.0 |
| Dicalcium phosphate | 11.2 | 11.2 | 9.2 | 9.2 |
| Limestone | 7.1 | 7.1 | 8.2 | 8.2 |
| Trace mineral salt (Hi-Zn) | 5.0 | 5.0 | 5.0 | 5.0 |
| V.T.M. - premix[a] | 5.0 | 5.0 | 5.0 | 5.0 |
| Bestron[b] | 0.5 | --- | 0.5 | --- |
| Tylan-10[c] | --- | 0.5 | --- | 0.5 |
| | 1000 | 1000 | 1000 | 1000 |
| Calculated analysis | | | | |
| % Protein | 12.0 | 12.0 | 16.0 | 16.0 |
| % Ca | 0.6 | 0.6 | 0.6 | 0.6 |
| % P | 0.5 | 0.5 | 0.5 | 0.5 |

[a]Ten lb. of V.T.M.-premix contains 0.6 lb. of M.S.U. A & D mix[d]; 1 lb. of B vitamin mix[e]; 1 lb. of vitamin $B_{12}$[f]; 0.1 lb. zinc oxide; and 7.3 lb. of ground yellow corn.

[b]1/2 lb. of Bestron contains 1 gm. of Diethylstilbestrol; 1 gm. of methyl-testosterone and 5 gm. of Tylosin.

[c]1/2 lb. of Tylan-10 contains 5 gm. of Tylosin.

[d]M.S.U. A & D mix contains 800,000 I.U. of vitamin D/lb. and 3,628,720 I.U. of vitamin A/lb.

[e]Vitamin B - Merck 1231 contains 8,000 mg. riboflavin/lb.; 14,720 mg. of pantothenic acid/lb.; 36,000 mg. of niacin/lb.; and 40,000 mg. of choline/lb.

[f]Dawes $B_{12}$ contains 6 mg. of vitamin $B_{12}$/ lb.

The pigs were removed from the experiment when they individually reached approximately 210 lb. live weight. Individual pig daily gains were calculated; however, feed consumption and feed efficiency represent lot averages.

## Slaughter Procedure

Bestron was withheld approximately 90 hours prior to slaughter. The animals were slaughtered in the University meat laboratory and dressed packer style. Hams were faced but the facing was left attached and leaf fat was loosened and removed after chilling. The carcasses were chilled at 34-40°F. for 48 hr.

Prior to cutting the carcasses, length and backfat thickness (av. of three measurements) were measured as described by the Pork Carcass Evaluation Committee (1952).

## Cutting Procedure

The cutting procedure followed was that described by the Pork Carcass Evaluation Committee (1952). Area of the *longissimus dorsi* muscle and marbling score (Wisconsin score system) were recorded at the 10th and last rib.

## Physical Separation and Grinding

The right trimmed ham plus collar fat and other fat trim from this ham were physically separated into skin, bone, and the combined lean and fat. The combination of lean and fat was ground five times to assure homogeneity, twice through a 1/4 in. plate and three times through a 5/64 in. plate. A sample of approximately 50 to 75 gm. was taken and stored in glass bottles at -20°F. for subsequent protein, fat, and moisture determinations.

## Chemical Analysis

Duplicate composite ham samples of approximately 5 gm. were placed in disposable aluminum dishes, and dried at 100°C. for 24 hr. for moisture determinations. Fat content was determined by extraction of the above dried sample with anhydrous ether for 3 1/2 to 4 hr. in a Goldfisch Fat Extractor as outlined in A.O.A.C. (1965). The micro-Kjeldahl technique described in A.O.A.C. (1965) was used to determine total nitrogen. Approximately 1 gm. of fresh tissue was used for this analysis.

The following formulas were used to calculate the percent moisture, fat, and protein on a fresh weight basis.

$$\frac{\text{wt. of 24 hr. dried sample}}{\text{wt. of fresh sample}} \times 100 = \%\ \text{moisture}$$

$$\frac{\text{wt. of dried ether extract}}{\text{wt. of fresh sample}} \times 100 = \%\ \text{fat}$$

*gm. nitrogen X 6.25 = gm. of protein

$$\frac{\text{gm. of protein}}{\text{wt. of fresh sample (gm.)}} \times 100 = \%\ \text{protein}$$

*Assumed that the protein contains 16% nitrogen

## Blood Analysis

The hogs were bled at the start and finish of the experiment. Blood samples were obtained from the anterior vena cava as described by Carle and Dewhirst (1942).

The blood was placed in centrifuge tubes, allowed to clot and the clot freed from the tube. The clot and serum were separated in a Servall model M centrifuge. The serum was then placed in vials and aliquots taken for serum protein and electrophoretic analyses. The remaining serum was frozen and stored at -20°F. until used for calcium and phosphorus analyses.

Hematocrit was determined using fresh blood according to the micromethod described by McGovern et al. (1955). The blood samples were centrifuged at 10,000 rpm. for 5 min. in an International "Hemacrit" centrifuge. Hemoglobin was obtained using fresh whole blood by the cyanmethemoglobin method of Crosby et al. (1954).

Total serum protein concentration was determined using the ultraviolet spectrophotometric technique described by Waddell (1956). Electrophoretic separation of serum proteins was accomplished on agar gel in a modified Durrum cell (Cawley and Eberhardt, 1962). Quantitation was accomplished with a Beckman Spinco Analytrol densitometer.

Serum calcium was determined by atomic absorption spectrophotometry (Jarrel-Ash Model 82-516 with a Hetco burner and an air-hydrogen flame) as described by Ullrey et al. (1967). Inorganic phosphorus was determined by application of the spectrophotometric method of Gomorri (1942).

## Bone Analysis

The right femur was cleaned of adhering tissues, weighed, and frozen at -10 to -20°F. for further analysis. Femur strength was determined by using the *Instron Testing Instrument Model-TT CML equipped with a load cell-F.M.-compression having 500 kg. full scale, crosshead speed of 0.2 cm./min. and a chart speed of 1 cm./min. The method for testing the bone strength and the formulas for maximum load, moment of inertia, maximal bending moment, and breaking stress were similar to those reported by Weir et al. (1949) and Miller et al. (1962).

One-half of the femur was cut into small pieces on a power band saw for determination of calcium, phosphorus, and percent ash. The fat and moisture were removed by subsequent 24 hr. extractions in absolute alcohol and anhydrous ether with a Soxhlet extractor. The dry, fat-free bone was ashed in a muffle furnace at 1200°F. for 18 hr.

Percent ash was determined as follows:

$$\frac{\text{wt. ashed bone}}{\text{wt. dry, fat free bone}} \times 100 = \%\ \text{ash on a dry, fat-free basis}$$

Approximately 300 mg. of powdered ash were dissolved in 5 ml. of 6N HCl and diluted to 100 ml. with deionized water for the calcium and phosphorus determinations. The ash solution was diluted 1:100 with 10,000 ppm. $SrCl_2$. This solution and standard stock solutions were used to determine bone calcium by atomic absorption spectrophotometry as described above for serum calcium.

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*Instron Engineering Corporation
Canton, Mass., U.S.A.

Bone phosphorus was determined by application of the spectrophotometric method previously described for serum phosphorus.

### Endocrine Gland Weights

Both right and left adrenal glands were excised during the slaughtering procedure and weighed after removing adhering tissues. After removal of the skull cap and brain, the pituitary gland was removed from the sella turcica and the intact gland was weighed to the nearest 0.1 mg.

### Organoleptic Analysis

A section of the right loin (11th to last rib) was scored for degree of marbling and then frozen at -10 to -20°F. for taste panel and tenderness studies. Two 1 in. chops were removed anterior to the last rib for tenderness evaluation.

The remaining loin section was wrapped in aluminum foil and roasted at an oven temperature of 350°F. in an Etco Convection Oven (Model 186C.2) to an internal temperature of 170°F. The internal temperature was recorded on a recording potentiometer. After cooking, the loins were uncovered and independently scored for odor by three panelists. The loins were allowed to cool to room temperature and were then divided into 18 equal parts for taste panel evaluation. A consumer type panel, comprised of Michigan State University Food Science personnel was instructed to rate each sample for overall preference only using a 9 point scale. Not more than five samples were presented at one time.

The two remaining chops were cooked in 280°F. deep fat to an internal temperature of 170°F. Four 1/2 in. cores were taken from each chop and were sheared at the approximated midpoint by the Warner-Bratzler shear apparatus.

## Statistical Analysis

Analysis of variance and simple correlations were determined as described by Steel and Torrie (1960).

## RESULTS AND DISCUSSION

### Feedlot Performance

#### The effect of diethylstilbestrol and methyltestosterone, sex and protein level upon swine performance

Table 3 summarizes the feedlot performance by hormone treatment, protein level, and sex. Pigs fed diethylstilbestrol plus methyltestosterone (DES + MT) gained 1.68 lb. per day which was essentially the same as that gained by controls (1.67 lb./day). This agrees with the findings of Baker *et al.* (1967) who found no significant difference in gains between hormone treated and control pigs. However, these findings disagree with the work of Jordan *et al.* (1965), Thrasher *et al.* (1967), and Wallace and Lucas (1969) since they reported a reduction in gain attributable to hormone feeding.

TABLE 3. FEEDLOT PERFORMANCE

| Trait | Hormone treatment | | Protein level | | Sex | |
|---|---|---|---|---|---|---|
| | DES + MT[a] | Control[a] | 12%[a] | 16%[a] | Barrows[a] | Gilts[a] |
| Gain/day, lb. | 1.68 | 1.67 | 1.69 | 1.67 | 1.70 | 1.66 |
| Feed/day, lb. | 6.1 | 6.4 | 6.4 | 6.2 | 6.3 | 6.2 |
| Feed/lb. gain, lb. | 3.69 | 3.92 | 3.89 | 3.72 | 3.84 | 3.89 |

[a]32 pigs per group.

Barrows gained 1.70 lb. per day while the gilts gained 1.66 lb. per day. Athough this difference was not significant ($P > .05$), this trend agrees with most reports in the literature which indicate barrows grow faster than gilts.

The treated pigs consumed 6.1 lb. of feed per day as compared to 6.4 lb. per day for the controls. Likewise these data agree with the current literature reports indicating that DES + MT-fed pigs consumed less feed per day. The hormone-fed pigs were also more efficient than controls. It took 3.69 lb. of feed per pound of gain among the DES + MT -fed pigs while controls required 3.92 lb. of feed per pound of gain. Jordan *et al.* (1965), Baker *et al.* (1967) and Wallace and Lucas (1969) found that DES + MT-fed pigs were more efficient than untreated controls.

Pigs fed the 16% protein ration also gained more efficiently than those receiving the 12% protein ration. Crum *et al.* (1964) and Hale and Southwell (1966) reported that pigs receiving higher levels of protein are more efficient than pigs receiving lower levels of protein.

The interaction of treatment X sex was significant ($P < .01$) for gain/day. The treated gilts gained 1.76 lb. per day compared to 1.60 lb. per day for the treated barrows, while the control gilts only gained 1.64 lb. per day compared to 1.71 lb. per day for the barrows. These data agree with the work of Baker *et al.* (1967) since they also found that DES + MT reduced the gains of barrows.

The interaction of treatment X protein level was significant ($P < .05$) for gain per day. The pigs receiving DES + MT-12% protein ration gained 1.65 lb. per day as compared to 1.71 lb. per day for those on the DES + MT-16% protein rations, while the control pigs on the 12% protein ration gained 1.72 lb. per day as compared to 1.63 lb. per day for those on the 16% protein ration. Thus, the hormone treated pigs gained faster on the 16% protein ration while the control pigs gained faster on the 12% protein ration.

## Carcass Merit

### Effect of diethylstilbestrol plus methyltestosterone

Table 4 shows the effects of DES + MT upon carcass traits. The hormone treated pigs had significantly ($P < .01$) less backfat, larger *l. dorsi* muscle areas at both the 10th and last rib, lower percent fat trim, higher percent lean cuts and percent ham and loin than the untreated controls. The hormone fed pigs were also 0.3 of an inch longer but this difference was nonsignificant. The DES + MT treated pigs produced carcasses that were leaner and heavier muscled than the controls. Jordan *et al.* (1965) and Baker *et al.* (1967) also found that hormone treated pigs produced carcasses that were leaner and heavier muscled than controls. However, these results disagree with the results of Wallace and Lucas (1969) since they reported that DES + MT had no significant effect upon the *l. dorsi* muscle size.

Hormone treatment reduced marbling score slightly, but since marbling scores represent a 15 point scale there was essentially no difference among treatments.

increased from 3.79 to 4.14 sq. in. These data agree with the findings of Kropf et al. (1959).

TABLE 5. INFLUENCE OF PROTEIN LEVEL ON CARCASS TRAITS

| Trait | 12% Protein[a] | 16% Protein[a] |
|---|---|---|
| Av. backfat thickness, in. | 1.68 | 1.63 |
| Length, in. | 30.1 | 30.2 |
| L. dorsi muscle area, 10th rib, sq. in. | 3.70 | 3.94 |
| L. dorsi muscle area, last rib, sq. in. | 3.79 | 4.14** |
| Fat trim, % | 27.4 | 25.8 |
| Lean cuts, % | 50.4 | 51.7 |
| Ham and loin, % | 33.9 | 34.7 |
| Marbling score, 10th rib[b] | 5.6* | 3.9 |
| Marbling score, last rib[b] | 4.0* | 2.8 |

*P < .05
**P < .01
[a]Each group contained 32 pigs.
[b]Based on 15 point scale, using the Wisconsin scoring system of 5 possible scores; each score was further divided into three categories, i.e., $1^-$, 1, $1^+$, $2^-$, etc.

The 16% protein level also tended to decrease the percent fat trim and to increase the percent lean cuts and ham and loin, but these differences were not significant. The 16% protein level significantly ($P < .05$) reduced marbling score at both the 10th and last rib. Crum et al. (1964) reported that higher levels of protein reduced marbling as compared to lower levels of protein.

Barrows vs. gilts

Carcass traits for the barrows and gilts are presented in Table 6. Gilts had less backfat and were longer than barrows but these differences were not significant.

TABLE 6. THE INFLUENCE OF SEX GROUP UPON CARCASS TRAITS

| Trait | Barrows[a] | Gilts[a] |
|---|---|---|
| Av. backfat thickness, in. | 1.70 | 1.61 |
| Length, in. | 30.1 | 30.3 |
| *L. dorsi* muscle area, 10th rib, sq. in. | 3.59 | 4.06** |
| *L. dorsi* muscle area, last rib, sq. in. | 3.73 | 4.20** |
| Fat trim, % | 27.6 | 25.6* |
| Lean cuts, % | 50.3 | 51.9* |
| Ham and loin, % | 33.5 | 35.1** |
| Marbling score, 10th rib[b] | 4.5 | 5.0 |
| Marbling score, last rib[b] | 3.6 | 3.1 |

*$P < .05$
**$P < .01$
[a]Each group contained 32 pigs.
[b]Based on 15 point scale, using the Wisconsin scoring system of 5 possible scores; each score was further divided into three categories, i.e., $1^-$, 1, $1^+$, $2^-$, etc.

The gilts had larger *l. dorsi* muscle areas at both the tenth and last rib and these differences were statistically significant ($P < .01$). Gilts also had significantly ($P < .05$) less fat trim, greater lean cuts, and higher percent ham and loin ($P < .01$) than barrows. Gilts had larger *l. dorsi* muscle areas (0.47 sq. in.) at both the tenth and last rib than barrows. These results are similar to those reported by Bruner *et al.* (1958) since they found gilts had 0.51 sq. in. larger muscle areas than barrows. Hale and Southwell (1966) and McCampbell and Baird (1965) reported that gilt carcasses were superior to barrows in most characteristics.

## Hormone treatment, protein level and sex interactions for the carcass traits

The interaction of DES + MT X sex, DES + MT X protein, and protein X sex for the carcass traits are summarized in Table 7. There were no significant effects upon carcass traits for the hormone treatment-sex interaction, thus hormones had a similar influence upon barrow and gilt carcasses. Baker *et al.* (1967) and others found that barrows were more affected by hormone treatment than gilts, especially for the carcass traits.

A significant ($P < .05$) interaction between hormone treatment and protein level was observed for backfat thickness only, when comparing the carcass traits. Carcasses from the hormone treated, high protein group had considerably less backfat than carcasses from the hormone treated 12% protein group, while this observation was reversed for the control groups, *i.e.*, the 12% protein group had less backfat than the 16% protein group. The protein X sex interaction had no significant effect upon any of the carcass traits measured.

TABLE 7. HORMONE TREATMENT, PROTEIN LEVEL, AND SEX INTERACTIONS FOR THE CARCASS TRAITS.

| | DES + MT X Sex | | | | DES + MT X Protein Level | | | |
|---|---|---|---|---|---|---|---|---|
| | DES + MT | | Control | | DES + MT | | Control | |
| Trait | Gilts[a] | Barrows[a] | Gilts[a] | Barrows[a] | 12% Protein[a] | 16% Protein[a] | 12% Protein[a] | 16% Protein[a] |
| Av. backfat thickness, in. | 1.56 | 1.60 | 1.66 | 1.79 | 1.66* | 1.50* | 1.69* | 1.76* |
| Length, in. | 30.3 | 30.3 | 30.2 | 29.8 | 30.2 | 30.4 | 29.9 | 30.1 |
| L. dorsi muscle area, 10th rib, sq. in. | 4.16 | 3.85 | 3.96 | 3.32 | 3.81 | 4.19 | 3.58 | 3.70 |
| L. dorsi muscle area, last rib, sq. in. | 4.42 | 4.01 | 3.97 | 3.45 | 3.98 | 4.45 | 3.59 | 3.83 |
| Fat trim, % | 24.6 | 25.6 | 26.6 | 29.5 | 26.4 | 23.9 | 28.4 | 27.6 |
| Lean cuts, % | 52.8 | 52.0 | 50.9 | 48.6 | 51.2 | 53.5 | 49.6 | 49.9 |
| Ham and loin, % | 35.8 | 34.8 | 34.4 | 32.2 | 34.5 | 36.1 | 33.3 | 33.3 |
| Marbling score, 10th rib[b] | 4.8 | 4.3 | 5.2 | 4.8 | 5.3 | 3.8 | 5.9 | 4.0 |
| Marbling score, last rib[b] | 3.1 | 3.8 | 3.2 | 3.5 | 4.2 | 2.7 | 3.8 | 2.9 |

*$P < .05$

[a]Each group contained 16 pigs.

[b]Based on 15 point scale, using the Wisconsin scoring system of 5 possible scores; each score was further divided into three categories, i.e., $1^-$, 1, $1^+$, $2^-$, etc.

## Chemical Analysis

### Effect of diethylstilbestrol plus methyltestosterone

The influence of DES + MT upon chemical composition of the ham muscle is shown in Table 8. Hormone treatment significantly (P < .01) increased the percent moisture and protein content of the composite sample of the right ham. The sample from the hormone treated pigs contained 54.07% and 15.31% moisture and protein, respectively, compared to 50.27% and 14.17% for the untreated controls. Percent fat was significantly (P < .01) reduced from 34.97% to 30.28% among the hormone fed pigs.

TABLE 8. EFFECT OF DES + MT ON HAM CHEMICAL ANALYSIS.

| Trait | DES + MT[a] | Control[a] |
|---|---|---|
| Moisture, % | 54.07** | 50.27 |
| Fat, % | 30.28** | 34.97 |
| Protein, % | 15.31** | 14.17 |

**P < .01
[a]Each group contained 32 pigs.

### 12% vs. 16% protein level

Table 9 compares the composite ham sample data from the pigs fed 12% and 16% protein.

The composite ham sample from the 16% protein level had significantly (P < .05) more moisture and less fat than the 12%. The 16% protein level

TABLE 9. THE EFFECT OF RATION PROTEIN LEVEL ON HAM CHEMICAL ANALYSIS.

| Trait | 12% Protein[a] | 16% Protein[a] |
|---|---|---|
| Moisture, % | 51.07 | 53.27* |
| Fat, % | 33.92 | 31.32* |
| Protein, % | 14.50 | 14.92 |

*P < .05
[a]Each protein level contained 32 pigs.

also had higher protein content but the difference was nonsignificant (P > .05). Jurgens et al. (1967) reported that loins from pigs fed 16% protein had significantly less fat and more protein than those fed 12% protein. Lee et al. (1967) observed that the ether extract of the trimmed loin and right ham varied inversely with the protein level fed.

## Barrows vs. gilts

The compositional analysis of the right ham for barrows and gilts is shown in Table 10. Gilts had hams with slightly more moisture and protein content and less fat than barrows, but these differences were not significant. Kropf et al. (1959) reported that the *longissimus dorsi* muscle of gilts contained more protein and moisture and less fat than barrows.

TABLE 10. THE EFFECT OF SEX GROUP UPON HAM CHEMICAL ANALYSIS.

| Trait | Barrows[a] | Gilts[a] |
|---|---|---|
| Moisture, % | 52.48 | 51.86 |
| Fat, % | 32.22 | 33.01 |
| Protein, % | 14.82 | 14.66 |

[a]Each sex group contained 32 pigs.

Hormone treatment, protein level, and sex interactions for the ham composition analysis

A summary of the hormone, protein level and sex interactions for the composite ham chemical analysis data is given in Table 11. There were no significant ($P > .05$) interactions between any of the variables studied for the ham chemical analysis.

## Blood Analysis

Effect of diethylstilbestrol plus methyltestosterone

Table 12 summarizes the effect of DES + MT on the blood components measured. Hormone treatment had no apparent effect upon hematocrit, hemoglobin, or total serum proteins. However, the DES + MT altered the percentage of the serum proteins, although it had no significant effect on the total amount of serum proteins. The hormone treated pigs had a significantly ($P < .01$) higher percent albumin than untreated controls. Although the $\alpha$-, $\beta$-, and $\gamma$-globulins were decreased, hormone treatment

TABLE 11. HORMONE TREATMENT, PROTEIN LEVEL AND SEX INTERACTIONS FOR THE HAM COMPOSITION DATA

| | DES + MT X Sex | | | | DES + MT X Protein Level | | | |
|---|---|---|---|---|---|---|---|---|
| | DES + MT | | Control | | DES + MT | | Control | |
| Trait | Gilts[a] | Barrows[a] | Gilts[a] | Barrows[a] | 12% Protein[a] | 16% Protein[a] | 12% Protein[a] | 16% Protein[a] |
| Moisture, % | 54.11 | 54.04 | 50.86 | 49.68 | 52.89 | 55.25 | 49.25 | 51.28 |
| Fat, % | 30.29 | 30.27 | 34.16 | 35.75 | 31.60 | 28.97 | 36.24 | 33.67 |
| Protein, % | 15.25 | 15.37 | 14.40 | 13.95 | 15.06 | 15.56 | 13.94 | 14.41 |

| | Protein Level X Sex | | | |
|---|---|---|---|---|
| | 12% Protein | | 16% Protein | |
| Trait | Gilts[a] | Barrows[a] | Gilts[a] | Barrows[a] |
| Moisture, % | 51.40 | 50.74 | 53.56 | 52.98 |
| Fat, % | 33.38 | 34.45 | 31.07 | 31.57 |
| Protein, % | 14.76 | 14.23 | 14.88 | 15.09 |

[a]Each group contained 16 pigs.

TABLE 12. EFFECT OF HORMONE TREATMENT UPON BLOOD COMPONENTS.

| Trait | DES + MT[a] | Control[a] |
|---|---|---|
| Hematocrit, % | 39.9 | 40.5 |
| Hemoglobin, gm./100 ml. | 12.8 | 12.9 |
| Total serum protein, gm./100 ml. | 6.28 | 6.23 |
| Albumin, % | 52.3** | 49.0 |
| $\alpha^1$-globulin, % | 5.1 | 6.4 |
| $\alpha^2$-globulin, % | 8.7 | 9.2 |
| $\alpha^3$-globulin, % | 6.6 | 6.8 |
| $\beta$-globulin, % | 9.1** | 10.4 |
| $\gamma$-globulin, % | 17.8 | 18.6 |
| Serum calcium, mg./100 ml. | 10.6 | 10.5 |
| Serum inorganic phosphorus, mg./100 ml. | 7.5 | 7.7 |

**$P < .01$

[a]Each group contained 32 pigs.

had the greatest effect upon the β-globulins and albumins since they were significantly ($P < .01$) reduced and increased, respectively. Baker et al. (1968) reported that DES + MT decreased serum cholesterol and also decreased serum triglycerides among gilts but had no influence upon free fatty acids. White et al. (1964) reported that most of the plasma lipids are present as lipoproteins and migrate electrophoretically with both the α- and β-globulins.

Serum calcium and phosphorus were not significantly ($P > .05$) influenced by hormone treatment in the present study.

<u>12% vs. 16% protein level</u>

The influence of protein level on blood components is shown in Table 13. Protein level had no significant effect upon any of the blood components measured except serum calcium. Pigs fed the 12% protein level had a serum calcium level of 10.8 mg./100 ml. as compared to 10.3 mg./100 ml. for the 16% protein group. This difference was significant ($P < .05$).

TABLE 13. INFLUENCE OF PROTEIN LEVEL ON BLOOD COMPONENTS

| Trait | 12%[a] | 16%[a] |
|---|---|---|
| Hematocrit, % | 40.2 | 40.2 |
| Hemoglobin, gm./100 ml. | 12.9 | 12.9 |
| Total serum protein, gm./100 ml. | 6.27 | 6.24 |
| Albumin, % | 50.3 | 51.0 |
| $\alpha^1$-globulin, % | 5.7 | 5.7 |
| $\alpha^2$-globulin, % | 9.3 | 8.6 |
| $\alpha^3$-globulin, % | 6.6 | 6.9 |
| $\beta$- globulin, % | 9.6 | 10.0 |
| $\gamma$-globulin, % | 18.6 | 17.6 |
| Serum calcium, mg./100 ml. | 10.8* | 10.3 |
| Serum phosphorus, mg./100 ml. | 7.6 | 7.6 |

*$P < .05$
[a]Each group contained 32 pigs.

Hormone treatment, protein level and sex interactions for the blood components

The hormone, protein level and sex interactions for the blood components are summarized in Table 15. There were no significant ($P > .05$) interactions between DES + MT X sex, DES + MT X protein, or protein X sex for any of the blood components observed in this study.

## Bone Analysis

The effect of diethylstilbestrol plus methyltestosterone

Table 16 summarizes the effect of DES + MT upon the bone (femur) data. Hormone treatment significantly ($P < .01$) increased weight of the femur bone. Clegg and Carroll (1956) reported that a trend existed toward higher percent bone in stilbestrol fed cattle.

There were no significant effects upon bone calcium, phosphorus or percent ash. The hormone treated pigs had significantly ($P < .01$) increased moment of inertia, maximum load, and bending moment. There was essentially no difference between the breaking stress of the bones from hormone treated and control pigs. The hormone treated pigs had increased bone weight but not strength. The bones from treated pigs also contained lower percent ash than the controls but this difference was not significant ($P > .05$).

TABLE 15. HORMONE TREATMENT, PROTEIN LEVEL, AND SEX INTERACTIONS FOR THE BLOOD COMPONENTS

| | DES + MT X Sex | | | | DES + MT X Protein Level | | | |
|---|---|---|---|---|---|---|---|---|
| | DES + MT | | Control | | DES + MT | | Control | |
| Trait | Gilts[a] | Barrows[a] | Gilts[a] | Barrows[a] | 12% Protein[a] | 16% Protein[a] | 12% Protein[a] | 16% Protein[a] |
| Hematocrit, % | 40.4 | 39.5 | 40.4 | 40.5 | 39.8 | 40.0 | 40.6 | 40.3 |
| Hemoglobin, gm./100 ml. | 12.7 | 13.0 | 13.1 | 12.8 | 12.9 | 12.7 | 12.9 | 13.0 |
| Total serum protein, gm./100 ml. | 6.3 | 6.3 | 6.1 | 6.3 | 6.3 | 6.3 | 6.3 | 6.2 |
| Albumin, % | 52.2 | 52.5 | 49.5 | 48.5 | 51.6 | 53.1 | 49.0 | 49.0 |
| $\alpha^1$-globulin, % | 5.2 | 4.9 | 5.6 | 7.1 | 5.0 | 5.2 | 6.5 | 6.2 |
| $\alpha^2$-globulin, % | 8.5 | 8.9 | 9.7 | 8.6 | 9.2 | 8.2 | 9.4 | 9.0 |
| $\alpha^3$-globulin, % | 6.9 | 6.3 | 6.9 | 6.7 | 6.7 | 6.5 | 6.4 | 7.2 |
| β-globulin, % | 8.9 | 9.3 | 10.0 | 10.8 | 8.9 | 9.4 | 10.3 | 10.6 |
| γ-globulin, % | 17.6 | 18.0 | 18.5 | 18.7 | 18.1 | 17.5 | 19.1 | 18.1 |
| Serum calcium, mg./100 ml. | 10.8 | 10.3 | 10.7 | 10.2 | 10.7 | 10.4 | 10.8 | 10.1 |
| Serum phosphorus, mg./100 ml. | 7.5 | 7.5 | 7.5 | 7.8 | 7.6 | 7.4 | 7.6 | 7.8 |

[a]Each group contained 16 pigs.

TABLE 15. HORMONE TREATMENT, PROTEIN LEVEL, AND SEX INTERACTIONS FOR THE BLOOD COMPONENTS (continued)

| | Protein Level X Sex | | | |
|---|---|---|---|---|
| | 12% Protein | | 16% Protein | |
| Trait | Gilts[a] | Barrows[a] | Gilts[a] | Barrows[a] |
| Hematocrit, % | 39.9 | 40.5 | 40.9 | 39.4 |
| Hemoglobin, g./100 ml. | 12.8 | 13.0 | 13.0 | 12.8 |
| Total serum protein, g./100 ml. | 6.2 | 6.4 | 6.3 | 6.2 |
| Albumin, % | 51.2 | 49.4 | 50.5 | 51.5 |
| $\alpha^1$-globulin, % | 5.5 | 6.0 | 5.4 | 6.1 |
| $\alpha^2$-globulin, % | 9.1 | 9.4 | 9.1 | 8.1 |
| $\alpha^3$-globulin, % | 6.6 | 6.5 | 7.2 | 6.5 |
| β-globulin, % | 9.1 | 10.1 | 9.9 | 10.0 |
| γ-globulin, % | 18.1 | 19.1 | 18.0 | 17.6 |
| Serum calcium, mg. % | 11.0 | 10.5 | 10.5 | 10.0 |
| Serum phosphorus, mg. % | 7.5 | 7.7 | 7.5 | 7.7 |

[a]Each group contained 16 pigs.

TABLE 16. BONE ANALYSIS AS INFLUENCED BY DES + MT.

| Trait | DES + MT[a] | Control[a] |
|---|---|---|
| Femur wt., gm. | 271.8** | 251.8 |
| Phosphorus, % of ash | 18.7 | 20.1 |
| Calcium, % of ash | 44.6 | 44.5 |
| Ash, %[b] | 55.4 | 56.2 |
| Moment of inertia, $cm.^4$ | 1.05** | 0.89 |
| Maximum load, Kg. | 291** | 272 |
| Bending moment, Kg.-cm. | 1075** | 996 |
| Breaking stress, $Kg./cm.^2$ | 1169 | 1164 |

**P < .01
[a]Each group contained 32 pigs.
[b]Expressed on a dry, fat-free basis.

12% vs. 16% protein level

The effect of protein level on the femur bone data is presented in Table 17. Protein level had no significant effect upon femur bone weight, phosphorus, calcium, or percent ash. The 16% protein level significantly ($P < .05$) increased the moment of inertia. The maximum load was also significantly ($P < .05$) increased (273 to 290 Kg.). There were no significant ($P > .05$) differences between the protein levels for bending moment and breaking stress.

TABLE 17. THE EFFECT OF PROTEIN LEVEL ON BONE

| Trait | Protein level 12%[a] | Protein level 16%[a] |
|---|---|---|
| Femur wt., gm. | 259.4 | 264.2 |
| Phosphorus, % of ash | 19.4 | 19.3 |
| Calcium, % of ash | 44.4 | 44.7 |
| Ash, %[b] | 55.6 | 55.9 |
| Moment of inertia, $cm.^4$ | 0.91 | 1.03* |
| Maximum load, Kg. | 273 | 290* |
| Bending moment, Kg.-cm. | 1008 | 1047 |
| Breaking stress, $Kg./cm.^2$ | 1196 | 1140 |

*$P < .05$
[a]Each group contained 32 pigs.
[b]Expressed on a dry, fat-free basis.

Barrows vs. gilts

The bone data for barrows and gilts are shown in Table 18. There were no significant ($P > .05$) differences for any of the traits measured except moment of inertia. Gilts had a greater ($P < .05$) moment of inertia (1.03 $cm.^4$) than barrows (0.91 $cm.^4$).

TABLE 18. BONE DATA FOR BARROWS AND GILTS

| Trait | Gilts[a] | Barrows[a] |
|---|---|---|
| Femur wt., gm. | 262.0 | 261.5 |
| Phosphorus, % of ash | 19.7 | 19.0 |
| Calcium, % of ash | 44.5 | 44.7 |
| Ash, %[b] | 56.3 | 55.2 |
| Moment of inertia, $cm.^4$ | 1.03* | 0.91 |
| Maximum load, Kg. | 284 | 279 |
| Bending moment, Kg.-cm. | 1047 | 1024 |
| Breaking stress, $Kg./cm.^2$ | 1140 | 1193 |

*P > .05
[a]Each group contained 32 pigs.
[b]Expressed on a dry, fat-free basis.

Hormone treatment, protein level and sex interactions for bone data

A summary of the hormone treatment, protein level and sex interactions for the bone analyses is presented in Table 19. There were no significant (P > .05) interactions for any of the bone components measured.

TABLE 19. HORMONE TREATMENT, PROTEIN LEVEL AND SEX INTERACTIONS FOR BONE DATA.

| | DES + MT x Sex | | | | DES + MT x Protein Level | | | |
|---|---|---|---|---|---|---|---|---|
| | DES + MT | | Control | | DES + MT | | Control | |
| Trait | Gilts[a] | Barrows[a] | Gilts[a] | Barrows[a] | 12% Protein[a] | 16% Protein[a] | 12% Protein[a] | 16% Protein[a] |
| Femur wt., gm. | 269.1 | 274.5 | 255.0 | 248.6 | 266.0 | 278.0 | 253.0 | 250.0 |
| Phosphorus, % of ash | 18.6 | 18.8 | 20.8 | 19.3 | 18.3 | 19.1 | 20.5 | 19.6 |
| Calcium, % of ash | 44.6 | 44.6 | 44.3 | 44.7 | 44.3 | 45.0 | 44.6 | 44.4 |
| Ash, %[b] | 56.1 | 54.6 | 56.6 | 55.8 | 55.4 | 55.3 | 55.8 | 56.6 |
| Moment of inertia, $cm.^4$ | 1.13 | 0.97 | 0.92 | 0.86 | 0.93 | 1.16 | 0.87 | 0.90 |
| Maximum load, Kg. | 299 | 283 | 269 | 275 | 282 | 300 | 263 | 280 |
| Bending moment, Kg.-cm. | 1097 | 1052 | 996 | 996 | 1045 | 1104 | 971 | 1021 |
| Breaking stress, Kg./$cm.^2$ | 1139 | 1200 | 1142 | 1186 | 1223 | 1116 | 1169 | 1159 |

[a]Each group contained 16 pigs.
[b]Expressed on a dry, fat-free basis.

TABLE 19. HORMONE TREATMENT, PROTEIN LEVEL AND SEX INTERACTIONS FOR BONE DATA (continued).

| | Protein X Sex | | | |
|---|---|---|---|---|
| | 12% Protein | | 16% Protein | |
| Trait | Gilts[a] | Barrows[a] | Gilts[a] | Barrows[a] |
| Femur wt., gm. | 264.0 | 255.0 | 261.0 | 268.0 |
| Phosphorus, % of ash | 20.1 | 18.7 | 19.3 | 19.3 |
| Calcium, % of ash | 44.2 | 44.7 | 44.7 | 44.7 |
| Ash, %[b] | 56.2 | 55.0 | 56.4 | 55.5 |
| Moment of inertia, $cm.^4$ | 0.94 | 0.88 | 1.11 | 0.95 |
| Maximum load, Kg. | 276 | 269 | 291 | 288 |
| Bending moment, Kg.-cm. | 1027 | 990 | 1067 | 1058 |
| Breaking stress, $Kg./cm.^2$ | 1204 | 1187 | 1077 | 1199 |

[a]Each group contained 16 pigs.
[b]Expressed on a dry, fat-free basis.

## Endocrine Gland Weights

### The effect of diethylstilbestrol and methyltestosterone, sex and protein level

A summary of the pituitary and adrenal gland weights for hormone treatment, sex and protein level are shown in Table 20.

Diethylstilbestrol plus methyltestosterone significantly ($P < .05$) increased the weight of the pituitary gland. The pituitary gland of the hormone treated pigs weighed 0.3201 gm. compared to 0.2907 gm. for controls. Cahill *et al.* (1956) and Clegg and Carroll (1956) reported that stilbestrol-treated cattle had heavier pituitary weights than untreated controls. Although a trend toward heavier adrenal glands among the hormone treated pigs existed in the present study no significant difference was observed.

Protein level had essentially no effect upon the pituitary or adrenal gland weights. Barrows had significantly ($P < .05$) heavier pituitary glands than gilts. The barrow pituitary glands averaged 0.3184 gm. while gilt pituitary glands weighed 0.2925 gm.

### Hormone treatment, protein level and sex interactions for endocrine gland weights.

The summary of the interactions of DES + MT X sex, DES + MT X protein, and protein X sex upon the pituitary and adrenal gland weights is shown in Table 21. None of the interactions were statistically significant

TABLE 20. INFLUENCE OF DES + MT, SEX AND PROTEIN LEVEL ON PITUITARY AND ADRENAL GLAND WEIGHTS.

| Gland | Hormone treatment | | Protein level | | Sex group | |
|---|---|---|---|---|---|---|
| | DES + MT[a] | Control[a] | 12% Protein[a] | 16% Protein[a] | Gilts[a] | Barrows[a] |
| Pituitary, gm. | 0.3201* | 0.2907 | 0.3043 | 0.3066 | 0.2925 | 0.3184* |
| Adrenal, gm. | 3.6656 | 3.4429 | 3.4823 | 3.6261 | 3.5467 | 3.5617 |

*$P < .05$

[a]Each group contained 32 pigs.

TABLE 21. HORMONE TREATMENT, PROTEIN LEVEL AND SEX INTERACTIONS FOR ENDOCRINE GLAND WEIGHTS

| | DES + MT x Sex | | | | DES + MT x Protein Level | | | | Protein Level x Sex | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DES + MT | | Control | | DES + MT | | Control | | 12% Protein | | 16% Protein | |
| Gland | Gilts[a] | Barrows[a] | Gilts[a] | Barrows[a] | 12% Protein[a] | 16% Protein[a] | 12% Protein[a] | 16% Protein[a] | Gilts[a] | Barrows[a] | Gilts[a] | Barrows[a] |
| Pituitary wt./gm. | 0.2970 | 0.3433 | 0.2880 | 0.2935 | 0.3143 | 0.3259 | 0.2942 | 0.2873 | 0.2911 | 0.3174 | 0.2939 | 0.3194 |
| Adrenal wt./gm. | 3.7247 | 3.6064 | 3.3686 | 3.5171 | 3.5063 | 3.8248 | 3.4583 | 3.4274 | 3.4445 | 3.5201 | 3.6489 | 3.6034 |

[a]Each group contained 16 pigs.

(P > .05), but the hormone x sex interaction was approaching significance (P < .08) for the pituitary gland. The pituitary from the hormone treated barrows was approximately 30 mg. heavier than control barrows while the pituitary from the treated gilts was only approximately 10 mg. larger than control gilts.

Pork Organoleptic Analysis

The Effect of diethylstilbestrol and methyltestosterone, sex and protein level

The summary of the influence of DES + MT, protein level and sex upon organoleptic data is presented in Table 22. The taste panel preference scores indicated that essentially no differences existed which were attributable to hormone treatment, sex or protein level. The score of all groups averaged 6.5 which was between like slightly and like moderately on the nine-point score sheet used.

Seven loins were described as having an undesirable odor by the three panelist who subjectively evaluated all loins immediately after removal from the oven. All seven of the loins were from hormone treated pigs, but none of these loins received low scores by the subsequent taste panel. Wallace and Lucas (1969) found that the loins from the DES + MT - treated pigs had an undesirable aroma and flavor and this had a significant (P < .01) effect upon the taste panel scores.

Hormone treatment significantly (P < .05) reduced the Warner-Bratzler shear values of the pork loins from 7.9 lb. to 7.4 lb. Neither protein level nor sex had any significant (P > .05) influence on shear values.

TABLE 22. THE INFLUENCE OF DES + MT, PROTEIN LEVEL, AND SEX ON ORGANOLEPTIC DATA

| Trait | Hormone treatment | | Protein level | | Sex | |
|---|---|---|---|---|---|---|
| | DES + MT[b] | Control[b] | 12% Protein[b] | 16% Protein[b] | Gilts[b] | Barrows[b] |
| Taste panel[a] | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 |
| Shear, lb. | 7.4* | 7.9 | 7.8 | 7.6 | 7.6 | 7.7 |

* $P < .05$

[a]Preference scores from 1 to 9 with 9 being most desirable.

[b]Each group contained 32 pigs.

Hormone treatment, protein level and sex interactions for the organoleptic data

Table 23 summarizes the effect of DES + MT x sex, DES + MT x protein level, and protein level x sex for the organoleptic data. None of the interactions studied had a significant influence upon pork quality attributes as measured by taste panel preference scores or Warner-Bratzler shear values.

## Correlation Coefficients

A few simple correlations between some of the variables measured and daily gain are presented in Table 24.

These correlation coefficients were developed from a summary of the 64 pigs in the experiment. The correlation between gain per day and marbling score was 0.37. This indicates that faster growing hogs had a higher marbling score. On the other hand, there was a negative correlation between daily gain and percent lean cuts (-.23).

High correlation coefficients were obtained between some of the carcass traits (Table 25). Percent lean cuts was positively correlated with *l. dorsi* muscle area at the 10th rib (0.78), carcass length (0.55), and percent ham and loin (0.97). Backfat thickness was negatively correlated with lean cuts (-.83). Hines (1966) and others reported similar correlations for carcass traits. Percent lean cuts was also positively correlated with percent ham protein (0.69) and femur weight (0.56).

TABLE 23. HORMONE TREATMENT, PROTEIN LEVEL AND SEX INTERACTIONS FOR THE ORGANOLEPTIC DATA

| | DES + MT x Sex | | | | DES + MT x Protein Level | | | | Protein Level x Sex | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DES + MT | | Control | | DES + MT | | Control | | 12% Protein | | 16% Protein | |
| Trait | Gilts[b] | Barrows[b] | Gilts[b] | Barrows[b] | 12% Protein[b] | 16% Protein[b] | 12% Protein[b] | 16% Protein[b] | Gilts[b] | Barrows[b] | Gilts[b] | Barrows[b] |
| Taste panel[a] | 6.5 | 6.5 | 6.5 | 6.4 | 6.5 | 6.5 | 6.4 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 |
| Shear, lb. | 7.3 | 7.5 | 8.0 | 7.9 | 7.7 | 7.1 | 7.9 | 8.0 | 7.8 | 7.7 | 7.4 | 7.7 |

[a]Preference scores from 1 to 9 with 9 being most desirable.

[b]Each group contained 16 pigs.

TABLE 24. SIMPLE CORRELATION COEFFICIENTS BETWEEN GAIN PER DAY AND SOME CARCASS AND BLOOD DATA

| | Gain per day |
|---|---|
| Percent lean cuts | -.23 |
| Marbling score 10th rib | 0.37 |
| Femur wt. | -.05 |
| Total serum protein | 0.04 |
| Hemoglobin | 0.05 |

Level of significance $P < .05 = > 0.246$
$P < .01 = > 0.320$

TABLE 25. SIMPLE CORRELATION COEFFICIENTS BETWEEN % LEAN CUTS AND SOME CARCASS TRAITS, BONE AND BLOOD DATA

| | Percent lean cuts |
|---|---|
| Av. backfat thickness | -.83 |
| Loin eye area 10th rib | 0.78 |
| Carcass length | 0.55 |
| % ham and loin | 0.97 |
| % protein (ham analysis) | 0.69 |
| Femur wt. | 0.56 |
| Total serum proteins | 0.07 |
| Hemoglobin | -.09 |

Level of significance $P < .05 = > 0.246$
$P < .01 = > 0.320$

Femur weight was negatively correlated with percent bone calcium (-.18) as shown in Table 26. Femur weight was not significantly correlated with percent bone phosphorus (-.01) or percent bone ash (0.01). These results suggest that bone mineralization is not associated with bone size. Femur size was positively correlated with moment of inertia (0.68), maximum load (0.45) and bending moment (0.56), but there was a negative correlation of -.26 between breaking stress and femur weight.

TABLE 26. SIMPLE CORRELATION COEFFICIENTS BETWEEN FEMUR WEIGHT AND SOME BONE DATA

| | Femur weight |
|---|---|
| Bone phosphorus | -.01 |
| Bone calcium | -.18 |
| Bone ash | 0.01 |
| Moment of inertia | 0.68 |
| Maximum load | 0.45 |
| Bending moment | 0.56 |
| Breaking stress | -.26 |

Level of significance $P < .05 = > 0.246$
$P < .01 = > 0.320$

The concentration of calcium in the blood was not highly correlated with any of the variables (Table 27). Serum inorganic phosphorus was positively correlated with breaking stress (0.36) but negatively correlated with femur weight (-.30).

TABLE 27. SIMPLE CORRELATION COEFFICIENTS BETWEEN SOME SERUM COMPONENTS AND BONE DATA

| | Serum calcium | Serum phosphorus |
|---|---|---|
| Bone phosphorus | -.06 | -.06 |
| Bone calcium | 0.08 | 0.12 |
| Bone ash | 0.16 | 0.10 |
| Femur weight | -.11 | -.30 |
| Total serum protein | 0.10 | -.12 |
| Breaking stress | 0.13 | 0.36 |

Level of significance $P < .05 = > .246$

$P < .01 = > .320$

Warner-Bratzler shear value was not significantly correlated (-.04) with the taste panel preference score.

## SUMMARY

This 2 x 2 x 2 factorial experiment was initiated to study the effects of diethylstilbestrol plus methyltestosterone, DES + MT, (0 and 1 mg./lb. of ration), protein level (12% and 16%) and sex group (barrows and gilts) upon feedlot performance, carcass qualitative and quantitative characteristics, some blood and bone components, and some endocrine gland weights. At 100 lb. live weight, 64 pigs were randomly assigned to eight lots and fed to slaughter weight (approximately 210 lb.). Gilts and barrows were lotted separately.

The DES + MT treatment had little effect upon feedlot performance for the combined barrow and gilt data; however, hormone treatment significantly reduced daily gain among barrows. The 16% protein level provided optimum growth for DES + MT treated barrows while untreated barrows gained faster on the 12% protein ration.

Hormone treated pigs had significantly ($P < .01$) less backfat thickness and fat trim, larger _l. dorsi_ muscle areas, higher percentages of lean cuts and ham and loin than untreated controls. There was a significant ($P < .05$) interaction between DES + MT x protein level for backfat thickness. The DES + MT treated pigs on the 16% protein ration had 0.16 in. less backfat compared to treated pigs on the 12% protein ration. Gilt carcasses were also leaner and heavier muscled than barrow carcasses. The DES + MT treatment significantly ($P < .01$) increased percent moisture and protein and reduced percent fat content of the composite ham sample.

Hams from pigs fed the 16% protein level had less analytical fat and more moisture than the 12% protein group.

Hormone treatment had little apparent influence on any of the blood components measured except DES + MT treatment significantly increased percent serum albumin and decreased percent β-globulin. Weight and size of the femur bone were increased by DES + MT treatment but no significant effects upon bone calcium, phosphorus, percent ash or bone strength were observed. Hormone treated pigs had heavier pituitary gland weights and barrows had larger pituitary glands than gilts.

Taste panel preference scores for the pork loin roasts indicated that no differences existed which were attributable to hormone treatment, sex group, or protein level since all groups received essentially the same score. Seven loins from the hormone treated pigs were described as having an undesirable odor. The DES + MT treatment significantly ($P < .05$) reduced Warner-Bratzler shear values.

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APPENDIX

APPENDIX A. DATA ON LOTS 7 & 8, TREATED AND CONTROL GILTS ON 12% PROTEIN

| Pig No. | Initial wt. (lb) | Final wt. (lb) | Gain/day (lb) | Days on feed | Backfat (in.) | Length (in.) | L. dorsi area 10th (sq. in.) | L. dorsi last rib (sq. in.) | % lean cuts | % ham & loin | % fat trim |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Lot 7[a] | | | | | | |
| 2 | 94.0 | 206.5 | 1.52 | 74.0 | 1.88 | 29.5 | 3.60 | 4.28 | 47.6 | 32.8 | 31.5 |
| 13 | 109.0 | 208.0 | 1.87 | 53.0 | 1.61 | 30.4 | 4.02 | 4.35 | 50.1 | 34.1 | 25.6 |
| 19 | 101.0 | 219.0 | 1.76 | 67.0 | 1.24 | 31.0 | 4.81 | 4.95 | 57.4 | 38.4 | 20.1 |
| 41 | 99.0 | 212.0 | 1.69 | 67.0 | 1.73 | 29.0 | 3.70 | 3.55 | 48.9 | 33.1 | 30.8 |
| 68 | 92.0 | 217.0 | 1.69 | 74.0 | 1.59 | 31.7 | 4.15 | 4.30 | 53.7 | 37.0 | 25.1 |
| 76 | 96.0 | 215.0 | 1.78 | 67.0 | 1.63 | 29.4 | 4.05 | 4.10 | 52.4 | 34.6 | 24.5 |
| 80 | 87.0 | 213.0 | 1.56 | 81.0 | 1.52 | 30.5 | 3.77 | 4.00 | 52.7 | 35.6 | 23.4 |
| 81 | 91.0 | 208.0 | 1.87 | 60.0 | 1.58 | 31.6 | 4.40 | 4.80 | 53.8 | 36.8 | 23.9 |
| Mean | 96.8 | 212.0 | 1.72 | 67.9 | 1.60 | 30.4 | 4.06 | 4.29 | 52.1 | 35.3 | 25.6 |
| | | | | | Lot 8[b] | | | | | | |
| 1 | 101.0 | 177.0 | 1.71 | 81.0 | 1.38 | 28.7 | 4.24 | 4.16 | 55.0 | 36.5 | 22.9 |
| 5 | 110.0 | 211.0 | 1.68 | 60.0 | 1.35 | 30.5 | 3.91 | 3.90 | 51.4 | 34.9 | 26.4 |
| 30 | 114.0 | 219.0 | 1.98 | 53.0 | 1.64 | 31.2 | 4.15 | 3.97 | 52.3 | 36.0 | 23.8 |
| 37 | 99.0 | 212.0 | 1.69 | 67.0 | 1.73 | 30.2 | 3.10 | 3.01 | 49.8 | 32.6 | 28.1 |
| 39 | 100.0 | 212.0 | 1.51 | 74.0 | 1.67 | 29.7 | 4.41 | 4.44 | 50.5 | 34.4 | 28.1 |
| 53 | 91.0 | 208.0 | 1.44 | 81.0 | 1.39 | 30.9 | 4.15 | 3.80 | 52.5 | 35.8 | 27.0 |
| 55 | 109.0 | 215.0 | 1.77 | 60.0 | 1.83 | 29.8 | 3.60 | 3.68 | 46.5 | 31.3 | 30.5 |
| 62 | 103.0 | 216.0 | 1.88 | 60.0 | 1.87 | 29.5 | 3.87 | 3.80 | 47.8 | 32.7 | 29.0 |
| Mean | 103.4 | 209.0 | 1.71 | 67.0 | 1.61 | 30.1 | 3.93 | 3.85 | 50.7 | 34.3 | 27.0 |

[a]Gilts, 12% protein-treated.

[b]Gilts, 12% protein-control.

APPENDIX A. DATA ON LOTS 7 & 8, TREATED AND CONTROL GILTS ON 12% PROTEIN (continued)

| Pig No. | Marbling score 10th rib (1-15) | Marbling score last rib | Pituitary wt. (gm.) | Adrenal wt. (gm.) | % Hct (start) | % Hct (finish) | Hgb (start) gm./100 ml. | Hgb (finish) gm./100 ml. |
|---|---|---|---|---|---|---|---|---|
| | | | | Lot 7[a] | | | | |
| 2 | 4.0 | 2.0 | .2188 | 2.8802 | 43.0 | 42.3 | 13.32 | 13.01 |
| 13 | 3.0 | 2.0 | .2790 | 4.0350 | 40.9 | 37.1 | 11.77 | 11.49 |
| 19 | 11.0 | 8.0 | .3059 | 3.9757 | 43.7 | 41.3 | 13.01 | 12.95 |
| 41 | 2.0 | 1.0 | .2725 | 2.1750 | 39.7 | 37.9 | 12.08 | 11.65 |
| 68 | 2.0 | 1.0 | .3146 | 4.2285 | 44.1 | 38.4 | 13.32 | 11.92 |
| 76 | 5.0 | 2.0 | .3300 | 3.7374 | 41.5 | 38.2 | 12.08 | 13.07 |
| 80 | 10.0 | 7.0 | .2750 | 3.5244 | 35.0 | 41.5 | 10.53 | 13.04 |
| 81 | 9.0 | 5.0 | .3332 | 3.8680 | 41.0 | 39.8 | 12.39 | 13.76 |
| Mean | 5.8 | 3.5 | .2911 | 3.5530 | 41.1 | 39.6 | 12.31 | 12.61 |
| | | | | Lot 8[b] | | | | |
| 1 | 2.0 | 3.0 | .2650 | 3.3383 | 40.1 | 40.8 | 11.77 | 12.76 |
| 5 | 6.0 | 5.0 | .3329 | 3.2870 | 35.0 | 37.5 | 9.91 | 12.70 |
| 30 | 11.0 | 6.0 | .3140 | 3.3900 | 39.6 | 40.9 | 12.24 | 11.68 |
| 37 | 6.0 | 8.0 | .2556 | 3.9866 | 41.0 | 43.9 | 12.55 | 15.03 |
| 39 | 7.0 | 3.0 | .2494 | 2.7064 | 45.0 | 38.5 | 13.32 | 12.08 |
| 53 | 2.0 | 1.0 | .3960 | 3.6964 | 42.1 | 40.7 | 12.08 | 12.55 |
| 55 | 8.0 | 2.0 | .2410 | 2.7250 | 44.0 | 44.2 | 12.55 | 14.62 |
| 62 | 8.0 | 4.0 | .2754 | 3.5580 | 39.6 | 35.1 | 12.24 | 12.55 |
| Mean | 6.3 | 4.0 | .2912 | 3.3360 | 40.8 | 40.2 | 12.08 | 13.00 |

[a]Gilts, 12% protein-treated.

[b]Gilts, 12% protein-control.

APPENDIX A. DATA ON LOTS 7 & 8, TREATED AND CONTROL GILTS ON 12% PROTEIN (continued)

| Pig No. | Total serum protein (start) gm./100 ml. | Total serum protein (finish) gm./100 ml. | Albumin (start) (%) | Albumin (finish) (%) | $\alpha^1$-Globulin (start) (%) | $\alpha^1$-Globulin (finish) (%) | $\alpha^2$-Globulin (start) (%) | $\alpha^2$-Globulin (finish) (%) |
|---|---|---|---|---|---|---|---|---|
| | | | | Lot 7[a] | | | | |
| 2 | 6.43 | 6.06 | 45.0 | 54.7 | 5.3 | 4.7 | 9.0 | 9.4 |
| 13 | 6.42 | 6.90 | 43.2 | 30.8 | 3.3 | 7.7 | 5.7 | 7.7 |
| 19 | 6.49 | 6.24 | 42.2 | 48.8 | 15.6 | 6.2 | 8.9 | 9.9 |
| 41 | 6.27 | 5.80 | 50.8 | 67.3 | 6.3 | 2.5 | 7.4 | 10.1 |
| 68 | 6.98 | 6.37 | 47.5 | 47.0 | 6.4 | 5.1 | 6.4 | 11.1 |
| 76 | 6.88 | 5.95 | 48.0 | 55.9 | 6.2 | 5.1 | 6.2 | 6.3 |
| 80 | 5.95 | 6.64 | 43.4 | 54.3 | 5.9 | 4.3 | 9.9 | 7.3 |
| 81 | 6.59 | 6.01 | 47.4 | 50.0 | 5.7 | 6.3 | 6.8 | 10.6 |
| Mean | 6.50 | 6.25 | 45.9 | 51.1 | 6.8 | 5.2 | 7.5 | 9.1 |
| | | | | Lot 8[b] | | | | |
| 1 | 6.42 | 5.75 | 45.6 | 57.4 | 5.8 | 3.9 | 8.0 | 6.2 |
| 5 | 6.30 | 6.50 | 40.2 | 48.6 | 6.1 | 3.6 | 8.3 | 9.3 |
| 30 | 6.75 | 6.30 | 43.3 | 53.2 | 4.2 | 3.5 | 11.8 | 11.9 |
| 37 | 6.39 | 6.44 | 47.4 | 48.3 | 5.3 | 3.8 | 10.5 | 11.3 |
| 39 | 6.52 | 5.83 | 49.5 | 50.0 | 5.4 | 5.5 | 8.1 | 8.8 |
| 53 | 6.90 | 5.94 | 39.0 | 45.5 | 6.0 | 5.3 | 9.6 | 11.6 |
| 55 | 6.50 | 5.68 | 47.2 | 55.9 | 5.8 | 17.0 | 7.2 | 5.7 |
| 62 | 6.75 | 6.21 | 50.7 | 51.0 | 4.7 | 3.7 | 6.1 | 8.8 |
| Mean | 6.57 | 6.08 | 45.4 | 51.1 | 5.4 | 5.8 | 8.7 | 9.2 |

[a]Gilts, 12% protein-treated.

[b]Gilts, 12% protein-controls.

APPENDIX A. DATA ON LOTS 7 & 8, TREATED AND CONTROL GILTS ON 12% PROTEIN (continued)

| Pig No. | $\alpha^3$-Globulin (start) (%) | $\alpha^3$-Globulin (finish) (%) | β-Globulin (start) (%) | β-Globulin (finish) (%) | γ-Globulin (start) (%) | γ-Globulin (finish) (%) |
|---|---|---|---|---|---|---|
| Lot 7[a] | | | | | | |
| 2 | 6.7 | 3.7 | 11.0 | 8.9 | 23.0 | 18.8 |
| 13 | 14.4 | 8.6 | 11.5 | 13.7 | 22.0 | 31.6 |
| 19 | 0 | 5.4 | 11.6 | 8.6 | 21.7 | 20.2 |
| 41 | 7.4 | 5.5 | 12.0 | 8.0 | 16.1 | 6.5 |
| 68 | 7.1 | 7.1 | 11.3 | 10.1 | 21.3 | 19.7 |
| 76 | 7.0 | 6.7 | 11.4 | 9.1 | 21.2 | 16.9 |
| 80 | 7.9 | 8.5 | 13.2 | 9.2 | 19.7 | 16.5 |
| 81 | 9.2 | 9.1 | 13.2 | 9.1 | 17.7 | 14.9 |
| Mean | 7.5 | 6.8 | 11.9 | 8.3 | 20.3 | 18.1 |
| Lot 8[b] | | | | | | |
| 1 | 8.0 | 7.8 | 10.6 | 8.5 | 22.0 | 16.3 |
| 5 | 6.8 | 8.5 | 12.1 | 9.3 | 26.5 | 20.6 |
| 30 | 5.3 | 4.9 | 13.3 | 10.5 | 22.1 | 16.1 |
| 37 | 7.4 | 6.3 | 10.5 | 9.2 | 18.9 | 21.0 |
| 39 | 8.1 | 9.9 | 12.9 | 12.6 | 16.0 | 18.7 |
| 53 | 10.1 | 6.4 | 12.4 | 10.6 | 22.9 | 20.6 |
| 55 | 10.1 | 0 | 11.6 | 7.3 | 18.1 | 14.0 |
| 62 | 8.8 | 7.9 | 10.8 | 10.2 | 18.9 | 17.7 |
| Mean | 8.1 | 6.5 | 11.8 | 9.8 | 20.7 | 18.1 |

[a]Gilts, 12% protein-treated.

[b]Gilts, 12% protein-controls.

APPENDIX A. DATA ON LOTS 7 & 8, TREATED AND CONTROL GILTS ON 12% PROTEIN (continued)

| Pig No. | Serum Ca (start) (mg. %) | Serum Ca (finish) (mg. %) | Serum Pi (start) (mg. %) | Serum Pi (finish) (mg. %) | Femur wt. (gm.) | Bone P % ash | Bone Ca % ash | % Ash | I-moment of inertia (cm.⁴) | W-maximum load (Kg.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Lot 7[a] | | | | | |
| 2 | 9.3 | 11.1 | 8.1 | 8.4 | 270.9 | 15.6 | 44.1 | 57.7 | .80 | 245.0 |
| 13 | 9.3 | 10.5 | 6.5 | 6.4 | 245.2 | 17.6 | 46.7 | 53.3 | .79 | 275.0 |
| 19 | 10.0 | 11.1 | 7.9 | 7.8 | 277.7 | 21.9 | 43.9 | 54.9 | 1.15 | 375.0 |
| 41 | 11.0 | 10.8 | 8.8 | 8.5 | 232.1 | 18.8 | 43.3 | 54.8 | .67 | 282.0 |
| 68 | 10.0 | 11.4 | 7.4 | 8.0 | 285.2 | 20.5 | 44.0 | 57.0 | .98 | 260.0 |
| 76 | 9.3 | 10.7 | 6.4 | 7.1 | 289.7 | 17.9 | 43.5 | 57.4 | 1.36 | 296.0 |
| 80 | 10.0 | 10.2 | 6.7 | 6.1 | 294.8 | 21.7 | 42.6 | 56.6 | 1.32 | 310.0 |
| 81 | 11.9 | 11.0 | 7.7 | 8.0 | 255.3 | 19.0 | 44.2 | 56.4 | .80 | 275.0 |
| Mean | 10.1 | 10.9 | 7.4 | 7.5 | 268.9 | 19.1 | 44.0 | 56.0 | .98 | 289.8 |
| | | | | | Lot 8[b] | | | | | |
| 1 | 12.0 | 11.3 | 8.7 | 7.0 | 224.3 | 25.5 | 45.1 | 56.9 | .68 | 207.0 |
| 5 | 11.9 | 11.4 | 9.2 | 7.4 | 263.4 | 20.1 | 44.5 | 56.7 | .74 | 237.0 |
| 30 | 11.6 | 11.0 | 8.0 | 8.1 | 293.4 | 22.4 | 44.9 | 58.5 | 1.17 | 283.0 |
| 37 | 11.1 | 10.3 | 6.5 | 7.8 | 253.5 | 21.4 | 43.5 | 56.8 | .82 | 265.0 |
| 39 | 10.7 | 10.5 | 7.0 | 6.7 | 263.9 | 17.1 | 44.3 | 58.3 | 1.05 | 267.0 |
| 53 | 11.0 | 13.9 | 7.6 | 8.0 | 237.2 | 22.7 | 45.2 | 56.5 | .85 | 273.0 |
| 55 | 10.7 | 10.9 | 7.1 | 7.2 | 246.2 | 20.0 | 43.5 | 51.6 | .87 | 285.0 |
| 62 | 11.3 | 10.5 | 7.7 | 8.2 | 284.0 | 19.7 | 43.7 | 55.6 | .96 | 285.0 |
| Mean | 11.3 | 11.2 | 7.7 | 7.6 | 258.2 | 21.1 | 44.3 | 56.4 | .89 | 262.8 |

[a]Gilts, 12% protein-treated.

[b]Gilts, 12% protein-controls.

APPENDIX A. DATA ON LOTS 7 & 8, TREATED AND CONTROL GILTS ON 12% PROTEIN (continued)

| Pig No. | M-Bending moment (Kg.-cm.) | S-Breaking stress (Kg./cm.$^2$) | Ham Analysis % Moisture | Ham Analysis % Fat | Ham Analysis % Protein | Taste panel score (1 - 9) | Shear (lb.) |
|---|---|---|---|---|---|---|---|
| | | | Lot 7[a] | | | | |
| 2 | 949.4 | 1232.7 | 48.44 | 38.08 | 14.38 | 6.9 | 7.4 |
| 13 | 983.1 | 1263.1 | 52.96 | 32.20 | 13.30 | 5.9 | 8.0 |
| 19 | 1340.6 | 1412.7 | 59.03 | 24.77 | 16.09 | 6.1 | 7.0 |
| 41 | 1022.3 | 1482.3 | 51.79 | 32.93 | 15.25 | 6.1 | 8.8 |
| 68 | 994.5 | 1100.5 | 52.02 | 30.40 | 16.04 | 6.5 | 6.3 |
| 76 | 1102.6 | 971.0 | 52.07 | 31.77 | 15.76 | 6.7 | 8.9 |
| 80 | 1178.0 | 1041.0 | 52.79 | 31.52 | 15.27 | 7.3 | 8.4 |
| 81 | 983.1 | 1291.9 | 54.09 | 30.14 | 15.41 | 6.2 | 7.3 |
| Mean | 1069.2 | 1224.4 | 52.90 | 31.48 | 15.19 | 6.5 | 7.8 |
| | | | Lot 8[b] | | | | |
| 1 | 750.4 | 1074.4 | 57.02 | 26.16 | 15.63 | 6.2 | 8.1 |
| 5 | 853.2 | 1146.1 | 47.00 | 35.50 | 14.30 | 6.6 | 9.0 |
| 30 | 1075.4 | 1031.3 | 58.61 | 25.20 | 15.01 | 6.7 | 8.6 |
| 37 | 1020.3 | 1340.5 | 45.95 | 40.23 | 12.75 | 6.6 | 8.3 |
| 39 | 1021.3 | 1067.9 | 50.75 | 34.68 | 15.44 | 6.8 | 8.3 |
| 53 | 1057.9 | 1322.4 | 46.00 | 40.39 | 13.74 | 6.4 | 5.9 |
| 55 | 1090.1 | 1351.7 | 46.08 | 39.59 | 13.52 | 5.9 | 7.3 |
| 62 | 1004.6 | 1141.1 | 47.85 | 40.56 | 14.29 | 6.7 | 7.9 |
| Mean | 984.2 | 1184.4 | 49.91 | 35.29 | 14.34 | 6.5 | 7.9 |

[a]Gilts, 12% protein-treated.

[b]Gilts, 12% protein-controls.

APPENDIX B. DATA ON LOTS 9 & 10, TREATED AND CONTROL GILTS ON 16% PROTEIN

| Pig No. | Initial wt. (lb) | Final wt. (lb) | Gain/day (lb) | Days on feed | Backfat (in.) | Length (in.) | L. dorsi area 10th (sq. in.) | L. dorsi last rib (sq. in.) | % lean cuts | % ham & loin | % fat trim |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Lot 9[a] | | | | | | |
| 24 | 98.0 | 219.0 | 1.64 | 74.0 | 1.32 | 30.8 | 4.82 | 5.23 | 56.7 | 38.6 | 19.1 |
| 31 | 109.0 | 220.0 | 1.85 | 60.0 | 1.60 | 29.9 | 4.08 | 4.55 | 53.0 | 35.7 | 23.4 |
| 38 | 103.0 | 208.0 | 1.98 | 53.0 | 1.54 | 30.5 | 4.56 | 4.35 | 54.4 | 36.1 | 22.2 |
| 44 | 93.0 | 208.0 | 1.55 | 74.0 | 1.46 | 30.3 | 3.94 | 4.45 | 54.8 | 36.6 | 21.1 |
| 47 | 103.0 | 218.0 | 1.92 | 60.0 | 1.54 | 29.6 | 3.95 | 4.57 | 53.1 | 35.8 | 23.8 |
| 65 | 107.0 | 212.0 | 1.98 | 53.0 | 1.64 | 29.8 | 3.78 | 4.10 | 51.7 | 34.0 | 26.5 |
| 69 | 93.0 | 208.0 | 1.42 | 81.0 | 1.46 | 30.8 | 4.56 | 4.78 | 54.7 | 38.5 | 26.7 |
| 78 | 92.0 | 216.0 | 2.07 | 60.0 | 1.60 | 30.7 | 4.30 | 4.42 | 50.0 | 34.6 | 26.6 |
| Mean | 99.8 | 214.0 | 1.80 | 64.4 | 1.52 | 30.3 | 4.25 | 4.56 | 53.6 | 36.2 | 23.7 |
| | | | | | Lot 10[b] | | | | | | |
| 4 | 100.0 | 205.0 | 1.42 | 74.0 | 1.70 | 30.5 | 3.59 | 3.70 | 51.9 | 36.3 | 27.1 |
| 8 | 104.0 | 212.0 | 1.46 | 74.0 | 1.38 | 31.3 | 5.75 | 5.92 | 56.4 | 37.3 | 21.3 |
| 17 | 99.0 | 207.0 | 1.61 | 67.0 | 1.50 | 29.8 | 4.61 | 4.46 | 53.4 | 36.1 | 23.4 |
| 43 | 94.0 | 207.0 | 1.69 | 67.0 | 1.91 | 28.6 | 3.09 | 3.26 | 45.4 | 30.2 | 33.6 |
| 46 | 98.0 | 207.0 | 1.47 | 74.0 | 2.16 | 30.5 | 2.80 | 3.20 | 47.8 | 32.2 | 30.9 |
| 58 | 109.0 | 210.0 | 1.68 | 60.0 | 1.71 | 30.3 | 4.00 | 4.00 | 50.2 | 34.8 | 20.0 |
| 84 | 93.0 | 209.0 | 1.57 | 74.0 | 1.77 | 30.3 | 3.80 | 3.83 | 50.2 | 32.8 | 29.4 |
| 85 | 93.0 | 215.0 | 1.65 | 74.0 | 1.54 | 30.7 | 4.29 | 4.37 | 53.3 | 36.5 | 23.6 |
| Mean | 98.8 | 209.0 | 1.57 | 70.5 | 1.71 | 30.3 | 3.99 | 4.09 | 51.1 | 34.5 | 26.2 |

[a]Gilts, 16% protein-treated.

[b]Gilts, 16% protein-control.

APPENDIX B. DATA ON LOTS 9 & 10, TREATED AND CONTROL GILTS ON 16% PROTEIN (continued)

| Pig No. | Marbling score 10th rib (1-15) | Marbling score last rib | Pituitary wt. (gm.) | Adrenal wt. (gm.) | % Hct (start) | % Hct (finish) | Hgb (start) gm./100 ml. | Hgb (finish) gm./100 ml. |
|---|---|---|---|---|---|---|---|---|
| | | | | Lot 9[a] | | | | |
| 24 | 2.0 | 2.0 | .4017 | 3.8064 | 43.0 | 42.0 | 12.70 | 12.54 |
| 31 | 5.0 | 3.0 | .3780 | 3.8954 | 39.8 | 37.9 | 12.08 | 12.70 |
| 38 | 5.0 | 3.0 | .2560 | 3.2440 | 43.2 | 40.5 | 13.01 | 11.83 |
| 44 | 1.0 | 2.0 | .2824 | 3.8356 | 41.3 | 40.2 | 12.08 | 12.70 |
| 47 | 2.0 | 3.0 | .3018 | 4.3150 | 39.1 | 47.1 | 12.24 | 13.79 |
| 65 | 8.0 | 5.0 | .2320 | 4.3620 | 41.2 | 39.4 | 12.86 | 11.74 |
| 69 | 2.0 | 1.0 | .2650 | 3.3383 | 42.8 | 40.4 | 13.17 | 12.24 |
| 78 | 6.0 | 3.0 | .3064 | 4.3750 | 42.0 | 42.5 | 12.08 | 14.00 |
| Mean | 3.9 | 2.8 | .3029 | 3.8965 | 41.6 | 41.3 | 12.53 | 12.69 |
| | | | | Lot 10[b] | | | | |
| 4 | 1.0 | 2.0 | .2540 | 3.4070 | 43.1 | 43.8 | 12.70 | 13.32 |
| 8 | 2.0 | 1.0 | .2866 | 3.3267 | 43.8 | 43.2 | 12.86 | 13.63 |
| 17 | 5.0 | 3.0 | .2416 | 3.3664 | 40.0 | 37.5 | 11.15 | 12.08 |
| 43 | 3.0 | 1.0 | .2529 | 3.0510 | 44.2 | 44.0 | 11.93 | 15.34 |
| 46 | 11.0 | 7.0 | .4455 | 3.7598 | 44.2 | 40.2 | 14.87 | 12.39 |
| 58 | 5.0 | 2.0 | .2759 | 3.4520 | 44.1 | 35.4 | 13.01 | 13.07 |
| 84 | 4.0 | 2.0 | .2393 | 3.0185 | 40.1 | 37.9 | 11.52 | 12.33 |
| 85 | 2.0 | 1.0 | .2831 | 3.8289 | 46.7 | 43.0 | 13.01 | 13.63 |
| Mean | 4.1 | 2.4 | .2849 | 3.4013 | 43.3 | 40.6 | 12.61 | 13.22 |

[a]Gilts, 16% protein-treated.

[b]Gilts, 16% protein-control.

APPENDIX B. DATA ON LOTS 9 & 10, TREATED AND CONTROL GILTS ON 16% PROTEIN (continued)

| Pig No. | Total serum protein (start) gm./100 ml. | Total serum protein (finish) gm./100 ml. | Albumin (start) (%) | Albumin (finish) (%) | $\alpha^1$-Globulin (start) (%) | $\alpha^1$-Globulin (finish) (%) | $\alpha^2$-Globulin (start) (%) | $\alpha^2$-Globulin (finish) (%) |
|---|---|---|---|---|---|---|---|---|
| Lot 9[a] | | | | | | | | |
| 24 | 6.85 | 6.64 | 43.5 | 46.9 | 3.8 | 5.6 | 11.3 | 7.9 |
| 31 | 6.93 | 6.41 | 44.7 | 52.0 | 4.6 | 4.8 | 11.0 | 8.7 |
| 38 | 6.66 | 6.20 | 46.8 | 54.0 | 5.8 | 6.0 | 11.8 | 8.5 |
| 44 | 5.84 | 6.18 | 50.5 | 54.6 | 6.3 | 6.3 | 5.9 | 6.3 |
| 47 | 6.37 | 6.28 | 46.4 | 54.9 | 4.7 | 4.5 | 8.5 | 8.0 |
| 65 | 6.46 | 6.20 | 50.0 | 55.2 | 6.2 | 5.5 | 13.8 | 8.0 |
| 69 | 6.90 | 6.16 | 51.7 | 54.9 | 3.4 | 3.5 | 8.2 | 8.0 |
| 78 | 6.40 | 6.43 | 49.3 | 53.6 | 4.7 | 5.4 | 5.3 | 8.0 |
| Mean | 6.55 | 6.31 | 47.9 | 53.3 | 4.9 | 5.2 | 9.5 | 7.9 |
| Lot 10[b] | | | | | | | | |
| 4 | 6.84 | 6.27 | 42.2 | 45.8 | 5.0 | 4.7 | 9.3 | 11.7 |
| 8 | 7.01 | 6.30 | 42.9 | 43.4 | 6.6 | 5.5 | 8.1 | 10.5 |
| 17 | 6.67 | 6.35 | 45.4 | 50.6 | 5.9 | 5.3 | 8.6 | 8.9 |
| 43 | 6.25 | 5.60 | 49.7 | 44.2 | 5.3 | 6.0 | 9.9 | 11.1 |
| 46 | 6.90 | 6.37 | 48.2 | 47.7 | 6.0 | 5.7 | 7.0 | 7.7 |
| 58 | 6.31 | 6.19 | 51.9 | 49.5 | 6.2 | 6.0 | 6.9 | 11.0 |
| 84 | 6.08 | 6.17 | 47.4 | 50.0 | 5.8 | 5.5 | 7.4 | 9.8 |
| 85 | 6.51 | 6.41 | 41.7 | 51.2 | 4.4 | 5.3 | 9.7 | 11.2 |
| Mean | 6.57 | 6.21 | 46.2 | 47.8 | 5.7 | 5.5 | 8.4 | 10.2 |

[a]Gilts, 16% protein-treated.

[b]Gilts, 16% protein-controls.

APPENDIX B. DATA ON LOTS 9 & 10, TREATED AND CONTROL GILTS ON 16% PROTEIN (continued)

| Pig No. | $\alpha^3$-Globulin (start) (%) | $\alpha^3$-Globulin (finish) (%) | β-Globulin (start) (%) | β-Globulin (finish) (%) | γ-Globulin (start) (%) | γ-Globulin (finish) (%) |
|---|---|---|---|---|---|---|
| | | | Lot 9[a] | | | |
| 24 | 7.6 | 7.9 | 11.8 | 9.0 | 22.0 | 22.6 |
| 31 | 7.4 | 6.1 | 12.9 | 9.1 | 19.4 | 19.5 |
| 38 | 5.8 | 6.0 | 10.2 | 8.0 | 19.6 | 17.5 |
| 44 | 7.9 | 8.4 | 10.6 | 10.5 | 18.8 | 14.0 |
| 47 | 7.6 | 6.3 | 15.2 | 10.1 | 17.6 | 16.0 |
| 65 | 0 | 9.2 | 9.4 | 9.2 | 20.6 | 12.9 |
| 69 | 9.5 | 5.8 | 10.2 | 10.2 | 17.0 | 17.7 |
| 78 | 10.0 | 6.7 | 11.3 | 10.3 | 19.4 | 16.1 |
| Mean | 7.0 | 7.1 | 11.5 | 9.6 | 19.3 | 17.0 |
| | | | Lot 10[b] | | | |
| 4 | 6.8 | 7.0 | 11.2 | 8.9 | 25.5 | 22.0 |
| 8 | 7.1 | 7.3 | 10.1 | 9.6 | 25.2 | 23.7 |
| 17 | 7.8 | 6.9 | 11.9 | 10.5 | 20.4 | 17.8 |
| 43 | 6.6 | 9.5 | 11.2 | 11.1 | 17.3 | 18.1 |
| 46 | 8.0 | 8.8 | 10.9 | 9.8 | 19.9 | 20.2 |
| 58 | 8.1 | 6.5 | 11.9 | 10.5 | 15.0 | 16.5 |
| 84 | 9.5 | 6.7 | 12.5 | 10.4 | 17.4 | 17.7 |
| 85 | 11.2 | 5.9 | 12.1 | 11.2 | 20.9 | 15.3 |
| Mean | 8.1 | 7.3 | 11.5 | 10.3 | 19.0 | 18.9 |

[a]Gilts, 16% protein-treated.

[b]Gilts, 16% protein—controls.

APPENDIX B. DATA ON LOTS 9 & 10, TREATED AND CONTROL GILTS ON 16% PROTEIN (continued)

| Pig No. | Serum Ca (start) (mg. %) | Serum Ca (finish) (mg. %) | Serum Pi (start) (mg. %) | Serum Pi (finish) (mg. %) | Femur wt. (gm.) | Bone P % ash | Bone Ca % ash | % Ash | I-moment of inertia (cm.4) | W-maximum load (Kg.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Lot 9[a] | | | | | |
| 24 | 11.3 | 10.7 | 7.7 | 7.8 | 307.8 | 15.2 | 44.5 | 56.2 | 1.81 | 370.0 |
| 31 | 11.6 | 10.6 | 7.2 | 8.4 | 265.3 | 15.7 | 44.4 | 51.7 | 1.27 | 300.0 |
| 38 | 10.0 | 10.8 | 6.5 | 6.3 | 276.9 | 17.9 | 45.5 | 51.0 | 1.34 | 323.0 |
| 44 | 12.0 | 10.1 | 8.0 | 7.4 | 284.8 | 14.2 | 44.5 | 63.9 | 1.63 | 324.0 |
| 47 | 11.3 | 11.1 | 6.5 | 8.1 | 247.4 | 18.9 | 45.2 | 57.1 | .98 | 290.0 |
| 65 | 10.0 | 11.7 | 6.0 | 7.3 | 244.2 | 22.2 | 45.7 | 56.9 | 1.06 | 278.0 |
| 69 | 11.0 | 10.9 | 6.3 | 7.4 | 236.4 | 17.7 | 45.8 | 56.7 | .73 | 263.0 |
| 78 | 11.1 | 10.7 | 7.5 | 7.3 | 291.6 | 23.3 | 45.7 | 55.3 | 1.39 | 320.0 |
| Mean | 11.0 | 10.8 | 7.0 | 7.5 | 269.3 | 18.1 | 45.2 | 56.1 | 1.28 | 308.5 |
| | | | | | Lot 10[b] | | | | | |
| 4 | 12.0 | 11.0 | 5.4 | 6.8 | 278.5 | 27.4 | 44.1 | 56.8 | .84 | 265.0 |
| 8 | 12.0 | 10.8 | 7.2 | 7.5 | 273.7 | 16.9 | 43.6 | 56.6 | 1.35 | 260.0 |
| 17 | 11.0 | 10.0 | 7.2 | 7.4 | 255.6 | 21.2 | 42.5 | 58.4 | 1.15 | 303.0 |
| 43 | 9.3 | 9.7 | 5.4 | 7.7 | 214.6 | 19.2 | 46.4 | 54.4 | .69 | 255.0 |
| 46 | 10.0 | 10.5 | 6.5 | 8.3 | 243.6 | 18.4 | 43.5 | 56.7 | .79 | 268.0 |
| 58 | 10.7 | 10.0 | 7.8 | 7.3 | 240.3 | 15.7 | 44.2 | 56.7 | .78 | 247.0 |
| 84 | 11.5 | 9.0 | 7.6 | 7.6 | 246.4 | 25.0 | 43.4 | 56.7 | .96 | 317.0 |
| 85 | 11.0 | 10.5 | 7.3 | 7.4 | 261.5 | 20.5 | 46.3 | 57.8 | 1.05 | 280.0 |
| Mean | 10.9 | 10.2 | 6.8 | 7.5 | 251.8 | 20.5 | 44.3 | 56.8 | .95 | 274.4 |

[a]Gilts, 16% protein-treated.

[b]Gilts, 16% protein—controls.

APPENDIX B. DATA ON LOTS 9 & 10, TREATED AND CONTROL GILTS ON 16% PROTEIN (continued)

| Pig No. | M-Bending moment (Kg.-cm.) | S-Breaking stress (Kg./cm.$^2$) | Ham analysis % Moisture | Ham analysis % Fat | Ham analysis % Protein | Taste panel score (1 - 9) | Shear (lb.) |
|---|---|---|---|---|---|---|---|
| | | | Lot 9[a] | | | | |
| 24 | 1369.0 | 965.5 | 59.10 | 23.79 | 16.33 | 6.7 | 7.2 |
| 31 | 1117.5 | 1037.8 | 54.06 | 30.59 | 15.10 | 6.1 | 7.0 |
| 38 | 1146.7 | 1026.9 | 56.61 | 27.24 | 15.38 | 6.6 | 6.5 |
| 44 | 1190.7 | 919.3 | 57.35 | 26.53 | 16.18 | 6.8 | 7.7 |
| 47 | 1044.0 | 1151.3 | 55.24 | 29.40 | 15.74 | 6.6 | 6.9 |
| 65 | 1000.8 | 1030.8 | 53.06 | 31.55 | 14.73 | 6.7 | 7.6 |
| 69 | 960.0 | 1307.9 | 54.28 | 31.52 | 14.11 | 5.9 | 6.1 |
| 78 | 1176.0 | 983.5 | 52.81 | 32.24 | 14.87 | 6.8 | 6.2 |
| Mean | 1125.6 | 1052.9 | 55.31 | 29.11 | 15.31 | 6.5 | 6.9 |
| | | | Lot 10[b] | | | | |
| 4 | 980.5 | 1164.5 | 50.22 | 35.54 | 13.05 | 7.1 | 6.9 |
| 8 | 955.5 | 824.1 | 59.06 | 24.08 | 13.97 | 6.6 | 8.8 |
| 17 | 1098.4 | 1122.3 | 53.38 | 31.38 | 15.25 | 6.7 | 7.8 |
| 43 | 918.0 | 1298.5 | 47.95 | 37.70 | 14.24 | 6.5 | 8.0 |
| 46 | 991.6 | 1288.5 | 48.44 | 37.29 | 14.18 | 6.2 | 9.0 |
| 58 | 876.9 | 1148.2 | 53.55 | 32.08 | 14.58 | 6.4 | 7.3 |
| 84 | 1133.3 | 794.7 | 48.84 | 34.85 | 16.02 | 6.2 | 7.1 |
| 85 | 1113.0 | 1159.6 | 53.00 | 31.28 | 14.39 | 6.3 | 9.0 |
| Mean | 1008.4 | 1100.0 | 51.81 | 33.03 | 14.46 | 6.5 | 8.0 |

[a]Gilts, 16% protein-treated.

[b]Gilts, 16% protein—controls.

APPENDIX C. DATA ON LOTS 7A & 8A, TREATED AND CONTROL BARROWS ON 12% PROTEIN

| Pig No. | Initial wt. (lb) | Final wt. (lb) | Gain/day (lb) | Days on feed | Backfat (in.) | Length (in.) | L. dorsi area 10th (sq. in.) | L. dorsi last rib (sq. in.) | % lean cuts | % ham & loin | % fat trim |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Lot 7A[a] | | | | | | |
| 11 | 98.0 | 218.0 | 1.62 | 74.0 | 1.58 | 30.2 | 4.74 | 4.85 | 52.4 | 35.4 | 25.3 |
| 21 | 102.0 | 209.5 | 1.45 | 74.0 | 1.35 | 31.1 | 4.09 | 3.75 | 57.2 | 38.3 | 20.6 |
| 34 | 111.0 | 212.0 | 1.68 | 60.0 | 2.13 | 29.9 | 3.50 | 3.38 | 46.2 | 30.6 | 32.4 |
| 36 | 99.0 | 208.0 | 1.82 | 60.0 | 1.81 | 30.0 | 3.22 | 3.17 | 47.7 | 32.6 | 27.7 |
| 60 | 92.0 | 205.0 | 1.53 | 74.0 | 1.77 | 29.5 | 3.52 | 3.73 | 49.0 | 32.3 | 28.0 |
| 61 | 114.0 | 207.0 | 1.55 | 60.0 | 1.41 | 29.7 | 3.00 | 3.37 | 49.5 | 32.4 | 25.9 |
| 75 | 102.0 | 210.0 | 1.61 | 67.0 | 1.97 | 30.2 | 3.24 | 3.63 | 50.7 | 34.1 | 29.6 |
| 79 | 107.0 | 215.0 | 1.46 | 74.0 | 1.76 | 30.1 | 3.25 | 3.54 | 50.5 | 33.8 | 28.0 |
| Mean | 103.1 | 211.0 | 1.59 | 67.9 | 1.72 | 30.1 | 3.57 | 3.68 | 50.4 | 33.7 | 27.2 |
| | | | | | Lot 8A[b] | | | | | | |
| 6 | 101.0 | 213.0 | 1.67 | 67.0 | 1.54 | 30.5 | 3.82 | 4.00 | 53.2 | 35.0 | 23.6 |
| 15 | 99.0 | 209.0 | 1.83 | 60.0 | 1.54 | 30.2 | 3.07 | 3.02 | 48.2 | 31.8 | 29.1 |
| 22 | 104.0 | 216.0 | 1.51 | 74.0 | 1.83 | 29.2 | 3.05 | 3.15 | 51.4 | 34.8 | 27.6 |
| 32 | 103.0 | 207.0 | 1.73 | 60.0 | 1.71 | 29.3 | 2.50 | 3.03 | 44.7 | 29.4 | 33.0 |
| 49 | 99.0 | 211.0 | 1.87 | 60.0 | 1.85 | 31.5 | 3.30 | 3.45 | 47.1 | 31.8 | 31.2 |
| 52 | 102.0 | 207.0 | 1.75 | 60.0 | 1.93 | 28.1 | 3.74 | 3.50 | 47.3 | 32.0 | 30.5 |
| 64 | 88.0 | 210.0 | 1.82 | 67.0 | 1.99 | 29.4 | 2.74 | 2.90 | 45.9 | 30.1 | 35.7 |
| 74 | 86.0 | 209.0 | 1.66 | 74.0 | 1.81 | 29.5 | 3.68 | 3.60 | 50.0 | 33.8 | 28.4 |
| Mean | 97.8 | 210.0 | 1.73 | 65.3 | 1.78 | 29.7 | 3.24 | 3.33 | 48.5 | 32.3 | 29.9 |

[a]Barrows, 12% protein-treated.

[b]Barrows, 12% protein-controls.

APPENDIX C. DATA ON LOTS 7A & 8A, TREATED AND CONTROL BARROWS ON 12% PROTEIN (continued)

| Pig No. | Marbling score 10th rib (1-15) | Marbling score last rib | Pituitary wt. (gm.) | Adrenal wt. (gm.) | % Hct (start) | % Hct (finish) | Hgb (start) gm./100 ml. | Hgb (finish) gm./100 ml. |
|---|---|---|---|---|---|---|---|---|
| | | | | Lot 7A[a] | | | | |
| 11 | 3.0 | 2.0 | .4068 | 3.7110 | 40.9 | 40.0 | 11.77 | 14.72 |
| 21 | 3.0 | 2.0 | .3485 | 3.1907 | 43.5 | 38.8 | 12.34 | 14.41 |
| 34 | 8.0 | 8.0 | .3375 | 2.4114 | 38.5 | 42.9 | 11.15 | 14.01 |
| 36 | 11.0 | 12.0 | .3408 | 3.0670 | 41.2 | 36.7 | 11.46 | 11.77 |
| 60 | 2.0 | 2.0 | .2806 | 3.6925 | 46.0 | 43.8 | 13.32 | 13.38 |
| 61 | 8.0 | 5.0 | .3350 | 3.5095 | 44.0 | 38.5 | 13.01 | 12.55 |
| 75 | 2.0 | 2.0 | .3150 | 4.4508 | 42.3 | 41.4 | 12.70 | 13.07 |
| 79 | 2.0 | 6.0 | .3363 | 3.6444 | 39.7 | 38.8 | 12.08 | 11.90 |
| Mean | 4.9 | 4.4 | .3375 | 3.4597 | 42.0 | 40.1 | 12.24 | 13.24 |
| | | | | Lot 8A[b] | | | | |
| 6 | 5.0 | 2.0 | .3126 | 3.1018 | 41.0 | 39.5 | 11.62 | 12.39 |
| 15 | 3.0 | 3.0 | .2618 | 4.9700 | 39.0 | 38.0 | 11.46 | 12.24 |
| 22 | 6.0 | 5.0 | .4057 | 4.0842 | 41.8 | 41.0 | 12.39 | 11.99 |
| 32 | 8.0 | 2.0 | .2446 | 3.4200 | 42.5 | 43.3 | 13.32 | 13.94 |
| 49 | 9.0 | 5.0 | .2650 | 2.7660 | 38.8 | 41.0 | 11.31 | 12.70 |
| 52 | 5.0 | 2.0 | .2896 | 3.3570 | 43.8 | 41.8 | 13.32 | 13.94 |
| 64 | 6.0 | 8.0 | .2835 | 3.5134 | 35.2 | 39.7 | 10.69 | 13.10 |
| 74 | 3.0 | 2.0 | .3144 | 3.4321 | 34.3 | 43.3 | 9.91 | 12.02 |
| Mean | 5.6 | 3.6 | .2972 | 3.5806 | 39.6 | 41.0 | 11.75 | 12.79 |

[a]Barrows, 12% protein-treated.

[b]Barrows, 12% protein-controls.

APPENDIX C. DATA ON LOTS 7A & 8A, TREATED AND CONTROL BARROWS ON 12% PROTEIN (continued)

| Pig No. | Total serum protein (start) gm./100 ml. | Total serum protein (finish) gm./100 ml. | Albumin (start) (%) | Albumin (finish) (%) | $\alpha^1$-Globulin (start) (%) | $\alpha^1$-Globulin (finish) (%) | $\alpha^2$-Globulin (start) (%) | $\alpha^2$-Globulin (finish) (%) |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lot 7A[a] | | | |
| 11 | 6.80 | 6.81 | 42.5 | 50.0 | 4.6 | 2.4 | 10.5 | 11.4 |
| 21 | 6.47 | 6.65 | 44.5 | 45.7 | 6.8 | 4.3 | 10.0 | 11.1 |
| 34 | 5.92 | 6.25 | 49.2 | 55.3 | 6.0 | 3.0 | 10.0 | 12.1 |
| 36 | 6.65 | 6.58 | 45.7 | 53.8 | 5.8 | 5.3 | 16.2 | 8.9 |
| 60 | 7.30 | 6.30 | 47.6 | 51.3 | 5.8 | 5.2 | 3.7 | 5.4 |
| 61 | 6.67 | 5.97 | 47.4 | 50.6 | 6.7 | 6.9 | 12.9 | 7.7 |
| 75 | 6.62 | 5.53 | 37.0 | 58.6 | 7.8 | 5.1 | 9.9 | 8.6 |
| 79 | 6.62 | 6.17 | 48.2 | 51.2 | 4.8 | 5.4 | 11.3 | 9.6 |
| Mean | 6.63 | 6.28 | 45.3 | 52.1 | 6.0 | 4.7 | 10.6 | 9.4 |
| | | | | | Lot 8A[b] | | | |
| 6 | 6.91 | 6.19 | 36.7 | 48.8 | 7.8 | 4.6 | 9.6 | 8.0 |
| 15 | 6.28 | 6.74 | 47.6 | 43.4 | 4.1 | 4.7 | 10.9 | 12.4 |
| 22 | 5.75 | 6.51 | 28.8 | 45.3 | 4.5 | 5.2 | 24.2 | 10.4 |
| 32 | 6.38 | 6.50 | 43.2 | 40.4 | 5.9 | 20.3 | 8.6 | 8.2 |
| 49 | 6.36 | 6.52 | 51.2 | 49.1 | 7.5 | 7.4 | 11.7 | 13.0 |
| 52 | 6.66 | 7.03 | 45.2 | 48.9 | 6.9 | 5.7 | 6.9 | 6.8 |
| 64 | 5.58 | 6.15 | 54.2 | 52.2 | 6.5 | 4.9 | 4.6 | 9.4 |
| 74 | 6.31 | 6.23 | 46.9 | 46.3 | 4.8 | 5.3 | 6.2 | 7.8 |
| Mean | 6.28 | 6.48 | 45.5 | 46.8 | 6.0 | 7.3 | 10.3 | 9.5 |

[a]Barrows, 12% protein-treated.

[b]Barrows, 12% protein-controls.

APPENDIX C. DATA ON LOTS 7A & 8A, TREATED AND CONTROL BARROWS ON 12% PROTEIN (continued)

| Pig No. | $\alpha^3$-Globulin (start) (%) | $\alpha^3$-Globulin (finish) (%) | β-Globulin (start) (%) | β-Globulin (finish) (%) | γ-Globulin (start) (%) | γ-Globulin (finish) (%) |
|---|---|---|---|---|---|---|
| | | | Lot 7A[a] | | | |
| 11 | 6.4 | 5.9 | 11.0 | 9.3 | 25.0 | 21.0 |
| 21 | 8.2 | 6.0 | 11.4 | 9.0 | 19.1 | 23.9 |
| 34 | 5.5 | 7.0 | 13.1 | 8.5 | 16.2 | 14.1 |
| 36 | 0 | 6.6 | 12.7 | 9.6 | 19.6 | 15.8 |
| 60 | 11.1 | 7.3 | 12.7 | 8.9 | 19.1 | 18.9 |
| 61 | 0 | 6.9 | 14.4 | 10.3 | 18.6 | 17.6 |
| 75 | 12.0 | 6.3 | 16.3 | 10.9 | 25.7 | 16.6 |
| 79 | 11.3 | 7.2 | 12.5 | 9.6 | 23.0 | 16.9 |
| Mean | 6.8 | 6.7 | 13.0 | 9.5 | 20.8 | 18.1 |
| | | | Lot 8A[b] | | | |
| 6 | 7.3 | 8.6 | 12.6 | 10.4 | 25.8 | 24.2 |
| 15 | 6.8 | 8.6 | 11.6 | 10.1 | 19.0 | 20.9 |
| 22 | 9.2 | 7.1 | 9.8 | 10.4 | 23.5 | 21.7 |
| 32 | 6.4 | 0 | 12.7 | 11.5 | 23.2 | 19.8 |
| 49 | 0 | 0 | 13.1 | 11.1 | 16.5 | 19.4 |
| 52 | 7.5 | 9.1 | 12.3 | 11.4 | 21.2 | 18.2 |
| 64 | 8.5 | 8.5 | 11.2 | 9.8 | 15.0 | 15.2 |
| 74 | 9.5 | 8.2 | 12.2 | 11.5 | 20.4 | 20.9 |
| Mean | 6.9 | 6.3 | 11.9 | 10.8 | 20.6 | 20.0 |

[a]Barrows, 12% protein-treated.

[b]Barrows, 12% protein-controls.

APPENDIX C. DATA ON LOTS 7A & 8A, TREATED AND CONTROL BARROWS ON 12% PROTEIN (continued)

| Pig No. | Serum Ca (start) (mg. %) | Serum Ca (finish) (mg. %) | Serum Pi (start) (mg. %) | Serum Pi (finish) (mg. %) | Femur wt. (gm.) | Bone P % ash | Bone Ca % ash | % Ash | I-moment of inertia (cm.$^4$) | W-maximum load (Kg.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Lot 7A[a] | | | | | |
| 11 | 12.0 | 11.0 | 7.9 | 8.2 | 249.7 | 18.6 | 44.6 | 55.7 | .77 | 237.0 |
| 21 | 10.7 | 11.5 | 7.5 | 8.2 | 291.8 | 19.3 | 44.2 | 57.2 | 1.07 | 305.0 |
| 34 | 11.2 | 10.9 | 7.9 | 7.3 | 252.4 | 18.0 | 45.2 | 53.3 | .88 | 270.0 |
| 36 | 11.0 | 10.5 | 7.4 | 7.6 | 282.4 | 13.3 | 43.9 | 51.3 | .90 | 303.0 |
| 60 | 12.0 | 9.8 | 7.8 | 8.0 | 257.7 | 17.0 | 43.9 | 56.3 | 1.01 | 263.0 |
| 61 | 10.0 | 11.0 | 5.8 | 7.3 | 252.2 | 13.8 | 43.3 | 55.1 | .79 | 273.0 |
| 75 | 10.7 | 8.6 | 8.2 | 7.2 | 248.7 | 21.1 | 44.4 | 52.3 | .97 | 280.0 |
| 79 | 11.3 | 11.1 | 7.9 | 8.2 | 264.5 | 19.1 | 46.4 | 56.6 | .73 | 270.0 |
| Mean | 11.1 | 10.6 | 7.6 | 7.8 | 262.4 | 17.5 | 44.5 | 54.7 | .89 | 275.1 |
| | | | | | Lot 8A[b] | | | | | |
| 6 | 10.7 | 10.8 | 8.5 | 7.3 | 272.2 | 20.4 | 42.9 | 57.3 | 1.03 | 285.0 |
| 15 | 12.0 | 9.6 | 8.6 | 6.2 | 253.6 | 16.6 | 44.5 | 56.5 | .71 | 207.0 |
| 22 | 10.7 | 10.3 | 8.0 | 7.1 | 256.2 | 19.6 | 44.1 | 55.7 | .92 | 249.0 |
| 32 | 9.3 | 11.3 | 6.5 | 8.4 | 220.3 | 20.9 | 45.3 | 52.3 | .64 | 247.0 |
| 49 | 8.7 | 9.9 | 9.2 | 7.9 | 282.0 | 21.6 | 45.5 | 57.9 | 1.07 | 320.0 |
| 52 | 9.7 | 10.5 | 6.7 | 8.1 | 239.8 | 25.8 | 44.6 | 52.8 | .90 | 303.0 |
| 64 | 10.0 | 10.2 | 6.3 | 8.2 | 212.3 | 16.6 | 45.6 | 55.6 | .56 | 220.0 |
| 74 | 8.7 | 10.8 | 6.6 | 7.4 | 247.6 | 18.0 | 46.1 | 54.1 | 1.08 | 282.0 |
| Mean | 10.0 | 10.4 | 7.6 | 7.6 | 248.0 | 19.9 | 44.8 | 55.3 | .86 | 264.1 |

[a]Barrows, 12% protein-treated.

[b]Barrows, 12% protein-controls.

APPENDIX C. DATA ON LOTS 7A & 8A, TREATED AND CONTROL BARROWS ON 12% PROTEIN (continued)

| Pig No. | M-Bending moment (Kg.-cm.) | S-Breaking stress (Kg./cm.$^2$) | Ham analysis % Moisture | % Fat | % Protein | Taste panel score (1 - 9) | Shear (lb.) |
|---|---|---|---|---|---|---|---|
| | | | Lot 7A[a] | | | | |
| 11 | 906.5 | 1168.4 | 55.72 | 28.30 | 15.84 | 6.5 | 9.9 |
| 21 | 1166.6 | 1195.0 | 58.71 | 24.78 | 17.62 | 6.6 | 6.9 |
| 34 | 972.0 | 1198.4 | 52.61 | 32.03 | 13.89 | 6.8 | 6.1 |
| 36 | 1106.0 | 1354.7 | 51.15 | 35.02 | 13.40 | 6.1 | 6.6 |
| 60 | 953.4 | 1006.1 | 49.73 | 33.46 | 14.97 | 6.8 | 7.3 |
| 61 | 1023.8 | 1334.6 | 53.84 | 30.91 | 14.65 | 6.3 | 9.8 |
| 75 | 1050.0 | 1173.3 | 50.04 | 35.37 | 14.20 | 6.5 | 7.6 |
| 79 | 992.3 | 1341.3 | 51.22 | 33.89 | 14.78 | 6.6 | 6.5 |
| Mean | 1021.3 | 1221.5 | 52.88 | 31.72 | 14.92 | 6.5 | 7.6 |
| | | | Lot 8A[b] | | | | |
| 6 | 1054.5 | 1111.1 | 53.70 | 30.38 | 14.76 | 6.2 | 6.7 |
| 15 | 765.9 | 1095.7 | 47.22 | 38.98 | 13.37 | 6.6 | 8.6 |
| 22 | 902.6 | 1037.7 | 53.00 | 31.20 | 14.02 | 6.5 | 7.8 |
| 32 | 876.9 | 1317.4 | 46.44 | 40.21 | 12.74 | 6.6 | 7.6 |
| 49 | 1216.0 | 1257.0 | 48.87 | 37.23 | 13.48 | 6.9 | 7.7 |
| 52 | 1060.5 | 1240.0 | 46.00 | 39.87 | 12.90 | 6.1 | 8.1 |
| 64 | 797.5 | 1173.3 | 43.03 | 44.67 | 12.52 | 6.1 | 7.2 |
| 74 | 987.0 | 989.7 | 50.54 | 34.92 | 14.52 | 6.1 | 9.3 |
| Mean | 957.6 | 1152.7 | 48.60 | 37.18 | 13.54 | 6.4 | 7.9 |

[a]Barrows, 12% protein-treated.

[b]Barrows, 12% protein-controls.

APPENDIX D. DATA ON LOTS 9A & 10A, TREATED AND CONTROL BARROWS ON 16% PROTEIN

| Pig No. | Initial wt. (lb) | Final wt. (lb) | Gain/day (lb) | Days on feed | Backfat (in.) | Length (in.) | L. dorsi area 10th (sq. in.) | L. dorsi last rib (sq. in.) | % lean cuts | % ham & loin | % fat trim |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Lot 9A[a] | | | | | | |
| 18 | 90.0 | 211.0 | 1.64 | 74.0 | 1.22 | 31.1 | 4.00 | 3.98 | 54.7 | 36.8 | 22.0 |
| 23 | 105.0 | 210.0 | 1.57 | 67.0 | 1.37 | 31.5 | 4.19 | 4.66 | 56.7 | 38.5 | 20.3 |
| 33 | 98.0 | 206.5 | 1.62 | 67.0 | 1.80 | 29.6 | 3.49 | 3.55 | 47.7 | 31.4 | 32.9 |
| 56 | 114.0 | 210.0 | 1.43 | 67.0 | 1.22 | 30.8 | 4.60 | 4.76 | 58.6 | 39.3 | 17.6 |
| 57 | 96.0 | 213.0 | 1.75 | 67.0 | 1.59 | 30.5 | 4.20 | 4.60 | 53.4 | 35.6 | 23.9 |
| 59 | 107.0 | 207.0 | 1.67 | 60.0 | 1.24 | 30.0 | 4.72 | 5.03 | 55.6 | 38.2 | 21.0 |
| 66 | 108.0 | 206.5 | 1.64 | 60.0 | 1.27 | 30.7 | 4.35 | 4.61 | 54.4 | 36.5 | 22.0 |
| 86 | 94.0 | 213.0 | 1.61 | 74.0 | 2.05 | 29.8 | 3.52 | 3.57 | 46.9 | 30.6 | 32.9 |
| Mean | 101.5 | 210.0 | 1.62 | 67.0 | 1.47 | 30.5 | 4.13 | 4.35 | 53.5 | 35.9 | 24.1 |
| | | | | | Lot 10A[b] | | | | | | |
| 14 | 110.0 | 207.5 | 1.63 | 60.0 | 1.78 | 29.6 | 2.98 | 3.01 | 47.3 | 32.3 | 28.1 |
| 25 | 94.0 | 207.0 | 1.53 | 74.0 | 1.71 | 29.9 | 3.82 | 4.30 | 53.6 | 35.3 | 26.1 |
| 40 | 101.0 | 222.0 | 1.81 | 67.0 | 2.03 | 29.3 | 3.06 | 3.05 | 46.2 | 29.6 | 33.5 |
| 42 | 108.0 | 214.0 | 1.77 | 60.0 | 2.01 | 29.9 | 3.72 | 3.52 | 47.1 | 31.0 | 32.1 |
| 67 | 99.0 | 206.5 | 1.60 | 67.0 | 1.59 | 30.0 | 3.30 | 3.34 | 48.6 | 32.1 | 23.7 |
| 72 | 92.0 | 208.0 | 1.57 | 74.0 | 1.69 | 30.3 | 3.25 | 3.79 | 49.2 | 31.9 | 29.1 |
| 73 | 100.0 | 209.0 | 1.82 | 60.0 | 1.73 | 30.2 | 4.05 | 4.30 | 49.6 | 32.4 | 27.2 |
| 77 | 97.0 | 213.0 | 1.73 | 67.0 | 1.97 | 30.3 | 3.04 | 3.25 | 48.6 | 31.6 | 32.8 |
| Mean | 100.1 | 211.0 | 1.68 | 66.1 | 1.81 | 29.9 | 3.40 | 3.57 | 48.8 | 32.0 | 29.1 |

[a]Barrows, 16% protein-treated.

[b]Barrows, 16% protein-controls.

APPENDIX D. DATA ON LOTS 9A & 10A, TREATED AND CONTROL BARROWS ON 16% PROTEIN (continued)

| Pig No. | Marbling score 10th rib (1-15) | Marbling score last rib | Pituitary wt. (gm.) | Adrenal wt. (gm.) | % Hct (start) | % Hct (finish) | Hgb (start) gm./100 ml. | Hgb (finish) gm./100 ml. |
|---|---|---|---|---|---|---|---|---|
| | | | | Lot 9A[a] | | | | |
| 18 | 5.0 | 5.0 | .3570 | 4.8220 | 36.2 | 36.3 | 10.84 | 13.94 |
| 23 | 3.0 | 2.0 | .3458 | 4.2075 | 41.0 | 37.9 | 12.08 | 11.65 |
| 33 | 5.0 | 3.0 | .3477 | 3.0503 | 45.5 | 38.1 | 13.17 | 12.36 |
| 56 | 5.0 | 3.0 | .3451 | 3.6980 | 37.2 | 36.7 | 11.46 | 12.08 |
| 57 | 2.0 | 2.0 | .3169 | 3.1694 | 34.0 | 37.8 | 10.22 | 13.38 |
| 59 | 5.0 | 3.0 | .3324 | 3.7660 | 42.0 | 44.2 | 12.55 | 14.13 |
| 66 | 4.0 | 2.0 | .3981 | 4.1210 | 39.4 | 38.8 | 11.62 | 12.86 |
| 86 | 1.0 | 1.0 | .3485 | 3.1907 | 39.7 | 40.7 | 11.00 | 11.77 |
| Mean | 3.8 | 2.6 | .3489 | 3.7531 | 39.4 | 38.8 | 11.62 | 12.77 |
| | | | | Lot 10A[b] | | | | |
| 14 | 5.0 | 6.0 | .2950 | 3.6160 | 37.9 | 36.1 | 11.31 | 12.08 |
| 25 | 3.0 | 2.0 | .2749 | 4.1670 | 41.0 | 43.2 | 11.77 | 13.01 |
| 40 | 8.0 | 5.0 | .2963 | 2.8800 | 41.7 | 40.0 | 12.08 | 12.70 |
| 42 | 6.0 | 6.0 | .3013 | 3.2080 | 42.0 | 43.8 | 11.77 | 14.56 |
| 67 | 2.0 | 2.0 | .3185 | 3.4998 | 47.8 | 37.8 | 14.25 | 12.24 |
| 72 | 1.0 | 1.0 | .2888 | 3.6192 | 41.4 | 41.0 | 11.77 | 11.77 |
| 73 | 3.0 | 3.0 | .2320 | 3.5000 | 42.1 | 39.0 | 12.70 | 12.86 |
| 77 | 3.0 | 2.0 | .3115 | 3.1387 | 39.8 | 39.3 | 12.55 | 12.70 |
| Mean | 3.9 | 4.0 | .2898 | 3.4304 | 41.7 | 40.0 | 12.28 | 12.74 |

[a]Barrows, 16% protein-treated.

[b]Barrows, 16% protein-controls.

APPENDIX D. DATA ON LOTS 9A & 10A, TREATED AND CONTROL BARROWS ON 16% PROTEIN (continued)

| Pig No. | Total serum protein (start) gm./100 ml. | Total serum protein (finish) gm./100 ml. | Albumin (start) (%) | Albumin (finish) (%) | $\alpha^1$-Globulin (start) (%) | $\alpha^1$-Globulin (finish) (%) | $\alpha^2$-Globulin (start) (%) | $\alpha^2$-Globulin (finish) (%) |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lot 9A[a] | | | |
| 18 | 5.90 | 5.87 | 52.4 | 55.8 | 7.0 | 6.1 | 10.0 | 6.1 |
| 23 | 5.53 | 6.66 | 47.6 | 50.4 | 13.1 | 3.3 | 9.0 | 8.1 |
| 33 | 6.52 | 6.14 | 46.2 | 54.7 | 6.6 | 5.5 | 8.4 | 6.6 |
| 56 | 6.37 | 5.66 | 47.6 | 52.9 | 5.9 | 4.8 | 11.8 | 5.4 |
| 57 | 6.16 | 5.54 | 48.9 | 55.3 | 6.4 | 5.5 | 12.8 | 12.8 |
| 59 | 7.11 | 6.94 | 46.4 | 49.7 | 2.1 | 4.9 | 3.4 | 11.9 |
| 66 | 6.88 | 6.73 | 47.5 | 49.7 | 5.4 | 5.4 | 6.6 | 8.6 |
| 86 | 5.96 | 6.83 | 46.9 | 55.0 | 8.1 | 5.8 | 13.8 | 8.8 |
| Mean | 6.30 | 6.30 | 47.9 | 52.9 | 6.8 | 5.2 | 9.5 | 8.5 |
| | | | | | Lot 10A[b] | | | |
| 14 | 6.31 | 6.33 | 47.4 | 51.3 | 6.8 | 12.6 | 14.1 | 7.6 |
| 25 | 6.66 | 6.88 | 41.0 | 49.8 | 3.6 | 6.3 | 9.7 | 8.5 |
| 40 | 6.84 | 6.42 | 44.8 | 51.6 | 8.3 | 6.8 | 4.4 | 5.2 |
| 42 | 6.62 | 6.04 | 46.2 | 48.6 | 4.0 | 8.3 | 10.8 | 4.9 |
| 67 | 6.98 | 5.80 | 49.3 | 51.7 | 6.4 | 4.6 | 5.4 | 8.0 |
| 72 | 6.49 | 6.33 | 48.4 | 49.5 | 5.2 | 5.3 | 13.1 | 9.6 |
| 73 | 6.65 | 5.79 | 48.2 | 52.3 | 7.1 | 5.6 | 13.1 | 9.4 |
| 77 | 5.72 | 5.52 | 44.8 | 46.2 | 8.1 | 6.3 | 5.7 | 8.1 |
| Mean | 6.53 | 6.14 | 46.3 | 50.1 | 6.2 | 7.0 | 9.5 | 7.7 |

[a] Barrows, 16% protein-treated.

[b] Barrows, 16% protein-controls.

APPENDIX D. DATA ON LOTS 9A & 10A, TREATED AND CONTROL BARROWS ON 16% PROTEIN (continued)

| Pig No. | $\alpha^3$-Globulin (start) (%) | $\alpha^3$-Globulin (finish) (%) | β-Globulin (start) (%) | β-Globulin (finish) (%) | γ-Globulin (start) (%) | γ-Globulin (finish) (%) |
|---|---|---|---|---|---|---|
| | | | Lot 9A[a] | | | |
| 18 | 0 | 4.2 | 12.4 | 12.1 | 18.2 | 15.8 |
| 23 | 0 | 6.5 | 13.1 | 8.9 | 17.2 | 22.8 |
| 33 | 5.7 | 7.7 | 13.6 | 8.8 | 19.5 | 16.6 |
| 56 | 0 | 7.5 | 11.8 | 10.7 | 22.9 | 16.0 |
| 57 | 0 | 0 | 11.3 | 10.3 | 20.6 | 16.1 |
| 59 | 13.9 | 5.9 | 10.5 | 9.4 | 23.7 | 18.2 |
| 66 | 6.6 | 7.6 | 11.5 | 9.7 | 22.4 | 18.9 |
| 86 | 0 | 7.6 | 15.6 | 3.5 | 15.6 | 19.3 |
| Mean | 3.3 | 5.9 | 12.5 | 9.2 | 20.0 | 18.0 |
| | | | Lot 10A[b] | | | |
| 14 | 0 | 0 | 12.0 | 10.1 | 19.8 | 18.6 |
| 25 | 6.2 | 5.9 | 18.5 | 11.4 | 21.0 | 18.8 |
| 40 | 9.9 | 9.6 | 14.9 | 11.2 | 17.7 | 15.6 |
| 42 | 7.6 | 11.1 | 13.0 | 10.4 | 18.4 | 16.7 |
| 67 | 7.4 | 8.6 | 12.3 | 9.8 | 19.2 | 17.2 |
| 72 | 0 | 6.4 | 13.1 | 10.6 | 20.2 | 18.6 |
| 73 | 0 | 7.5 | 13.7 | 11.2 | 17.9 | 14.0 |
| 77 | 8.1 | 8.1 | 12.6 | 12.6 | 20.7 | 18.8 |
| Mean | 4.9 | 7.2 | 13.8 | 10.9 | 19.4 | 17.3 |

[a]Barrows, 16% protein-treated.

[b]Barrows, 16% protein-controls.

APPENDIX D. DATA ON LOTS 9A & 10A, TREATED AND CONTROL BARROWS ON 16% PROTEIN (continued)

| Pig No. | Serum Ca (start) (mg. %) | Serum Ca (finish) (mg. %) | Serum Pi (start) (mg. %) | Serum Pi (finish) (mg. %) | Femur wt. (gm.) | Bone P % ash | Bone Ca % ash | % Ash | I-moment of inertia (cm.$^4$) | W-maximum load (Kg.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Lot 9A[a] | | | | | |
| 18 | 11.3 | 8.6 | 6.0 | 6.1 | 338.0 | 22.3 | 46.1 | 51.6 | .99 | 310.0 |
| 23 | 9.3 | 10.0 | 6.5 | 6.9 | 293.5 | 17.8 | 43.7 | 51.8 | 1.19 | 285.0 |
| 33 | 11.3 | 10.7 | 7.1 | 7.3 | 260.0 | 23.7 | 45.8 | 57.1 | 1.06 | 310.0 |
| 56 | 10.0 | 11.1 | 6.5 | 7.7 | 317.3 | 20.4 | 44.5 | 55.5 | 1.20 | 320.0 |
| 57 | 8.7 | 9.5 | 6.4 | 8.1 | 277.3 | 16.7 | 45.2 | 56.4 | .91 | 248.0 |
| 59 | 11.5 | 10.0 | 8.6 | 7.6 | 262.5 | 23.3 | 43.7 | 54.2 | .92 | 290.0 |
| 66 | 8.7 | 9.5 | 6.5 | 6.5 | 291.9 | 16.3 | 44.3 | 55.7 | 1.32 | 237.0 |
| 86 | 11.2 | 10.7 | 7.3 | 8.2 | 252.8 | 20.0 | 45.0 | 54.3 | .81 | 326.0 |
| Mean | 10.3 | 10.0 | 6.9 | 7.3 | 286.7 | 20.1 | 44.8 | 54.6 | 1.05 | 290.8 |
| | | | | | Lot 10A[b] | | | | | |
| 14 | 10.7 | 9.4 | 6.3 | 7.7 | 267.0 | 16.8 | 44.9 | 56.9 | .93 | 237.0 |
| 25 | 10.0 | 10.8 | 6.9 | 7.6 | 249.4 | 17.1 | 44.5 | 58.3 | .71 | 297.0 |
| 40 | 10.0 | 9.9 | 6.6 | 7.5 | 234.6 | 18.9 | 45.3 | 57.5 | .89 | 285.0 |
| 42 | 12.0 | 9.9 | 8.5 | 8.2 | 235.3 | 14.0 | 44.8 | 57.6 | .78 | 275.0 |
| 67 | 10.7 | 10.9 | 6.9 | 8.8 | 259.5 | 19.6 | 43.8 | 54.8 | .93 | 315.0 |
| 72 | 10.5 | 11.1 | 8.4 | 8.2 | 246.0 | 21.5 | 44.7 | 58.7 | .90 | 296.0 |
| 73 | 10.0 | 8.9 | 7.4 | 8.2 | 261.0 | 21.5 | 42.7 | 51.3 | .97 | 290.0 |
| 77 | 9.3 | 9.4 | 9.0 | 8.3 | 240.0 | 19.6 | 45.7 | 55.8 | .67 | 292.0 |
| Mean | 10.4 | 10.0 | 7.5 | 8.1 | 249.1 | 18.6 | 44.6 | 56.4 | .85 | 285.9 |

[a]Barrows, 16% protein-treated.

[b]Barrows, 16% protein-controls.

APPENDIX D. DATA ON LOTS 9A & 10A, TREATED AND CONTROL BARROWS ON 16% PROTEIN (continued)

| Pig No. | M-Bending moment (Kg.-cm.) | S-Breaking stress (Kg./cm.$^2$) | Ham analysis % Moisture | % Fat | % Protein | Taste panel score (1 - 9) | Shear (lb.) |
|---|---|---|---|---|---|---|---|
| | | | Lot 9A[a] | | | | |
| 18 | 1193.5 | 1399.5 | 57.59 | 24.77 | 17.50 | 7.0 | 6.5 |
| 23 | 1033.1 | 975.9 | 60.50 | 21.73 | 17.66 | 5.8 | 6.9 |
| 33 | 1054.0 | 1068.0 | 48.76 | 37.34 | 13.56 | 6.6 | 8.2 |
| 56 | 1272.0 | 1254.0 | 59.14 | 23.44 | 17.20 | 6.2 | 8.6 |
| 57 | 942.4 | 1140.4 | 53.27 | 30.99 | 15.20 | 6.1 | 6.6 |
| 59 | 1058.5 | 1227.1 | 57.50 | 26.40 | 16.22 | 6.6 | 7.3 |
| 66 | 918.4 | 846.9 | 54.28 | 30.48 | 14.35 | 6.6 | 6.5 |
| 86 | 1189.9 | 1516.8 | 50.58 | 35.46 | 14.86 | 6.6 | 7.9 |
| Mean | 1082.7 | 1178.6 | 55.20 | 28.83 | 15.81 | 6.4 | 7.3 |
| | | | Lot 10A[b] | | | | |
| 14 | 859.1 | 986.3 | 51.22 | 34.47 | 15.12 | 6.8 | 6.9 |
| 25 | 1039.5 | 911.8 | 53.90 | 30.76 | 14.15 | 6.2 | 7.2 |
| 40 | 997.5 | 1133.8 | 45.93 | 41.17 | 13.27 | 6.5 | 7.0 |
| 42 | 983.1 | 1285.3 | 50.72 | 34.93 | 13.93 | 6.4 | 8.9 |
| 67 | 1157.6 | 1340.5 | 52.41 | 32.80 | 14.46 | 6.2 | 9.3 |
| 72 | 1132.2 | 1328.3 | 51.31 | 34.18 | 15.66 | 6.8 | 8.0 |
| 73 | 1065.8 | 1248.4 | 53.06 | 31.74 | 14.07 | 6.3 | 9.0 |
| 77 | 1036.6 | 1514.9 | 47.52 | 34.53 | 14.15 | 6.6 | 7.6 |
| Mean | 1033.9 | 1218.7 | 50.76 | 34.32 | 14.35 | 6.5 | 8.0 |

[a]Barrows, 16% protein-treated.

[b]Barrows, 16% protein-controls.