THE ANABOLIC RESPONSE OF SWINE TO 4-HYDROXY-17-ALPHA-METHYLTESTOSTERONE AND RELATIONSHIPS BETWEEN CHEMICAL AND PHYSICAL CHARACTERISTICS OF PORK CARCASSES

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presented by

Wayne Edward Henry

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ABSTRACT

THE ANABOLIC RESPONSE OF SWINE TO
4-HYDROXY-17-ALPHA-METHYLTESTOSTERONE
AND RELATIONSHIPS BETWEEN CHEMICAL AND PHYSICAL
CHARACTERISTICS OF PORK CARCASSES

by Wayne Edward Henry

Three trials involving 79 head of swine and feeding three different levels (2,4 and 8 mg./lb. of feed) of 4-hydroxy-17-alpha-methyltestosterone (MK-320) were conducted to study the effect of the synthetic steroid on: (1) feedlot performance and visual indications of virility; (2) backfat, lean cuts and water-holding capacity of fresh pork muscle; (3) to determine percent protein, percent fat, percent moisture, weight of skin, weight of bone, and weight of fat and lean combined of untrimmed wholesale cuts and; (4) to study the relationship of the physical and chemical composition of the wholesale cuts to carcass evaluation and to various palatability characteristics.

Supplementation of MK-320 to swine rations had no significant effect on feedlot performance, caused no viriligenic effects or other undesirable characteristics. The level of 8 mg. of the testosterone derivative supplemented in Trials I & II appeared to have a significant effect on the percent protein of the untrimmed, boneless wholesale cuts. The average percent protein (13.53) in the animals receiving 8 mg. of the synthetic steroid was significantly higher ($p < .01$) than the control lot (12.57). However, the significant treatment response was due to the barrows. Gilts did not respond significantly to the treatment.

The results of Trial III were in complete contrast to Trials I & II. In Trial III, the same treatment indicated no significant difference between lots when both gilts and barrows were considered. The analysis of

protein content of the barrows revealed the protein content to be significantly higher in the control lot than in the lots receiving 4 and 8 mg. of the hormone derivative. The Trial III experiment was conducted in the winter and the animals were maintained outdoors. It is possible that low winter temperatures increased the metabolic rate to a point where an additional hormone stimulation of the anterior pituitary failed to produce a response over and above that given by the normal autogenous growth hormone. No significant difference due to treatment was found in backfat, percent lean cuts, loin eye area and carcass length of all three trials. No significant difference was found between pH or expressible-water of the Longissimus dorsi between treatments.

Based on the chemical and physical analyses of all three trials, the approximate protein, fat and moisture content of the untrimmed (boneless) wholesale cuts of hogs weighing approximately 200 lb. was 13.0, 43.0 and 43.7 percent, respectively. The average weight of the bone in the shoulder, ham and loin was 1.3, 1.4 and 1.8 lb., respectively. The average weight of the skin for the shoulder, loin, belly and ham was 0.63, 0.73, 0.82 and 0.84 lb., respectively. The approximate chemical composition of the pork skin was 34.9 percent protein, 22.6 percent fat, and 44.4 percent moisture.

Percent protein of ham and loin, percent protein of ham, loin and shoulder, percent protein of ham, loin, shoulder and belly, were significantly correlated with percent lean cuts ($r = 0.78$, 0.80 and 0.79 respectively). The highly significant correlation ($r = 0.94$) was found between percent trimmed ham and percent lean cuts. Percent protein of ham and loin ($r = 0.70$), percent protein of ham, loin and shoulder ($r = 0.67$), percent protein of ham, loin, shoulder and belly ($r = 0.63$), percent protein of the belly ($r = 0.60$) and percent lean cuts ($r = 0.63$) were significantly correlated with the cross-sectional area of the *Longissimus dorsi* taken at the 10th rib. Correlation coefficients obtained between average carcass length and percent protein of ham and loin (0.47), percent protein of ham, loin and shoulder (0.50), percent protein of belly (0.45), and average carcass backfat (-0.47) were highly significant, but account for less than 30 percent of the total variation in protein or carcass backfat. Carcass length accounted for less than 9 percent of the total variation in percent lean cuts and no significant relationship was found between carcass length and loin eye area.

Taste panel scores indicated that tenderness was highly related ($p < .01$) with marbling ($r = 0.37$) and juiciness ($r = 0.63$). Warner-Bratzler shear correlated significantly with taste panel tenderness ($r = -0.73$) and with marbling ($r = -0.25$) at $p < .01$ and $p < .05$, respectively. Marbling correlated significantly ($p < .05$) with flavor ($r = 0.23$), but not with juiciness ($r = 0.003$).

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By

Wayne Edward Henry

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INTRODUCTION

Rapid growth and formation of muscle protein and fat in swine are questions of prime practical importance. The increased consumer demand for leaner cuts and the decreased demand for lard, along with the decline in consumption of pork, are indications that a different type of hog carcass is needed. The preference of consumers for leaner cuts of meat emphasizes the importance to be placed upon the carcass merit of hogs. Thus, in general, it is agreed that a leaner, more muscular type of hog is desired.

Unequivocal demonstrations in the production of swine with more favorable ratio of lean to fat has not been possible heretofore, although many observations have been in agreement with such production. In addition, many methods for evaluating the fat and lean content of pork carcasses have been studied, yet the methods have not been investigated sufficiently to establish a reliable means for determining the fat-lean ratio of pork carcasses.

Carcass length and backfat thickness are the criteria used by the Government for grading pork carcasses. Backfat thickness is the characteristic most commonly used in predicting the yield of a carcass. However, desirable traits, such as, percent lean cuts, loin eye area, intramuscular fat, and percent protein are not predicted as closely as desired by backfat depth. Other indices, such as, loin index, specific gravity, percent skinned ham, skinned shoulder, belly, and carcass weight have all been studied to predict body composition. However, the results are often misleading. Thus, in order to produce the leaner carcass demanded by the consumers, a more reliable method of measuring the fat-lean ratio of the carcass is needed.

It is also imperative to understand the relationship of these various carcass traits to the palatability of the carcass. Knowing what relationships exist between various muscle components and tenderness, juiciness, or flavor would greatly assist in the establishment of a more reliable system of quality standardization of pork. There is much controversy as to the relationship of various carcass traits and palatability. Some research work indicates a highly significant relationship between marbling to both juiciness and tenderness of pork, yet other studies indicate a non-significant relationship. A correlation between water-holding capacity and juiciness of cooked meat should be expected, in that the more water meat contains the faster the water will bind to the coagulated tissue. Several studies have been made to compare the amount of fluid expressed from cooked meat and taste panel scores for quantity of juice. However, the results between studies are not in complete agreement. It is possible that a great deal of disagreement in the literature may be due to the different concepts of juiciness or to the methods used in measuring water-holding capacity, or juiciness.

The objectives of this study were: (1) to feed anabolic agents to swine and study the effects on rate of gain, feed efficiency, and development of secondary sex characteristics; (2) to determine the effect of anabolic agents on protein content, backfat, percent lean cuts and water-holding capacity of pork muscle; (3) to determine percent protein, percent fat, percent moisture, weight of skin, weight of bone, and weight of fat and lean combined of the untrimmed wholesale cuts and; (4) to study the relationship of the physical and chemical composition of the wholesale cuts to carcass evaluation and to various palatability characteristics.

REVIEW OF LITERATURE

In view of the anabolic response of ruminants to diethyl-stilbestrol and of rats to testosterone and certain of its derivatives, several feeding experiments have been conducted over the past years.

Action of the Growth Hormone (Somatotrophin).

The hypophyseal growth hormone is a primary regulator of muscle and skeleton growth, Henricson and Ullberg (1960). It governs the relationship between the metabolism of muscle protein and fat. However, according to Turner (1960), it has not been conclusively determined whether the primary action of the growth hormone is to diminish protein and amino acid catabolism or to stimulate protein anabolism. Moon *et al*. (1957) pointed out that somatotrophin is a protein anabolic hormone that probably affects the growth of all body tissues, and one of its most important actions being to increase nitrogen retention. According to Turner (1960), the bulk of the amino acids not utilized by the body are normally converted to urea. Somatotrophin, administered to nephrectomized rats, retards the conversion of amino acids to urea. Thus, when the growth hormone is injected into the rat, the increase in body weight is due to an actual increase in tissue protein or water and salts, but not to fat deposition. The action of the growth hormone on certain kinds of tissue protein is altered by the withdrawal of thyroid hormone (Turner, 1960).

The exact action of diethylstilbestrol in animals is not clear. Clegg *et al*. (1954) concluded that diethylstilbestrol caused an increase of corticotrophin (ACTH) from the pituitary, which in turn brings about adrenal cortical stimulation. Dorfman (1955) indicated that the adrenal plays an important role in the endocrine effect of exogenous estrogenic substance in ruminants. He pointed out that progesterone was important as an intermediate in corticoid biosynthesis. According to Turner (1960), two general types of theories have been proposed to account for the action of hormones at the cellular level: (1) a direct effect on intracellular enzyme systems; and (2) the changing of the permeability of the cell membrane. The two theories are not necessarily separated. In the first theory it is believed that the hormone may alter the formation rate of new enzyme molecules; they may cause the conversion of an inactive form of an enzyme into its active form; or they may serve as coenzymes and thus be involved in the reaction catalyzed by the enzymes. In the latter theory it is thought that the hormone may change the permeability of the cell membranes or the membranes which enclose the various intracellular structures. The permeability is governed by the rate at which substrates and cofactors are made available to the enzyme system.

According to Emmens (1950), synthetic estrogenic substances are not themselves estrogenic but exert their effects after metabolic transfer into the body. Struempler *et al*. (1959) support the theory that the growth-stimulating influence of stilbestrol in immature ruminants is primarily mediated through growth hormone stimulation within the animal body.

Effect of Growth Hormones on Feedlot Performance and Carcass Characteristics.

In view of the growth-stimulating actions of diethylstilbestrol in cattle and sheep, the response of pigs to diethylstilbestrol has been studied. Beeson *et al*. (1955) reported that oral administration of stilbestrol to swine failed to produce a response in rate of gain or feed efficiency. However, Cahill et al. (1961) found that the implantation of

96 mg. of stilbestrol increased gain and also increased the percent edible portion of hams of boars.

Woehling et al. (1951), Pearson et al. (1952), Tribble et al. (1958), Thrasher et al. (1959), in studying the effect of stilbestrol in swine, reported that stilbestrol implants failed to induce significant increases in carcass leanness. Day et al. (1960) concurred with these findings that stilbestrol implants in swine failed to effect carcass leanness. However, Heitman and Clegg (1957) reported that the implantation of 30 mg. of stilbestrol in feeder pigs weighing 58 to 73 pounds decreased backfat thickness and increased percent lean cuts.

Woehling et al. (1951) studied the effect of implanting stilbestrol pellets into growing-fattening pigs. They found that of all the characteristics studied, daily gain, feed efficiency, dressing percent, carcass length, weight of regular ham, percent external fat in regular ham, loin eye area, backfat, specific gravity, length of femur, weight of leaf fat and seediness of belly, only seediness of belly in the stilbestrol group showed significant deviation. They also observed that the reproductive organs of treated pigs showed evidence of hormonal stimulation. Dinusson et al. (1951) found that stilbestrol pellets implanted subcutaneously produced no stimulation in growth. However, the untreated hogs required from 5.2 percent to 13.7 percent more feed per lb. of gain. In this study they reported that the treated lots showed teat development in both sexes, a mild nymphomaniac response and extreme swelling of external genitalia of gilts, and in barrows, a restored ability for erection and renewed sex desire.

It is known that androgens increase nitrogen retention in dog, rat, and man, and that nitrogen is stored in the form of protein in the animal body. Hershberger *et al.* (1953) found that the myotrophic activity of 19-nortestosterone and other steroids increased nitrogen retention in rat, dog, and man. Saunders and Drill (1957), in a comparative study of the androgenic and anabolic effects of various steroids, concluded that, in general, androgens increased nitrogen retention. Sala and Baldratti (1957) concurred with Saunders and Drill's findings. Testosterone and esters of testosterone have been used clinically as anabolic agents (Kochakian *et al.*, 1935; Kochakian *et al.*, 1936) but usage has been limited by early appearance of undesirable masculinization.

Sleeth *et al.* (1953), Bratzler *et al.* (1954), Beeson *et al.* (1955), Perry *et al.* (1956), and Noland *et al.* (1956), reported that testosterone when fed or implanted did not improve the growth rate or feed efficiency of growing-finishing hogs. Woehling *et al.* (1951), and Sleeth *et al.* (1953) observed no significant effects from the administration of testosterone subcutaneously. Hale *et al.* (1960) studied the response of pigs fed testosterone in diets high and low in energy protein. They found that the animals on the high energy diet, supplemented with 20 mg. of testosterone per day, gained less than the control group, or 1.73 lb. per day and 2.00 lb. per day, respectively. The animals on the low energy diet, both the control and the testosterone supplemented groups, had equal average gains of 1.66 lb. per day. They did find, however, that testosterone decreased backfat in all diets, but had no effect on carcass length or loin eye muscle. It, therefore, appears that the administration of testosterone to fattening swine either by feeding or subcutaneous injection is not very beneficial. In many cases undesirable secondary sex characteristics were observed. However, the use of testosterone derivatives in swine rations appears more promising.

Kochakian (1960) concluded that growth hormone and testosterone propionate produced an increase in nitrogen retention and body weight of mice. He also reported that the growth hormone had the ability to superimpose its protein-anabolic action on the maximal effect of testosterone propionate. Beeson _et al_. (1955) and Perry _et al_. (1956) fed methyltestosterone to swine which resulted in an increase in percent lean cuts. Johnston _et al_. (1957) confirmed these findings when they fed methyltestosterone and observed an increase in percent lean cuts. Noland and Burris (1956) and Whiteker _et al_. (1959) observed some effect towards carcass leanness. However, Perry _et al_. (1956) and Noland _et al_. (1956) reported that oral administration of methyltestosterone did not affect feedlot performance. No viriligenic effects or any other observable side effects due to treatment were noted when methyltestosterone was added to the swine rations.

Thrasher _et al_. (1959) studied the effect of several androgenic compounds upon the growth and carcass composition of swine. A 16 percent basal ration was fed to the animals to an average weight of 125 lb. From 125 lb. to 210 lb. the percent protein was reduced to 14 percent. Their experiment involved 5 different treatments. Lot treatments in mg. per lb. of feed were as follows:

Lot I, basal ration; Lot II, basal plus 5.0 mg. methyltestosterone; Lot III, basal plus 0.6 mg. 9 alpha fluro-11-beta-hydroxy-17-alpha-methyl testosterone; Lot IV, basal plus 0.4 mg. 17-ethyl-19-nortestosterone; Lot V, basal plus 2.0 mg. 17-ethyl-19-nortestosterone; Lot VI, basal plus 0.6 mg. 11-beta-hydroxy-17-alpha-methyl testosterone. No significant difference was found between lot averages for dressing percent, percent protein, percent fat, percent moisture, percent ash, percent primal cuts and various carcass measurements. However, in comparing the data for backfat depth, percent of ham, loin, lean cuts and backfat as well as percentage moisture, protein and fat in the edible portion, Lot II, which received 5.0 mg. methyltestosterone per lb. of feed, showed a tendency toward greater leanness when compared with the control lot. Carcasses from the lots receiving methyltestosterone were observed to be somewhat softer than those from the other treatments. No significant difference was noted in feedlot performance, although the animals in Lot V consumed more feed per pound of gain than the other lots. Thrasher et al. (1959) repeated the experiment, feeding different levels of 11-beta-hydroxy-17-alpha-methyltestosterone and found no significant difference in feedlot performance or carcass composition due to treatment. They also observed no development of secondary sex characteristics.

Aaron et al. (1959) compared the effect of several steroids administered orally and parenterally to male castrated rats. Their study used andro-stanazole (17-beta-hydroxy-17-alpha methyltestosterone 3,2-C pyrazole), methyltestosterone, and testosterone propionate. Orally, androstanazole appeared to be 30 times more anabolic and 25 times as androgenic as methyltestosterone. Parenterally, it appeared to be 1/20 as anabolic and 1/40 as androgenic as testosterone propionate. Androstanazole appeared to be as effective orally as parenterally.

Whiteker et al. (1959) reported that methylandrostenediol, methyltestosterone, thyroprotein, and a combination of the latter two failed to effect rate of gain in swine. The animals receiving methyltestosterone produced a higher percent lean cuts than pigs fed the basal ration. Masculine behavior and characteristics were noted among the animals receiving methyltestosterone. Johnston et al. (1957) fed methyltestosterone to swine at the rate of 9 mg. per lb. of feed and observed a decreased rate of gain, daily feed consumption, feed efficiency and backfat thickness. However, the results indicated that methyltestosterone increased the ratio of lean to fat in the carcass.

Sala *et al*. (1960), in a clinical evaluation of the protein-anabolizing property of 4-hydroxy-17-alpha methyltestosterone, reported that the gain in body weight was insufficient basis to determine the anabolic action of 4-hydroxy-17-alpha methyltestosterone since water-salt retention could account for much of the gain. According to Gaunt *et al*. (1949), estrogens and androgens have the property to reduce the excretion of sodium and cause an increased water retention. They concluded that probably all steroid hormones affect salt and water metabolism in some manner.

Chemical and Physical Measurements of Swine Carcasses as Indices of Carcass Value.

Chemical Composition. Mitchell and Hamilton (1929) designed an experiment to study the composition of growing and fattening pigs at different weights in relation to swine type (chuffy, intermediate and rangy) and general problems of swine nutrition. Carcasses were divided and one side was physically separated into bone, skin, fat and lean. Each component was then chemically analyzed for dry substance, protein, fat and ash content. In some cases the fat and lean were mixed together and then chemically analyzed. A comparison of composition between sows and barrows showed no significant differences between dry substance, protein, fat and ash. The approximate average percent composition for all animals was, dry substance 49.2, crude protein (N X 6.0) 11.3, fat 34.4, and ash 2.1 percent. The skin, which included the ears and snouts, from all hogs was analyzed as a composite. Its composition percent for dry matter, protein, fat and ash was "90.00, 37.08, 51.85 and 0.35 percent", respectively.

According to Atkinson and Klein (1946), the edible portion of a 175 lb. hog contains about 13 lb. of protein and 63.5 lb. of fat, and of a 200 lb. hog the protein and fat content of the edible portion is approximately 14.1 lb. and 76.1 lb., respectively. The fat content is 5 times greater than protein in the 175 lb. hog and is 5.4 times greater in the 200 lb. animal. Thus, as the weight of a hog increases, the percentage of fat rises and the percentage of protein and of lean declines.

Thrasher *et al.* (1959), in a study on the effect of estrogenic and androgen compounds upon the growth and carcass composition of swine, indicated that the average protein, fat and moisture content for hogs weighing approximately 205 lb. was 12.4, 47.5, and 38.8 percent, respectively. The chemical analysis was based upon the primal cuts which were boned and skinned prior to analyzing. Warner *et al.* (1934) reported that chemical analysis of various cuts was the most accurate measure of fatness. However, it is time consuming and impractical to determine carcass evaluation by total chemical analysis.

Physical Composition. Since the four lean cuts (ham, loin, picnic, Boston butt) are commonly used to express the value of hog carcasses, many experiments are conducted relating physical measurements to percent lean cuts. It is the general opinion that the percent lean cuts is the best single physical measurement of total carcass leanness. Very little data were found relating the chemical composition of the hog carcass to the primal or lean cuts. Warner *et al.* (1934) correlated percent fat cuts with percent edible portion and percent fat cuts with percent lean cuts. They concluded that these measurements were more reliable than percent belly or backfat thickness.

Backfat. Carcass backfat has been one of the most practical measurements obtainable for estimating the yield of fat. Many investigators, Hankins and Ellis (1934); Ellis and Hankins (1937); McMeekan (1941); Wiley et al. (1951); Aunan (1952); Pearson et al. (1958, 1959); Price (1960); Marcum and Stouffer (1961), and others, have reported the significance of carcass backfat to carcass evaluation studies.

McMeekan (1941) found a correlation of 0.97 between total weight of separable fat and backfat measurements. Jordan et al. (1956) studied several trials in the production of leaner type hogs, and found an average correlation of all trials of -0.91 between percent lean cuts and chemical fat, and -0.80 between percent lean cuts and average backfat. Price (1956) reported a correlation of -0.176 between backfat thickness and percent lean cuts. However, Price (1960), in the use of ultrasound in meat animal evaluation, reported a correlation of -0.72 between percent lean cuts and backfat. Pearson et al. (1958 and 1959) reported correlations of -0.47 and -0.80, respectively, between percent lean cuts and backfat thickness.

Bratzler et al. (1947) found a significant correlation of -0.82 between loin-backfat ratio and yield of primal cuts from hog carcasses. Pearson et al. (1958) concluded that loin indices, especially loin index and trimmed loin-backfat ratio reflected the various measures of leanness or fatness more accurately than percent ham, percent New York shoulder and percent belly. Backfat thickness is a primary determinant of carcass value and other factors do not improve the relationship enough to warrant detailed treatment in correlation procedures according to Engelman _et al_. (1950). Marcum and Stouffer (1961) reported that fat-cover depth proved to be as valuable as any other measurement for predicting percent lean cuts.

Length. Aunan and Winters (1949) reported that carcass length was not significantly correlated with lean content of carcass. However, they did find a significant correlation between length and loin eye area. Cummings and Winters (1951) reported a correlation of -0.67 between the ratio of backfat thickness to length of carcass and yield of primal cuts. A low, but significant correlation was found between carcass length and percent primal cuts. Aunan and Winters (1952) obtained an index of carcass evaluation by taking the weight per inch of length and dividing by backfat thickness. They concluded that backfat and length were indications of lean and fat content of pork carcasses.

Price (1956) reported that length was not significantly correlated with any of the cut-out measurements. All measures tested, including carcass backfat and live probe, were more highly related to all the cut-out percentages than was carcass length. Thus, he concluded that carcass length _per se_ was not a reliable measure of cut-out. Zobrisky _et al_. (1954), in studying the relationship between yield of lean cuts and carcass length, obtained a positive correlation with one breed and negative correlation with another. In a subsequent study, Zobrisky _et al_. (1959) reported a correlation coefficient of -0.18 between carcass length and yield of lean cuts of 186 hogs. They also found that some breeds were positively correlated and others had negative correlations between length and yield of lean cuts.

Pearson *et al*. (1958 and 1959) reported positive correlations between carcass length and lean cuts of 0.33 and 0.57, respectively. They also reported a positive correlation between percent loin and carcass length, but the variation in length accounted for less than 20 percent of the variability in percent loin. Percent ham, percent belly, and percent skinned shoulder were not significantly influenced by carcass length, and this may explain the low degree of relationship between carcass length and percent lean cuts. It was postulated that increases in percent belly were more likely due to an increase in thickness than to an increase in length. Carpenter *et al*. (1961) reported correlation coefficients of -0.07 between backfat and length in light hog carcasses and -0.17 in heavy hog carcasses. It, therefore, appears that carcass length is a questionable criterion in evaluating hog carcasses.

Ham. Hankins and Ellis (1934) found a correlation of 0.93 between the fat content of the edible portion of the pork carcass and of the right ham. Aunan and Winters (1949) illustrated that separable lean and fat of the ham was an indication of the separable lean and fat in the hog carcass. Pearson *et al*. (1956) reported that the ham was more closely correlated with the carcass than the loin or shoulder. A highly significant correlation coefficient of 0.76 was found between percent skinned ham and lean cuts in a subsequent study by Pearson *et al*. (1957). Price *et al*. (1957) found that the specific gravity of the regular ham was associated with percent lean cuts. They indicated that the chemical composition of the regular ham, loin eye area, and backfat were more closely related with carcass specific gravity than with ham specific gravity. Fredeen *et al*. (1955) found a positive relationship between the weight of lean in the ham and carcass leanness. Bruner (1959) confirmed this relationship by reporting correlation coefficients of 0.79 to 0.89 between pounds of skinned ham and pounds of lean cuts.

Fredeen (1955) reported that fat content of the ham was negatively associated with carcass and ham length. In the same study, Fredeen found a positive relationship (r = 0.85) between lean content of the ham and loin eye area and a negative relationship (r = -0.72) between percent fat of ham and loin eye area. He concluded that a strong relationship existed between lean content of ham and total body leanness.

In studying the relationship between various physical factors of swine carcass characteristics, Hegarty (1960) postulated that since the ham represents two to three percent more of the chilled carcass than the loin, the ham may be a more reliable index of lean cuts than the loin. The high correlation of 0.79 found between the skinned ham and percent lean cuts based on carcass weight suggested that percent trimmed ham alone may be used to indicate the lean cut yield of a carcass. It was also stated that the high correlations between percent trimmed ham and loin eye area (0.71 and 0.76 at the 10th and last rib, respectively) again emphasize the fact that the skinned ham is an excellent indicator of carcass muscling.

Loin Eye Area. Hammond and Murry (1937) stated that since the region of the loin is the latest maturing part of the body, a measurement of this area would be a good index of the degree of carcass muscling. Auman and Winters (1949) reported that loin eye area was indicative of carcass leanness when the effect of carcass weight was removed, however, loin eye area was not correlated with lean cuts *per se*. Price (1956) found a highly significant relationship (0.609) between carcass specific gravity and loin eye area at the tenth rib. He indicated that this was the highest of any factor related to lean area of loin.

Pearson et al. (1959) reported correlation coefficients of -0.50 between backfat and loin eye area and 0.38 between carcass length and loin eye area, thus indicating the poor relationship between backfat and carcass length to the cross-sectional area of the loin eye muscle. Kline and Hazel (1955) found a highly significant relationship between the cross-sectional areas of the tenth and last rib of the *Longissimus dorsi* and percent lean cuts. Zobrisky (1959) reported that, of the factors studied, the single variable most highly associated with carcass leanness was the cross-sectional area of the loin eye (r = 0.60).

Hegarty (1960) reported that a strong relationship existed between percent lean cuts and loin eye area. He stated that the loin eye area at the last rib was a somewhat better indicator of percent lean cuts (0.67) than the loin eye area measured at the 10th rib (0.60). He suggested that the cross-sectional area of the *Longissimus dorsi* muscle should be measured at the last rib rather than at the tenth rib.

Water-Holding Capacity of Muscle.

> "Water-holding capacity" (WHC) means the ability of meat to hold fast to its own or added water during application of any force (pressing, heating, grinding, etc.). It is not possible to give any absolute figures for the immobilized part of water because the "immobilized" water determined depends on the method used. Therefore, we must define "water holding capacity" in terms of method of measurement (Hamm, 1960).

Shrinkage and WHC of meat, and particularly of processed meats, have always been of great concern to meat packers, hotels and restaurants, primarily from the standpoint of yield of product. According to Hamm (1960), higher water-holding capacity is associated with juicier meat after cooking. Also, tenderness, color, taste, and other characteristics of meat are related to its capacity for holding water. Furthermore, for transport, storage, canning, freezing and thawing, the WHC is of great practical importance.

Hamm (1960) explained two ways in which water may be bound by the muscle proteins. The peptide chains of protein contain some free electric charges, the negative carboxyl groups and the positive amino groups, as well as other polar groups as -OH, -SH and -CH-NH- groups. Water, being dipolar, is attracted by all kinds of polar groups in the protein. However, not all charged groups may bind water. Groups which compensate their charges by an intermolecular or intramolecular salt-cross linkage are not available for water molecules. Thus, only the net charge of protein will influence WHC. Hamm calls this the "net charge effect". Because of the cross-linkage of the peptide chains, such as salt linkages, bivalent metals, S-S-bonds or hydrogen bonds, a number of charged groups are not available for water binding due to this molecular configuration. Therefore, cleavage or rearrangement of the peptide molecule must take place before the polar groups become available to water molecules. Hamm calls changes of meat hydration which are not due to changes of net charge the "stero-effect".

The importance of protein charges can be demonstrated by the influence of pH on meat hydration. The dependence of WHC on pH value, showing minimum hydration around pH 5.0 was first measured by Grau et al. (1953).

The isoelectric point of muscle is about pH 5.0. Therefore, at this pH the net charge of the muscle protein is at a minimum, causing meat hydration to be at a minimum.

Wierbicki *et al*. (1956), Judge *et al*. (1958), Swift and Berman (1959), Webb (1959), Hamm and Deatherage (1960), Briskey *et al*. (1960), Sherman (1961) and others have confirmed the high relationship of pH to water-holding capacity of muscle. In addition to the effect of hydrogen ion concentration on meat hydration, certain mineral ions are also known to affect this phenomenon. Wierbicki *et al* (1957) reported that calcium chloride, magnesium chloride, potassium chloride, and sodium chloride increased the water-holding capacity of meat protein. According to Hamm (1960), one hundred g. of beef muscle contains about 25 mg. magnesium, 5 mg. calcium, and 4.2 mg. zinc. Although their concentration is relatively low, these ions have an important influence on WHC. He indicated that the bound calcium, bound magnesium and perhaps zinc decreases water-holding capacity. However, Swift and Berman (1959) found a positive correlation between water-holding of beef muscle and its zinc content. They also found an inverse relationship between WHC and magnesium and calcium content. Swift and Ellis (1956) reported an increase in the hydration capacity of beef muscle in the presence of small amounts of magnesium chloride. Briskey *et al*. (1959) indicated that a certain correlation seems to exist between the content of alkali metals in the press juice and amount of expressible water.

Wierbicki *et al*. (1957) studied the effect of temperature on water-holding capacity, pH, and on the ionic shift which takes place during heating. They used meat samples with nothing added, with sodium chloride added and with distilled water added. In general, they observed a moisture loss with an increase in temperature. They noted that in the temperature range of 55 to 65°C., reactions took place in such a way as to counteract the loss of water by the proteins. The added sodium chloride increased the pH and water retention of the meat at all temperatures, but was not observed in the expressible juice. Thus, it was indicated that the sodium ions are preferentially absorbed on the meat proteins as they are heated, while chloride ions are released into the juice.

Wierbicki et al. (1957) pointed out that in the temperature range of 50 to 70°C. potassium ions are absorbed by the meat, whereas magnesium and calcium ions are released. Adding sodium chloride increased the absorption of both potassium and magnesium ions with almost no effect on calcium ions. In the 40 to 70°C. range dynamic shifts between the meat and expressible juice involving potassium, calcium, and magnesium take place in such a manner as to promote protein hydration. The addition of sodium chloride increased the hydration effect.

Grau et al. (1953) and Hamm (1960) reported that the addition of polyphosphates to processed meat will increase the water binding properties. This is achieved by the polyphosphates sequestering calcium, magnesium and zinc in the raw meat, thus increasing water binding capacity. Although the addition of alkaline polyphosphates improves water binding, Sherman (1961) is of the opinion that it is not due to their ability to complex calcium and magnesium ions. He postulates that phosphates improve water binding capacity of meat primarily by the solubilization of meat proteins, particularly actomyosin. According to Mahon (1961), high concentration of tripolyphosphate is required to induce maximum water-holding of cured meat. It was reported that when sodium tripolyphosphate was added to a beef-pork mixture little effect was observed on the cured meat volume until 0.8 percent sodium tripolyphosphate had been added. However, when 3 percent sodium chloride was added, only 0.5 percent sodium tripolyphosphate was needed to exert a maximum effect. Therefore, he concluded that it was the sodium chloride in the proper concentration that controlled the volume of cured meat, and that sodium chloride and tripolyphosphate acted synergistically to increase water retention of cured meat.

Methods of Measuring Water-Holding Capacity of Meat.

Grau et al. (1953) developed a quantitative method for determining water-holding capacity. Their method involved the pressing of approximately 300 mg. of meat tissue on filter paper between two plates of Plexiglas under constant pressure and for a fixed time. The pressure was applied by screwing the two pieces of Plexiglas together by hand. They reported that the pressure produced by screwing the plates by hand was so great that individual differences of pressure did not influence the amount of expressed juice. The water squeezed out was absorbed by the filter paper and the area of the ring of expressed juice absorbed was proportional to the amount of free water. According to Grau et al. (1953), the pressure below the area of the pressed meat was so high that the filter paper absorbed almost no water. However, Wierbicki and Deatherage (1958) found that waxing the meat film area would increase the total moisture area by 1.4 to 5.4 percent. Several modifications of this method have been made. To cite a few, Wierbicki and Deatherage (1958) used a hydraulic jack and applied a constant pressure, Fiedler (1956) weighed the filter paper before and after pressing, and Frank (1955) pressed the meat samples between two filter papers. Briskey et al. (1960)

used the hydraulic jack, and applied greater pressure than either Grau and Hamm or Wierbicki and Deatherage.

Wierbicki et al. (1957) developed the centrifuge technique for measuring water-holding capacity. Their procedure requires a pyrex centrifuge tube, constant water bath centrifuge and a magnifying glass. The bottom portion of the centrifuge tubes are graduated to 12 ml. at 0.1 ml. divisions and the amount of expressible juice can be read directly. With this method, larger samples of meat can be used, thus, reducing sampling errors.

Asselbergs and Whitaker (1961) have divised a simplified hydraulic pressure technique for studying water-holding capacity of ground cooked meat. The cooked meat is weighed at room temperature, placed in the specially constructed pressure cell and pressed at a constant pressure and time. After pressing, the compressed sample is weighed and percent free moisture is calculated by difference between the initial weight of the meat and final pressed weight of the meat. This method is rapid, simple, and requires only 1.5 g. of cooked meat.

The Relationship of Juiciness and Tenderness to Various Carcass Traits.

Intramuscular fat is regarded as an important indicator of quality in beef. However, marbling in pork has had less emphasis placed on its relationship to pork quality. The relationship between intramuscular fat in fresh pork and tenderness has been shown by Kauffman (1959), Pohl (1959), Harrington and Pearson (1960), Naumann et al. (1960), Kauffman et al. (1961), Zessin et al. (1961), and others. Each of these studies indicates that a certain amount of marbling in pork is desirable to insure pork quality. Kauffman (1959) reported that panel score, panel chew, Denture Tenderometer, Grinder Tenderometer and Warner-Bratzler shear all indicated that as marbling scores increase so does tenderness.

Harrington and Pearson (1960) selected pork loins of varying degrees of marbling and studied tenderness in terms of chew count. They found a highly significant correlation of -0.61 between marbling scores and chew count, indicating that as marbling increased, fewer chews were necessary to prepare the meat for swallowing. Marbling scores averaged 3.6 for the marbled chops (5 pt. scale) compared with 2.3 for poorly marbled chops. The chew counts ranged from 25 to 47. Ether extract for the marbled chops was 4.8 percent compared with 2.0 percent for the poorly marbled chops. Warner-Bratzler shear values indicated that marbling increased tenderness. Naumann _et al_. (1960) are in agreement with Harrington and Pearson (1960) in that heavily marbled chops had the lower Warner-Bratzler shear values. Kelly _et al_. (1960) reported the correlation of -0.408 between marbling and Warner-Bratzler shear.

Kauffman _et al_. (1961) studied the effect of marbling and price with purchase of pork chops. They found that the taste panel preferred marbled chops over unmarbled chops, but a preference for unmarbled chops existed among the purchasers. Naumann _et al_. (1960), in a consumer preference study, reported that the panel preferred heavily marbled pork chops over sparsely marbled chops.

Judge _et al_. (1960) reported the low and non-significant correlation of -0.07 between marbling and tenderness and between tenderness and percent ether extract the low correlation of -0.03. However, in the same study tenderness was significantly related to juiciness ($r = 0.46$). According to Murphy and Carlin (1961), marbling had a significant effect on both tenderness and juiciness of braised pork chops. In a study conducted by Zessin *et al.* (1961), juiciness scores were found to be related to rib eye marbling. Judge *et al.* (1960) found the non-significant correlation of 0.13 between juiciness and ether extract of the *Longissimus dorsi*. Webb (1959) indicated that juiciness was not highly related to tenderness.

Studies have shown a positive relationship between water-holding capacity of meat and tenderness and juiciness. Wierbicki *et al.* (1956) indicated that tenderness is closely related to the degree of hydration of meat proteins. They found that changes in tenderness seemed to coincide with juice loss upon heating and with expressible moisture. Webb (1959) reported that water-holding capacity of beef was not highly associated with differences in tenderness. However, Wierbicki *et al.* (1956) showed that the increased tenderness of meat during aging is accompanied by an increase in water-holding capacity. Infusion with sodium chloride will increase tenderness as well as water-holding capacity, Wierbicki *et al.* (1957). According to Hamm and Deatherage (1960), meat having a high water-holding capacity in the raw state will bind its water faster during heating than meat having low water-holding capacity in the raw state. Thus, as water-holding capacity of raw meat increases, juiciness scores of cooked meat will increase. It, therefore, appears that juiciness and tenderness are closely related to the water-holding capacity of meat.

EXPERIMENTAL PROCEDURE

Source of Animals.

All animals used in this study came from the Animal Husbandry Farm of Michigan State University. The breeds represented were Yorkshire, Yorkshire and Duroc-Hampshire cross, Yorkshire and Duroc-Berkshire cross, Yorkshire and Hampshire-Duroc-Chesterwhite cross, and Yorkshire-Duroc cross. Previous work has indicated that feeding hormone derivatives to swine may increase total body leanness. Therefore, this study was conducted to determine the effect of supplementing swine rations with 4-hydroxy-17-alpha-methyltestosterone at various levels on feedlot performance, physical and chemical composition of untrimmed wholesale cuts, palatability characteristics and related factors. The animals were fed to approximately 200 lb., slaughtered, and physical and chemical determinations made. The animals were removed from the feedlot at least 12 hours prior to slaughter and allowed free access to water only.

Three separate trials involving a total of 79 pigs were conducted. Trials I and II consisted of 49 purebred Yorkshire hogs and Yorkshire-Duroc crossbreeds. Trial III consisted of 30 crossbred hogs of known breeding. Fifty animals were started in Trials I and II, but one animal was removed due to sickness.

The basal ration in all trials appears in Table I.

Table I. Composition of basal ration

Ingredient	Percentage
Corn	73.325
Casein[1]	3.000
Soybean oil meal	18.000
Fish meal	2.000
Alfalfa meal	2.000
Limestone	0.750
Dicalcium phosphate	0.200
Trace mineral salt[2]	0.500
B-vitamins[3]	0.100
Pro-strep[4]	0.100
A & D concentrate[5]	0.025
	100.000

[1]Casein was 90 percent protein.
[2]Trace mineral mix contained 0.400% manganese, 0.011% iodine, 0.330% iron, 0.048% copper, 0.022% cobalt and 0.800% zinc.
[3]Vitamin B mix contained 2 g./lb. riboflavin, 4 g./lb. panothenic acid, 9 g./lb. niacin and 109 g./lb. choline.
[4]Pro-strep contained 15 g./lb. streptomycin and 5 g./lb. penicillin.
[5]A & D concentrate contained 10,000 units of vitamin A/g. and 1,250 units of vitamin D_2/g.

In Trials I and II, the animals were removed from pasture and divided at random into 5 lots, five animals per lot for each trial. The first group of animals in Trial I were started on feed September 6, 1960, and the replication (Trial II) was started on feed September 24, 1960. Both groups were combined for the analysis. Table II presents the various treatments of each lot. The animals were fed in dry lot with water and feed *ad libitum*.

Table II. Anabolic supplementation to basal ration. Trials I & II.

Lot number Trial I	Lot number Trial II	Number of animals	Treatment
44 &	44A	10	Basal
45 &	45A	10	Basal + MK-320[a] @ 2 mg./lb. feed
46 &	46A	10	Basal + MK-320 @ 4 mg./lb. feed
47 &	47A	10	Basal + MK-320 @ 8 mg./lb. feed
48 &	48A	9	Basal + DL-2,5 dihydroxyphenylalanine @ 75 mg./lb. feed

[a]MK-320 is 4-hydroxy-17-alpha-methyltestosterone

Lots 48 and 48A were supplemented with the amino acid derivative (DL-2,5,dihydroxyphenylalanine) to determine if any vast differences might appear between this ration and the basal ration. However, chemical and physical data were collected from Lots 48 and 48A and used in evaluating some of the carcass data.

Trial III which consisted of all crossbred hogs previously mentioned, with the exception of Yorkshire-Duroc cross, was started December 9, 1960. The animals were divided at random into 5 lots and managed in the same manner as in Trials I and II. However, the animals of Trial III were maintained outdoors, whereas, the animals of Trials I and II were maintained indoors. Also, Lot 80 was not supplemented with the same amino acid derivative as Lots 48 and 48A in Trials I and II. The treatment for Trial III appears in Table III.

Lot 80 was handled in the same manner as Lots 48 and 48A in Trials I and II.

Feedlot data for all trials were obtained by weighing the animals at approximately 7 day intervals. The feed was provided *ad libitum*, and no attempt was made to measure wastage. Daily gain, feed consumption, and feed efficiency were based on lot averages. Observations were made for any viriligenic effects or other undesirable effects due to treatment.

Table III. Anabolic supplementation to basal ration. Trial III.

Lot number	Number of animals	Treatment
76	6	Basal
77	6	Basal + MK-320 @ 2 mg./lb. feed
78	6	Basal + MK-320 @ 4 mg./lb. feed
79	6	Basal + MK-320 @ 8 mg./lb. feed
80	6	Basal + Benzmalecene[a] @ 360 mg./ lb. feed

[a]Benzmalecene is N-(1) methyl) 2, 3-di-p-chlorophenylpropyl-maleamic acid.

Slaughter Procedure. The hogs, after attaining slaughter weight, were fasted 12 to 24 hours, reweighed and immediately slaughtered. The animals were dressed packer style, head off, hams faced but with ham facing left attached, leaf fat loosened and removed after chilling. The hot carcass weight was obtained and the carcasses were chilled at 36-40°F. for a period of 48 hours. Linear carcass measurements were taken in the cooler.

Length of carcass was measured from the anterior edge of the aitch bone to the anterior edge of the first rib. Backfat measurements were taken opposite the first rib, last rib, and last lumbar vertebra and averaged for mean backfat thickness. Skin thickness was included in the backfat measurements.

Cutting Procedure. The cutting procedures used followed those described by Cole (1951), with some slight deviations. The method used in its entirety follows.

The fore foot was removed approximately 1/2 inch above the knee joint and the hind foot was removed at the bony projection on the inside of the hock. A 2 1/2 rib shoulder was removed perpendicular to the general line of the back. The jowl was removed from the rough shoulder cutting parallel to the loin cut. The neck bones were removed as sparingly as possible, leaving the intact, untrimmed shoulder. The ham was removed by sawing between the third and fourth sacral vertebrae perpendicular to the hind shank, leaving the flank meat on the rough ham. The tail bones were removed and discarded with the feet, leaving the untrimmed ham. The untrimmed loin and rough belly were separated following the natural curvature of the back, cutting from the lower edge of the psoas major muscle on the ham end to a point just below the junction of the ribs and backbone on the blade end. The spareribs were removed from the untrimmed belly by cutting through the secondary flank muscle and as close under the ribs as possible.

To obtain the lean cuts and primal cuts, all untrimmed wholesale cuts were trimmed, leaving approximately 1/4 inch of fat covering on the ham and loin and skinned shoulder. The belly was trimmed by cutting through the teat line and squaring the flank end. All trimmings from each cut were kept separate for subsequent physical and chemical determinations of the untrimmed primal cuts.

The rough loin of the right side was divided by cutting at a point immediately posterior to the junction of the 10th rib with the thoracic vertebra and immediately posterior to the last rib. The cross sectional area of the Longissimus dorsi at the 10th and last rib was traced on acetate paper and measured with a compensating polar planimeter. All tracings were made by the same individual. The carcass data collection form is given in Figure 1.

Hog No._____ Lot No._____ Breed____________________ Sex_____________

Date Weighed__________ Date Slaughtered______________ Date Cut__________
Feedlot Wt._______ Hot Carcass Wt._________ Hot Dressing %_______
Slaughter Wt._____ Cold Carcass Wt._________ Cold Dressing %_______
24 hr. Shrink_____lb. Cooler Shrink _______lb.

Backfat
1st rib __________ Carcass length__________
Last rib __________ Area L.D. 10th__________
Last lumbar __________ Area L.D. last__________

	Left	Right		Total	% Live wt.	% Carcass wt.
Ham:						
Rough ham		_____		_____	_____	_____
Trimmed ham	_____		_____	_____	_____	_____
Boneless ham		_____		_____	_____	_____
Ham skin		_____		_____	_____	_____
Ham bone		_____		_____	_____	_____
Loin:						
Rough loin		_____		_____	_____	_____
Trimmed loin	_____		_____	_____	_____	_____
Boneless loin		_____		_____	_____	_____
Loin bone		_____		_____	_____	_____
Loin skin		_____		_____	_____	_____
Shoulder:						
Rough shldr.		_____		_____	_____	_____
Trimmed shldr.	_____		_____	_____	_____	_____
Boneless shldr.		_____		_____	_____	_____
Shldr. bone		_____		_____	_____	_____
Shldr. skin		_____		_____	_____	_____
Total Lean Cuts			_____	_____	_____	_____
Belly:						
Rough belly		_____		_____	_____	_____
Trimmed belly	_____		_____	_____	_____	_____
Boneless belly		_____		_____	_____	_____
Belly skin		_____		_____	_____	_____
Total Primal Cuts			_____	_____	_____	_____

Figure 1. Carcass data sheet.

Physical Separation. The untrimmed primal cuts of the right side were weighed, then separated into skin, bone (which included tendons and ligaments), and the combined lean and fat. Each component was weighed to the nearest 1/10 lb. The combination of the lean and fat from each cut was ground 5 times through a 5/64 inch plate to assure homogeneity. An aliquot of approximately 50 g. was taken and stored in sample bottles at -20°F. for subsequent protein, fat and moisture determinations. The bone was not chemically analyzed. The skin from all animals of the three trials was combined as a single composite, ground 10 times, and then analyzed for protein, fat, and moisture.

Chemical Analysis. Approximately 5 g. duplicate samples were taken from the ground samples, placed in disposable aluminum dishes and dried at 100°C. for 24 hours for moisture determinations. Ether extract was determined from the same samples used in moisture analysis. The fat was extracted with anhydrous ether for four hours in a Goldfish Fat Extractor. All samples were weighed to the nearest .0001 g. To obtain percentage protein, duplicate samples weighing approximately 1 g. were analyzed by the Kjeldahl-Gunning method as outlined in A.O.A.C. (1955).

Formulae for calculating the percent moisture, fat and protein were as follows:

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

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

$$N \times 6.25 = \text{g. of protein}$$

$$\frac{\text{g. of protein}}{\text{wt. of sample (g.)}} = \text{percent protein}$$

Water-Holding Capacity. Water-holding capacity, pH and palatability determinations were made on the left *Longissimus dorsi* muscle.

Determinations of pH and WHC were made approximately 72 hours after slaughter. The left loin was divided at the 10th rib and a chop containing the 10th rib was removed and used for the water-holding and pH determinations. The *Longissimus dorsi* from the 3rd rib to the 9th rib was removed, trimmed of all external fat, ground 5 times through a 5/64 inch plate and stored in the -20°F. freezer for subsequent fat (ether extract) and total moisture determinations. The remaining portion of the pork loin (11th rib to hip bone) was stored at -20°F. for subsequent tenderness and juiciness studies.

Measurements of expressible water were made by using the filter paper method proposed by Grau and Hamm (1953) and modified by Wierbicki and Deatherage (1958) and Briskey *et al*. (1960). The method in its entirety follows.

A Carver Press, adapted with a pressure gauge reading from 0 to 16,000 p.s.i., was used for pressing the meat samples weighing from 250 to 300 mg. They were placed on the center of a 11 cm. No. 42 Whatman filter paper of constant moisture content, obtained by holding the filter paper in a desiccator over saturated potassium chloride solution (Wierbicki and Deatherage, 1958). The filter paper was placed between two 10 X 6 X 1/4 inch Plexiglas sheets as the meat samples were being weighed. In this study six samples were pressed simultaneously. After the samples were placed between the Plexiglas sheets, 4500 p.s.i. of pressure was applied and allowed to drift for a 5 minute period (3700 p.s.i.). By pressing, the meat was squeezed to an almost circular film, while the expressed juice was absorbed by the filter paper, forming a circular brown or red color area.

Immediately after pressing, the Plexiglas plates were removed and the outside edge of the pressed meat film marked with a pencil on the reverse side of the filter paper. This was done before removing the Plexiglas plate from the meat side of the filter paper, as the meat film generally adhered to the Plexiglas. The filter paper was then removed and the muscle and water areas were measured with a polar planimeter.

The amount of expressible moisture was calculated as a percentage of the total water by modification of the formula reported by Wierbicki and Deatherage (1958) and Briskey *et al*. (1960).

For determining the hydration capacity of the filter paper, it was found that the type of paper, amount of pressure, and duration of pressure, were important considerations in determining the hydration constant (Briskey *et al*., 1960). For this study, several samples of pork *Longissimus dorsi* muscle 48 hours post-mortem were used. The muscle was ground once through a 5/64 inch plate and 20 g. samples were placed in centrifuge bottles and warmed at room temperature for 30 minutes and then centrifuged at 1000 rpm. After centrifugation, the extract was filtered through coarse filter paper and stored at 36-40°F. for 2 hours. An aliquot from each sample was removed and total moisture and percent solids determined by drying in a 100°C. hot air oven for 24 hours. A 2 ml. syringe was filled with the cooled extract, weighed to the nearest .0001 g., and drop by drop, in increasing amounts, the juice was transferred to a 11 cm. No. 42 Whatman filter paper, and pressed at 4500 p.s.i. for 5 minutes. The syringe was reweighed to obtain the weight of the juice added to the paper. The area of the juice on the filter paper was measured with a polar planimeter. To calculate the weight of water per unit area, the following expression was used:

$$\frac{\text{Wt. of juice}}{\text{Total area}} \text{ X percent water in juice} = \text{wt. of HOH per unit area.}$$

The hydration constant of 31 mg. of water/sq. in. of filter paper was found and used in this study. The results are expressed as the percent of the free water out of total moisture content of the meat.

$$\text{Percent expressible moisture} = \frac{\text{(total area-meat film area) X 31}}{\text{Total oven dried moisture (mg.) in fresh sample.}} \text{ X } 100$$

Determinations of pH were made at the same time as WHC was being determined. The electrodes of a Beckman Model G pH meter were placed directly into the *Longissimus dorsi* and the observed readings were recorded.

Palatability Tests. To evaluate such factors as tenderness, juiciness and flavor, taste panels and the Warner-Bratzler shear apparatus were used. The frozen section of the left pork loin (11th rib to ilium) was used for the taste panel and tenderness studies. Three 1-in. chops were removed anterior to the last rib and used for taste panel evaluation. Two additional 1-in. chops adjacent (posterior) to the last rib were removed from the frozen section for Warner-Bratzler shear measurements. The chops were cooked in 225°F. deep fat (range 210-235°F.) to an internal temperature of 170°F. Both the temperature of the deep fat and internal temperatures were observed on a recording potentiometer. After cooking, the samples were cooled to room temperature for taste panel and shear evaluation.

The panel was of a consumer type, comprised of Michigan State University personnel. The panel was instructed to rate each sample as to its tenderness, juiciness and flavor, and not to compare the different samples (Figure 2). Four 1/2 inch core samples were taken from each chop for both taste and shear evaluation. Twelve panel members were used for all evaluations and not more than 5 samples were presented at one time.

Sampling procedure for the objective tenderness measurements (Warner-Bratzler Shear) was carried out in the same manner as for the taste panel. Four 1/2 inch cores were taken from each of the two chops and sheared at the midpoint.

Statistical Analysis. Analysis of variance, simple correlation coefficients, standard error of estimate, standard deviation and predicting formulae were computed as outlined by Snedecor (1957). Multiple Range & Multiple F Test Tables (Duncan, 1955) were used for testing significance between means.

Name________________________________

Plate No. __________________________

Directions: Rate each sample as to its Tenderness, Flavor and Juiciness. Do not compare samples as each judgment is independent. Determine the suitable Sample Description and write the corresponding numerical Score in the space provided.

Sample Description	Score
Like extremely	9
Like very much	8
Like moderately	7
Like slightly	6
Neither like nor dislike	5
Dislike slightly	4
Dislike moderately	3
Dislike very much	2
Dislike extremely	1

Sample Identification	Tenderness	Flavor	Juiciness

Figure 2. Taste panel data sheet.

RESULTS AND DISCUSSION

Oranabol, the trade name of MK-320 (4-hydroxy-17-alpha-methyltestosterone) is a relatively new synthetic steroid. Initial experiments with rats indicated that the compound had a protein anabolizing action, which was active by the oral route (Merck and Company, 1960). In addition, no changes in secondary sex characteristics were observed in the treated rats. Since MK-320 exhibited proteoanabolic effect in rats and produced no viriligenic effects, it was felt that if the compound was supplemented to swine rations a leaner type of hog may be produced.

Effect of MK-320 on Feedlot Performance, Physical Characteristics and Chemical Composition

Effect of MK-320 on Feedlot Performance (Trials I and II)

A summary of the feedlot performance data of Trials I and II appears in Table IV. Final feedlot and slaughter weights appear in Appendix A.

Table IV. Summary of average feedlot performance. Trials I and II

Lot[1]	Treatment[2]	Initial wt. lb.	Final wt. lb.	Daily gain lb.	Feed/lb. gain lb.
44 & 44A	Control	145	203	1.6	3.9
45 & 45A	MK-320, 2 mg./lb.	141	210	1.8	3.8
46 & 46A	MK-320, 4 mg./lb.	138	202	1.7	3.9
47 & 47A	MK-320, 8 mg./lb.	137	201	1.6	3.8

[1]Each lot represents both Trials I and II, the letter "A" indicates the lots (Trial II) which were started at a later date.
[2]Each treatment had a total of 10 animals.

The animals were on green pasture prior to starting on the dry ration. With the animals consuming 6 to 8 lb. of feed per day, the total intake of the hormone derivative would be approximately 16, 32, and 64 mg. per day for lots 45 and 45A, 46 and 46A, and 47 and 47A, respectively. As can be seen in Table IV, no apparent effect on rate of gain or feed efficiency can be attributed to treatment. No viriligenic effects were observed in the animals receiving MK-320. Whiteker et al. (1959) observed masculine behavior and characteristics among pigs receiving methyltestosterone, but rate of gain or feed efficiency was not affected.

Since the rations of lots 48 and 48A (Table II) and lot 80 (Table III) were supplemented with compounds other than MK-320, their feedlot performance and physical and chemical measurements were compared with their respecitve control lots only. However, in determining correlation coefficients, all animals in Trials I, II and III were used. The level of DL-2,5,dihydroxyphenylalanine fed in this study (Lots 48 and 48A) had no significant effect on feedlot performance or carcass characteristics.

Effect of MK-320 on Feedlot Performance. Trial III

The animals in Trial III had been on a typical fattening ration prior to the beginning of the experiment. Also, the animals were fed outdoors for the duration of the study. In Trials I and II the animals were on pasture prior to the experiment, and were maintained indoors during the trial. A summary of the feedlot data of Trial III is presented in Table V. Final feedlot and slaughter weights appear in Appendix B.

Again no apparent effect of treatment was observed in Trial III. However, a significant difference was observed in feed/lb. of gain between the trials. In Trials I and II the average feed/lb. of gain was approximately 3.85 lb. as compared with 3.17 lb. in Trial III. In general, the daily gain was also in favor of Trial III. The difference in daily gain and feed efficiency between the trials can probable be attributed to a breed effect and/or a climatic effect. All animals in Trial

Table V. Summary of average feedlot performance. Trial III

Lot	Treatment[1]	Initial wt. lb.	Final wt. lb.	Daily gain lb.	Feed/lb. gain lb.
76	Control	146	201	1.8	3.1
77	MK-320, 2 mg./lb.	148	202	1.8	3.1
78	MK-320, 4 mg./lb.	148	197	1.8	3.1
79	MK-320, 8 mg./lb.	149	197	1.7	3.4

[1]Average of 6 animals per treatment.

III were crossbreeds, and for each treatment in Trials I and II, four animals were crossbreeds and six were purebred Yorkshires. However, since Trials I and II were conducted in the fall and Trial III in the winter, it is conceivable that the difference in feedlot performance was due to climatic conditions. As in Trials I and II, no secondary sex characteristics due to treatment were observed in Trial III. The level of Benzmalecene fed in Trial III (Lot 80) did not have a significant effect on feedlot performance or carcass characteristics.

Perry *et al*. (1956) and Noland and Burris (1956), supplementing swine rations with methyltestosterone, reported that methyltestosterone did not effect feedlot performance or cause any viriligenic effects. Based on the results of the present experiment, it appears that MK-320, at the levels fed, does not affect feedlot performance, cause any secondary sex development or other undesirable characteristics.

Effect of MK-320 on Backfat, Length and Loin Eye Area. Trials I and II.

The average and range of backfat, length and loin eye area of Trials I and II are presented in Table VI.

Table VI. Averages and ranges of backfat, length and loin eye area. Trials I and II

Lot	Average[1] backfat	Range	Average[2] length	Range	Average[3] loin eye area 10th rib	Range
44 & 44A	1.55	1.22-1.82	30.0	28.3-31.3	3.67	2.58-4.77
45 & 45A	1.63	1.17-1.80	30.0	28.7-32.3	3.67	2.96-4.37
46 & 46A	1.53	1.40-1.80	29.8	29.1-30.3	3.66	2.96-4.34
47 & 47A	1.46	1.03-1.65	30.4	29.2-32.0	3.80	3.19-4.62

[1]Backfat is in inches, average of fat-depth over 1st, last rib and last lumbar vertebra.
[2]Length of carcass in inches, measured from anterior edge of first rib to anterior edge of aitch bone.
[3]Loin eye area is measured in square inches.

With the exception of Lots 45 and 45A, backfat decreased slightly with an increased level of MK-320. Animals in Lots 45 and 45A were heavier at the time of slaughter and had gained more rapidly than the other lots, thus, feedlot performance may account for the increased backfat thickness. Although feedlot treatment had no significant effect on backfat, difference in backfat thickness due to sex was highly significant (Table VII). By the use of Duncan's (1955) range tables, it was found that the males were significantly thicker in backfat (1.61 in.) than the females (1.41 in.).

The average difference between carcass length and loin eye area between treatments was very small. Although the animals in Lots 47 and 47A had a lower average backfat thickness, were slightly longer and had a larger loin eye area, the differences were not statistically significant (Appendix A). Johnston et al. (1957), Thrasher et al. (1959) and Whiteker et al. (1959) reported that hogs receiving methyltestosterone showed a tendency towards greater leanness when compared to the control lots.

Table VII. Analysis of variance of backfat thickness. Trials I and II

Source of variance	Degrees of freedom	Sum of squares	Mean square	F
Total	39	1.13	-	-
Treatment	3	0.14	0.047	1.88
Sex	1	0.20	0.200	8.00**
Sex X treatment	3	0.00	0.000	-
Error	32	0.79	0.025	-

**Significant at the 1 percent level

Effect of MK-320 on Backfat, Length and Loin Eye Area. Trial III

Table VIII presents the averages and ranges of backfat, length and loin eye area found in Trial III.

Table VIII. Averages and ranges of backfat, length and loin eye area. Trial III.

Lot	Average[1] backfat	Range	Average[2] length	Range	Average[3] loin eye area 10th rib	Range
76	1.45	1.27-1.60	30.2	29.5-31.0	3.76	2.76-4.44
77	1.56	1.37-1.73	29.6	28.5-30.2	4.28	3.83-5.04
78	1.57	1.17-1.83	29.9	30.1-29.3	4.35	3.67-5.02
79	1.61	1.47-1.87	29.3	28.3-30.2	4.09	3.50-4.61

[1]Backfat is in inches, average of fat-depth over 1st rib, last rib and last lumbar vertebra.
[2]Length of carcass in inches, measured from anterior edge of 1st rib to anterior edge of aitch bone.
[3]Loin eye area measured in square inches.

It is interesting to note that the trend in backfat thickness is opposite to the results observed in Trials I and II. As can be seen in Table VIII, backfat thickness increased with the increased level of MK-320, but the difference between lots was not significant. No apparent trend was observed in carcass length or loin eye area (Appendix B).

Differences in backfat thickness, carcass length and loin eye area between Trials I and II and Trial III were not significant. However, animals in Trial III had, on the average, a larger cross-sectional area of the Longissimus dorsi muscle. The difference in loin eye area can be probably attributed to breed characteristics.

Effect of MK-320 on Chemical Composition. Trials I and II.

There was considerable variation between the percent protein in the untrimmed wholesale cuts (Appendix C). The same variation can be observed with percent fat and percent moisture. Observation of these data suggests that a significant difference in protein content exists between treatments. Table IX presents a summary of the average percent protein of each untrimmed wholesale cut. Protein content increased as the level

Table IX. Average percent protein of untrimmed ham, shoulder, loin and belly[1]. Trials I and II

	Boneless cuts			
Treatment	Ham	Shoulder	Loin	Belly
Control	15.14	13.64	11.68	9.81
MK-320, 2 mg./lb.	15.53	13.89	11.67	9.95
MK-320, 4 mg./lb.	15.81	14.27	11.97	10.00
MK-320, 8 mg./lb.	16.08	14.79	12.74	10.52

[1]Values in percent of fresh tissue.

of MK-320 increased in all cuts, with the exception of the loins from the group receiving 2 mg. of MK-320. Table IX also points out the wide variation in protein content (leanness) which exists in the wholesale cuts of pork.

Analysis of variance indicated a significant difference in protein content existing between treatments (Table X). Therefore, to determine whether or not a significant difference existed between the same cut of different treatments or if the difference was due to an additive effect of all cuts, an analysis of variance was determined for each wholesale cut. It can be seen in Table X that a highly significant difference in protein content existed between treatments and between wholesale cuts. The difference in protein content between treatments was due to an additive effect, that is, as the level of MK-320 was increased in the ration, the protein content of each cut increased, but not to a degree to make a significant difference. By combining the percent protein of all cuts, a significant difference was observed. Table XI presents the average percent protein, percent fat and percent moisture of all cuts in each treatment. Although analysis of variance showed a significant difference in protein content between treatments, percent fat or percent water did not differ significantly between treatment. In general, as fat content increased, protein and moisture decreased. Therefore, based on the results of the protein analysis, it appears that adding MK-320 at the level of 8 mg./lb. of feed to the ration caused an increase in nitrogen retention and increased total percent protein.

Table X. Analysis of variance of treatments, wholesale cuts, ham, shoulder, loin and belly. Trials I and II.

Item	F value
Treatments	4.7**
Wholesale cuts	159.8**
Ham	1.5
Shoulder	2.0
Loin	1.2
Belly	0.7

**Highly significant at $p = .01$ level.

Table XI. Average percent protein, fat and moisture of untrimmed wholesale cuts[1]. Trials I and II.

Treatment	Protein %	Fat %	Moisture %
Control	12.57	43.6	43.2
MK-320, 2 mg./lb.	12.76	42.8	44.3
MK-320, 4 mg./lb.	13.01	43.9	43.0
MK-320, 8 mg./lb.	13.53**	40.8	45.6

**$P < .01$ compared with control lot and lot receiving 2 mg. of MK-320.
[1]All values calculated on fresh tissue basis.

To determine whether or not the response to MK-320 was due to sex, the gilts and barrows were analyzed separately. As can be seen in Table XII, gilts did not show a response that was statistically significant. Table XIII indicates a highly significant difference in percent protein between treatments of barrows.

Table XII. Analysis of variance of percent protein of the ham, shoulder, loin and belly in females. Trials I and II.

Source of variance	Degrees of freedom	Sum of squares	Mean square	F
Total	75	398.97	-	-
Treatment	3	6.22	2.07	1.86
Cuts	3	323.56	107.85	97.16**
Treatment X cuts	9	2.41	0.27	-
Error	60	66.78	1.11	-

**Significant at $p < .01$ level.

Table XIII. Analysis of variance of percent protein of ham, shoulder, loin and belly in males. Trials I and II.

Source of variance	Degrees of freedom	Sum of squares	Mean square	F
Total	83	467.25	-	-
Treatment	3	14.76	4.92	6.00**
Cuts	3	395.70	131.90	160.85**
Treatment X cuts	9	0.90	0.10	-
Error	68	55.89	0.82	-

**Significant at $p < .01$ level.

Although the percent protein increased in gilts with an increased level of MK-320, the significant response was due to the barrows (Table XIV). However, in all lots (Appendix C), gilts contained a higher percent protein than barrows. This further supports the previous findings in that barrows are fatter than gilts (Table VII). As can be seen in Table XIV, the total average protein increase of 1.17 percent and 0.75 percent for the barrows and gilts, respectively, was found between the control lot and the lot receiving 8 mg./lb. of feed of MK-320.

Table XIV. Average percent protein content of gilts and barrows. Trials I and II.

Treatment	% Protein Gilts	% Protein Barrows
Control	13.43	11.71
MK-320, 2 mg./lb.	13.73	12.11
MK-320, 4 mg./lb.	13.60	12.42
MK-320, 8 mg./lb.	14.18	12.88**
Grand mean	13.74	12.28

**Significant at $p < .01$ level.

To determine if the increase in percent protein caused by the feeding of MK-320 could be measured by the percent lean cuts or backfat thickness, an analysis of variance was determined on each characteristic. Treatments did not significantly effect lean cuts or backfat thickness in either barrows or gilts. However, percent lean cuts were significantly higher (F = 15.80) in gilts than in barrows. As previously indicated (Table VII), barrows were significantly thicker in backfat than gilts. The percent lean cuts and percent primal cuts for Trials I and II are given in Appendix D. These data (Trials I and II) indicate that when MK-320 is supplemented to a swine fattening ration at the rate of 8 mg./lb. of feed, percent protein in barrow carcasses may be significantly increased.

Effect of MK-320 on Chemical Composition. Trial III.

As was found in Trials I and II, considerable variation was observed in percent protein content between the untrimmed wholesale cuts of Trial III (Appendix E). The summary of the average percent protein of each untrimmed wholesale cut from Trial III appears in Table XV.

Table XV. Average percent protein content of untrimmed ham, shoulder, loin and belly[1]. Trial III.

	Boneless cuts			
Treatment	Ham	Shoulder	Loin	Belly
Control	15.92	14.44	12.64	10.21
MK-320, 2 mg./lb.	15.27	13.89	12.51	10.08
MK-320, 4 mg./lb.	15.39	13.78	12.20	10.16
MK-320, 8 mg./lb.	15.32	13.84	12.05	9.76

[1]Values in percent fresh tissue, average of 6 animals per treatment.

The results of Trial III (Table XV) are in complete contrast to Trials I and II (Table IX). Although there is no trend in the percent protein content between treatments, the control lot, with all cuts, is higher in protein content than any of the treated lots. Analysis of variance indicated no significant difference between treatments, although, the usually high significant difference was observed between cuts. (Table XVI).

Table XVI. Analysis of variance of percent protein. Trial III.

Source of variance	Degrees of freedom	Sum of squares	Mean square	F
Total	95	498.12	-	-
Treatment	3	5.05	1.35	1.04
Wholesale cuts	3	387.69	129.23	99.41**
Treatment X cuts	9	1.33	0.15	-
Error	80	104.05	1.30	-

**Highly significant at $p < .01$ level.

Since the barrows of Trials I and II had a significant treatment response, the barrows of Trial III were analyzed separately. No significant difference was found between percent lean cuts (Appendix F) or backfat thickness (Appendix B). Table XVII indicates a significant ($p < .05$) difference existed in percent protein between treatments. However, the control lot was significantly higher ($p < .01$) in percent protein than the lots receiving 4 mg. and 8 mg./lb. of feed of MK-320. The average percent protein for the barrows of lots 76, 77, 78 and 79 was 12.97, 12.44, 12.25 and 12.13 percent, respectively.

Table XVII. Analysis of variance of percent protein of males. Trial III.

Source of variance	Degrees of freedom	Sum of squares	Mean square	F
Total	63	321.90	-	-
Treatment	3	6.61	2.20	2.86*
Wholesale cuts	3	276.61	92.20	119.74**
Treatment X cuts	9	1.50	0.17	-
Error	48	37.18	0.77	-

*Significant at $p < .05$ level.
**Significant at $p < .01$ level.

In Trials I and II, the percent protein in the carcass of animals receiving 8 mg. of MK-320 per lb. of feed, was significantly higher than the protein content of the control carcasses. The contrasting results between Trials I and II and Trial III cannot be entirely explained. Several factors must be considered in comparing Trials I and II with Trial III. The animals of Trials I and II were mainly purebred Yorkshires, on pasture prior to the experiment, maintained indoors during the study, weighed an average of 140 lb. when started on MK-320, and the experiment was conducted in the fall. Trial III consisted of all crossbred hogs, on a dry ration prior to the experiment, maintained outdoors during the study, weighed an average of 148 lb. when started on MK-320, and the experiment was conducted in the winter. It is possible that the positive effect on protein content in barrows of Trials I and II, and the negative effect on barrows in Trial III may be due to the difference in breed, but there is no evidence to support this postulation. It is more conceivable that the contrasting results are a metabolic effect. In the fall when the temperature was higher and the animals were maintained indoors, the metabolic rate would be somewhat lower than in the winter with colder temperatures. Therefore, if the animals are fed during the time that the metabolic rate is highest, it is possible that the animals in Trial III were incapable of responding to an additional hormone stimulation over and above that given by autogenous growth hormone.

Although a significant difference in percent protein was observed between the barrows of the control lot and the lots receiving 4 mg. and 8 mg. of MK-320 per lb. of feed, when the percent protein of all cuts and of both males and females were analyzed as a composite, no significant differences were observed (Table XVIII). It can be observed that the composite data in Trial III (Table XVIII) were very similar to the composite data of Trials I and II (Table XI). Based on the results of all three trials, the approximate protein, fat and moisture content of the untrimmed (boneless) wholesale cuts of hogs weighing approximately 200 lb. was 13.0, 43.0 and 43.7 percent, respectively. Thrasher et al. (1959), in a study on the effect of estrogenic and androgenic compounds upon the growth and carcass composition of swine, found the average percent protein, fat and moisture to be approximately 13.1, 47.0 and 38.8 percent, respectively. The chemical determinations were made upon boned and skinned primal cuts of 80 hogs of both Hampshire and Duroc breeds. The sums of percent protein, fat and moisture of the untrimmed wholesale cuts of each animal appear in Appendix G. A highly significant correlation coefficient of -0.98 was found between percent moisture and percent fat of 316 untrimmed wholesale cuts.

Table XVIII. Average percent protein, fat and moisture of untrimmed wholesale cuts[1]. Trial III.

Treatment	Protein %	Fat %	Moisture %
Control	13.35	41.4	45.1
MK-320, 2 mg./lb.	12.93	44.8	42.1
MK-320, 4 mg./lb.	12.88	42.5	44.3
MK-320, 8 mg./lb.	12.48	44.3	42.2

[1]All values expressed on fresh tissue basis.

Physical Separation of Wholesale Cuts and Chemical Analysis of Pork Skin

No attempt was made to statistically analyze the physical separation data. Observation of the data in Trials I and II (Appendix C) and in Trial III (Appendix E) indicates that no significant difference would be found between treatments or between animals. The average weight of the bone in the shoulder, ham and loin, for all animals in Trials I and II and in Trial III, was 1.3, 1.4 and 1.8 lb., respectively. The average weight of the skin for the shoulder, loin, belly and ham was 0.63, 0.75, 0.82 and 0.84 lb., respectively.

The skin from all the wholesale cuts of the 79 animals was chemically analyzed for protein, fat and moisture. The approximate composition of the pork skin was 34.9% protein, 22.6% fat and 44.4% moisture. Mitchell and Hamilton (1929) reported "90.00% dry matter, 37.08% protein, 51.85% moisture and 0.35% ash". In their study the snout and ears were included in the skin analysis.

Carcass Measurements and Their Relationship to Carcass Evaluation.

The various measurements with their means and standard deviations are shown in Table XIX. For the purpose of studying the relationship of various carcass measurements and chemical composition, animals from all three trials were studied as a composite, thus, there was a total of 79 hogs.

The number of highly significant correlation coefficients found between percent lean cuts of the carcass and other measures of leanness shown in Table XX, indicate that percent lean cuts is a reliable measure of leanness. The correlations between percent lean cuts and the percent protein of the various cuts are all highly significant, but none of the correlations is significantly different from the other. The correlation coefficient of 0.73 between lean cuts and percent protein of the belly accounts for approximately 49% of the variability, while the other correlations of the protein content will account for approximately 64% of the variability. A highly significant correlation of 0.79 was observed between the percent lean cuts and the sum of the percent protein in the four primal cuts. However, when the regression standard error of estimate (0.72%) is compared with the range of percent protein in these cuts (1.2%), it can be seen that percent lean cuts is not an accurate method of predicting protein content.. The highly significant correlation of 0.63 between percent lean cuts and loin eye area of the 10th rib is in agreement with Kline and Hazel (1955), Price et al. (1957), Hegarty (1960), and others. In a study by Zobrisky et al. (1959), the single variable most highly associated with carcass leanness was the cross-sectional area of the loin eye. Although this cross-sectional area at the 10th rib is highly significant when correlated with other measures of leanness (Table XX), the data suggest that percent lean cuts is a better indicator of carcass value. Of all the variables studied, the percent trimmed ham is the most highly associated with lean cuts (0.94). The highly significant correlation of 0.72 between percent trimmed ham and percent protein of the combined wholesale cuts further supports this high relationship between the skinned ham and carcass leanness. These data are, therefore, in agreement with Pearson et al. (1957), Bruner (1959) and Hegarty (1960), that the percent skinned ham is a good indicator of carcass muscling.

Correlations between carcass length and other carcass measurements are low (Table XX). The correlation coefficient of 0.50 between carcass length and percent protein of ham, loin and shoulder is highly significant, but accounts for only 25 percent of the variability. Pearson et al. (1958 and 1959) reported the low, but positive correlations between carcass length and lean cuts of 0.33 and 0.57, respectively. The correlation of 0.28 found in this study is also significant at the .05 level, but accounts for less than 10 percent of the variability. It appears

Table XIX. Means and standard deviations of various carcass measurements

Item	Mean	Standard deviation
Percent lean cuts on cold carcass basis	52.4	2.94
Loin eye area at 10th rib in sq. in.	3.8	0.50
Average carcass length (in.)	29.9	0.80
Percent protein of ham and loin[1]	7.9	0.71
Percent protein of ham, loin and shoulder	11.4	0.96
Percent protein of ham, loin, shoulder and belly	13.2	1.39
Percent protein of belly	10.0	1.07
Percent trimmed ham of cold carcass	9.6	0.90
Average carcass backfat (in.)	1.5	0.17
Percent fat in ham	32.4	3.79
Percent fat in belly	55.8	4.26
Percent fat in loin	48.2	6.22
Percent fat in shoulder	35.8	4.00
Percent ether extract of *Longissimus dorsi*	3.1	1.68
Percent fat of carcass	43.1	10.50
Percent HOH of carcass	44.0	8.20
Warner-Bratzler shear (lb.)	8.6	1.35
Taste panel tenderness[2]	6.7	0.80
Flavor	6.3	0.38
Juiciness	6.2	0.56

[1]All chemical analysis is on the untrimmed (boneless) wholesale cuts.
[2]Taste panel data based upon scale of 1 to 9.

Table XX. Correlation coefficients of lean cuts, loin eye area, carcass length and carcass backfat and the percent protein of the untrimmed wholesale cuts

	% lean cuts on carcass basis	Loin eye area at 10th rib	Average carcass length	% protein of ham, loin, shoulder & belly
% lean cuts on carcass basis	-	+0.63**	+0.28*	+0.79**
% protein of ham and loin	+0.78**	+0.70**	+0.47**	-
% protein of ham, loin and shoulder	+0.80**	+0.67**	+0.50**	-
% protein of ham, loin, shoulder and belly	+0.79**	+0.63**	-	-
% protein of belly	+0.73**	+0.60**	+0.45**	-
% trimmed ham	+0.94**	-	-	+0.72**
Average carcass backfat	-0.62**	-	-0.47**	-
Average carcass length	+0.28*	+0.10	-	-

*Significant at $p < .05$ level.
**Significant at $p < .01$ level.

that carcass length has very little influence on the value or leanness of pork carcasses.

Table XXI shows the relationships found between the backfat thickness and chemical fat of the pork carcass. The highly significant correlations of 0.68, 0.68, 0.65 and 0.61 between average backfat thickness and percent fat in shoulder, percent fat in loin, and percent fat in belly, respectively, indicate that average backfat thickness may be used with confidence to predict fat yield of swine carcasses. The low and non-significant correlation of 0.08 between backfat and percent ether extract of the Longissimus dorsi suggests that marbling is not influenced by the amount of backfat. Murphy and Carlin (1961) reported that marbling of the Longissimus dorsi increased slightly as backfat increased. Naumann et al. (1960), in studying the sensory attributes of pork differing in marbling and firmness, found that as backfat decreased marbling in the loins decreased. The data in Table XXI indicate that percent fat in the belly would be the best single measurement for predicting carcass fat. The Z test (Snedecor, 1957), showed that the correlations of percent fat in the belly with percent fat in ham, loin and shoulder were significantly different from the correlations of the other fat measurements. However, the impracticability of determining the total percent fat of the belly would prevent its being used for predicting total carcass fatness.

Table XXI. Correlation coefficients between the fat content of pork carcass.

	Average carcass backfat	% fat in ham	% fat in belly	% fat in loin	% fat in shoulder
% fat in shoulder	+0.68**	+0.66**	+0.82**	+0.76**	-
% fat in loin	+0.68**	+0.64**	+0.78**	-	+0.76**
% fat in belly	+0.65**	+0.77**	-	+0.78**	+0.82**
% fat in ham	+0.61**	-	+0.77**	+0.64**	+0.66**
% ether extract in Longissimus dorsi	+0.08	-	-	-	-

**Significant at $p < .01$ level.

Water-Holding Capacity and pH of the Longissimus dorsi.

A summary of the pH and expressible water measurements are shown in Table XXII. Observation of these data shows that very little difference exists between the average pH or between the average expressible moisture.

Table XXII. Average pH and expressible water.

Treatments	Trials I and II Av.[1] pH	Trials I and II % exp. water	Trial III Av. pH	Trial III % exp. water
Control	5.45	49.7	5.64	47.2
MK-320, 2 mg./lb.	5.42	53.8	5.60	52.2
MK-320, 4 mg./lb.	5.48	51.1	5.63	46.2
MK-320, 8 mg./lb.	5.48	53.8	5.59	44.6

[1]Average pH units obtained by averaging H^+ ion concentration.

Duplicate meat samples in Trials I and II (Appendix H) and triplicate meat samples in Trial III (Appendix I) were used in studying the expressible water. It can be seen that (Appendices H and I) greater variation existed between replications than between animals or between treatments. Wierbicki and Deatherage (1958) determined the water-holding capacity of fresh meat by the filter paper technique. They reported that the reproducibility of the method was within ± 5%. However, a sample size of 400 mg. to 600 mg. was necessary to obtain this accuracy. In their study, 500 p.s.i. pressure was applied for 1 minute. Briskey *et al.* (1960) used the filter paper technique and meat samples of approximately 300 mg. and applied 4000 p.s.i. pressure for 5 minutes. The reproducibility was not reported, but significant correlations were obtained between the expressible water and other characteristics of pork muscle.

In this study, six samples of meat, weighing approximately 300 mg., were pressed at a time for a period of 5 minutes with an initial pressure of 4500. Over the 5 minute pressing time the pressure would drop to approximately 3700 p.s.i. The pH was determined at the time of pressing. No significant correlation was found between pH and expressible water. However, this can be explained on the basis that the variation between pH values and the variation between the percent expressible water was too small. Briskey *et al*. (1960) reported the expressible water of pork *Longissimus dorsi* to be approximately 55 percent. In the present study, the average expressible water for all animals was approximately 50 percent. Because of the necessity of using a small sample (300 mg.), and the wide variation occuring in expressible water between replications, the usefulness of these data is questionable.

In determining the hydration capacity of the filter paper, Wierbicki and Deatherage (1958) reported a value of 61.10 mg. of water/sq. in. of paper, and Briskey *et al*. (1960) reported a value of 44.07 mg. of water/sq. in. It was found that the type of paper, treatment of paper, amount of pressure and duration of pressure were important considerations in determining the hydration capacity (Briskey *et al*. 1961). In addition to the above factors found by Briskey *et al*., it was found in this study that the percent solids in the extractable juice would effect the hydration and therefore effect the hydration constant. The hydration constant of 31.0 mg. of water/sq. in. of filter paper was found in this study. The average percent solids of the meat extract was 14.54 percent and the total moisture of the extract was 85.5 percent.

Physical, Chemical and Organoleptic Relationships of the *Longissimus dorsi*.

The palatability data collected on the 79 hogs appear in Appendix J. Observation of the data indicates that no significant difference in tenderness, flavor, or juiciness existed between treatments or between trials. Therefore, it appears that supplementing swine rations with 4-hydroxy-17-alpha-methyltestosterone will not effect organoleptic qualities. Plimpton *et al*. (1961) studied the influence of stilbestrol on the acceptance of pork from boar hogs. They found that the treated animals were scored higher for tenderness and juiciness than the untreated animals. Also, marbling and firmness were increased with stilbestrol treatments. Table XXIII presents the correlation coefficients between some physical, chemical and organoleptic measurements of pork quality.

Table XXIII. Correlation coefficients between chemical fat, Warner-Bratzler shear, and taste panel measurements.

	Warner-Bratzler shear	Ether extract of *Longissimus dorsi*	Taste panel tenderness
% fat in ham	-0.11	-	-
% fat in loin	-0.19	-	-
% fat in belly	-0.04	-	-
% fat in shoulder	-0.09	-	-
Ether extract of *Longissimus dorsi*	-0.25*	-	-
Taste panel tenderness	-0.73**	+0.37**	-
Flavor	-	+0.23*	-
Juiciness	-	+0.003	+0.63**

*Significant at $p < .05$ level.
**Significant at $p < .01$ level.

The percent fat in the ham, loin, belly and shoulder was not significantly related to the Warner-Bratzler shear values, but the negative correlations indicate that as percent fat increases, less pounds of pressure are required to shear a meat sample. A highly significant correlation of -0.73 was found between the Warner-Bratzler shear and taste panel tenderness.

Kauffman (1959); Pohl (1959); Kelly *et al*. (1960); Harrington and Pearson (1960); Murphy and Carlin (1961); and Zessin *et al*. (1961), have reported that a high relationship exists between marbling and tenderness.

The correlations of -0.25 between Warner-Bratzler shear and ether extract of the Longissimus dorsi, and +0.37 between taste panel tenderness and ether extract indicate that a significant relationship does exist. However, less than 9 percent of the variability is accounted for by the objective measurements, and less than 16 percent of the variability is accounted for by the subjective measurements.

A highly significant correlation of 0.63 was found between taste panel tenderness and juiciness. This is in agreement with the findings of Kelly et al. (1960) and Murphy and Carlin (1961), who reported that a high relationship existed between tenderness and juiciness. Judge et al. (1960) reported the significant correlation of 0.46 between tenderness and juiciness.

The literature is in disagreement as to the relationship of fat to flavor. Judge et al. (1960) found the significant negative correlation of -0.30 between percent fat and flavor evaluation of fresh pork. Murphy and Carlin (1961) reported that marbling or backfat was not related to pork flavor. In this study a positive correlation of 0.23 was found between ether extract of the Longissimus dorsi and flavor, and although the value is significant at the 5 percent level, it accounts for less than 6 percent of the variability. Juiciness and ether extract were not related in this study ($r = 0.03$). This is in agreement with Judge et al. (1960) who reported the non-significant correlation of 0.13 between juiciness and chemical fat of the pork Longissimus dorsi.

SUMMARY AND CONCLUSIONS

A study was made to determine the effect of feeding 4-hydroxy-17-alpha-methyltestosterone (MK-320) on the feedlot performance of swine and various physical and chemical measurements of swine carcasses. Protein, fat and moisture were determined on the untrimmed boneless wholesale cuts, and the relationship of the physical and chemical composition of the pork carcass to palatability characteristics were studied.

The level of MK-320 used to supplement swine rations in this study had no significant effect on feedlot performance, caused no development of secondary sex or other undesirable characteristics. The level of 8 mg. of MK-320 in Trials I and II appeared to have a significant effect upon the total percent protein of the untrimmed (boneless) ham, shoulder, loin and belly. The control lot had an average total percent protein of 12.57 percent compared with 13.53 percent protein in the lot receiving 8 mg. of the testosterone derivative which was significant at $p < .01$ level.

The significant difference in protein content was due to the increased response of the barrows to MK-320. An increase of 1.17% protein from the control animals to the animals receiving 8 mg. of MK-320 was observed. An increase of 0.75% protein was found in the gilts, however, this was not statistically significant. In Trial III, the same treatment indicated no significant difference between lots, when all animals were considered. However, the analysis of protein content of the barrows in Trial III indicated that the control animals were significantly higher in percent protein (12.97%) than the animals receiving 4 mg. or 8 mg. of MK-320/lb. of feed (12.13%). The contrasting results cannot be explained. However, it is possible that the metabolic rate of the Trial III animals was at a maximum due to the cold temperatures, and that the anterior pituitary was incapable of responding to an additional hormone stimulation over that given by the autogenous growth hormone. No significant differences were found in backfat, percent lean cuts, loin eye area, and carcass length due to treatment. In Trials I and II backfat decreased and percent lean cuts increased with increased levels of MK-320. In Trial III the backfat increased slightly with increased levels of the testosterone derivative and lean cuts decreased slightly. Animals in Trial III had, on the average, a larger cross-sectional area of the Longissimus dorsi. The difference in loin eye can be probably attributed to breed. No significant difference was found between pH or water-holding capacity of the Longissimus dorsi between treatments.

Based on the chemical and physical analysis of all three trials, the approximate protein, fat and moisture content of the untrimmed (boneless) wholesale cuts of hogs weighing approximately 200 lb. was 13.0, 43.0 and 43.7 percent, respectively. The average weight of the bone in the shoulder, ham and loin was 1.3, 1.4 and 1.8 lb., respectively. The average weight of the skin for the shoulder, loin, belly and ham was 0.63, 0.75, 0.82 and 0.84 lb., respectively. The approximate chemical composition of the pork skin was 34.9 percent protein, 22.6 percent fat and 44.4 percent moisture.

The number of highly significant correlation coefficients found between percent lean cuts of the carcass and other measurements of leanness indicate that percent lean cuts is a reliable measure of carcass leanness. Percent protein of ham and loin (0.78), percent protein of ham, loin and shoulder (0.80), percent protein of ham, loin, shoulder and belly (0.79) were significantly correlated with percent lean cuts (carcass basis) at the probability level of $p < .01$. The highly significant correlation (0.94) was found between the percent trimmed ham and percent lean cuts. This correlation would suggest that the percent trimmed ham could be used as a single variable for estimating pork carcass value or leanness. Loin eye area at the 10th rib was highly correlated ($p < .01$) with the protein composition of the untrimmed wholesale cuts, but correlations between loin eye area and the following: lean cuts (0.63), percent protein of ham and loin (0.70), percent protein of ham, loin and shoulder (0.67), percent protein of ham, loin, shoulder and belly (0.63), percent protein of belly (0.60) were significantly lower than the correlations between percent lean cuts and percent protein of the wholesale cuts. Of all the carcass measurements taken and correlated, carcass length appears to be the least reliable as an indicator of carcass leanness. Correlations between average carcass length and percent protein of ham and loin (0.47), percent protein of ham, loin and shoulder (0.50), percent protein of belly (0.45), and average carcass backfat (-0.47) were highly significant, but account for less than 30 percent of the total variation in protein or carcass backfat. Carcass length is even less reliable in predicting percent lean cuts (0.28) and had no significant relationship to loin eye area taken at the 10th rib (0.10).

The chemical fat in the untrimmed ham, loin, belly and shoulder was not significantly related to tenderness as measured by the Warner-Bratzler shear. A correlation of -0.73 was found between Warner-Bratzler shear values and taste panel tenderness on cooked center cut pork chops. Taste panel scores indicated that tenderness was highly related ($p < .01$)

with marbling (0.37), and juiciness (0.63). The significant correlation of -0.25 was found between Warner-Bratzler shear and ether extract of the Longissimus dorsi. Marbling correlated ($p < .05$) with flavor (0.23) but not with juiciness (0.003). It appears that marbling is related to flavor and tenderness and that juiciness is related to some other characteristic of meat, perhaps the water-holding ability of muscle protein.

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APPENDIX

Appendix A. Final feedlot, slaughter, and cold carcass weights and carcass measurements (Trial I & II)

Hog No.	Sex	Feedlot wt.	Slaughter wt.	Cold carcass wt.	Av. backfat	Carcass length	Area 10th L.D.	Area last L.D.
		lb.	lb.	lb.	in.	in.	sq.in.	sq.in.
Lot 44								
Y 16-6	M	210	199	140.0	1.43	31.3	4.13	3.93
DY77-8	F	200	189	137.5	1.60	29.4	3.73	3.75
Y 12-1	F	201	188	132.5	1.47	30.2	3.51	3.74
Y 24-5	M	202	193	144.0	1.82	30.6	3.11	3.34
Y 19-2	F	204	191	142.5	1.53	31.3	4.77	4.84
Av.		203.4	192.0	139.3	1.57	30.56	3.85	3.92
Lot 44 A								
DY 88-13	M	198	189	132.5	1.69	28.8	2.98	3.19
Y 27-5	F	212	204	147.5	1.22	31.4	4.17	4.69
Y 23-2	F	196	185	134.0	1.42	29.9	3.70	3.85
DY 77-14	M	203	198	146.0	1.73	28.3	3.61	3.45
DY 88-14	M	200	190	138.0	1.60	29.4	2.58	3.05
Av.		201.8	193.2	139.6	1.53	29.56	3.41	3.65
Lot 45								
Y 13-9	M	216	206	150.4	1.60	30.7	3.54	3.80
Y 18-7	M	219	205	153.0	1.70	30.0	3.45	3.67
Y 15-10	M	209	195	146.5	1.80	29.6	3.68	3.81
Y 14-2	F	205	195	146.5	1.67	30.0	4.37	4.33
DY 77-4	F	204	197	143.5	1.68	29.2	4.08	4.23
Av.		210.6	199.6	148.0	1.69	29.90	3.82	3.97
Lot 45 A								
DY 88-2	F	212	202	144.5	1.58	30.1	3.73	3.76
Y 24-2	F	214	198	143.0	1.17	32.3	4.06	4.29
DY 88-10	M	209	194	144.5	1.67	28.7	2.96	3.14
Y 27-9	M	203	193	143.0	1.62	29.4	3.63	3.78
Y 25-4	M	208	196	143.0	1.77	30.2	3.19	3.34
Av.		209.2	196.6	143.6	1.56	30.14	3.51	3.66
Lot 46								
Y 14-3	F	205	191	142.0	1.47	29.9	4.08	4.50
Y 19-1	F	202	187	139.0	1.60	30.1	3.63	3.59
Y 12-11	M	202	189	135.0	1.52	29.1	3.83	3.69
Y 24-4	M	202	190	140.5	1.80	30.0	2.96	3.41
DY 77-2	F	202	187	139.5	1.40	30.3	4.34	4.18
Av.		202.6	188.8	139.2	1.56	29.88	3.77	3.87
Lot 46 A								
Y 23-7	M	200	190	138.0	1.40	30.0	3.19	3.22
Y 25-5	M	202	189.	138.0	1.53	29.5	3.19	3.41
Y 15-12	M	206	200	141.5	1.63	30.0	3.58	3.20
DY 77-3	F	200	194	135.0	1.40	29.5	4.00	4.00
DY 88-5	F	196	189	140.0	1.52	29.5	4.00	3.91
Av.		200.8	192.4	138.5	1.50	29.70	3.59	3.55

Appendix A. Final feedlot, slaughter, and cold carcass weights and carcass measurements (Trial I & II) (continued)

Hog No.	Sex	Feedlot wt. lb.	Slaughter wt. lb.	Cold carcass wt. lb.	Av. backfat in.	Carcass length in.	Area 10th L.D. sq.in.	Area last L.D. sq.in.
Lot 47								
Y 16-4	M	199	189	135.0	1.34	31.0	3.86	4.62
Y 15-11	M	205	191	145.0	1.60	29.9	3.70	3.25
DY 77-1	F	200	188	141.5	1.63	29.8	4.62	4.44
Y 24-6	M	203	190	143.0	1.50	30.5	3.19	3.67
Y 19-5	F	200	189	140.5	1.40	30.3	4.30	4.40
Av.		201.4	189.4	141.0	1.49	30.30	3.93	4.08
Lot 47 A								
Y 25-8	M	192	182	125.0	1.40	29.3	3.32	3.36
Y 27-6	F	194	182	127.0	1.03	31.2	4.30	4.31
DY 88-1	F	206	198	143.0	1.52	32.0	3.27	3.38
DY 77-11	M	210	198	149.0	1.65	29.2	3.52	3.53
Y 19-6	F	204	196	144.0	1.53	30.1	3.83	4.03
Av.		201.2	191.2	137.6	1.43	30.36	3.65	3.72
Lot 48								
DY 77-13	M	199	188	137.0	1.50	28.5	3.34	3.64
Y 24-1	F	199	188	141.5	1.43	30.6	3.20	3.67
DY 77-12	M	202	193	143.0	1.70	29.0	3.30	3.78
Y 15-9	M	208	192	142.0	1.43	30.0	3.49	3.51
Av.		202.0	190.2	140.9	1.52	29.52	3.33	3.65
Lot 48 A								
DY 77-7	F	208	197	145.0	1.45	29.9	3.92	3.96
Y 23-10	M	194	182	130.0	1.37	29.6	3.09	3.45
DY 88-6	F	208	197	146.0	1.58	31.0	3.16	3.28
DY 88-12	F	200	188	138.0	1.72	29.7	2.60	3.22
Y 25-1	F	197	186	137.0	1.63	30.1	3.63	3.84
Av.		201.4	190.0	139.2	1.55	30.06	3.28	3.55

Appendix B. Final feedlot, slaughter, and cold carcass weights and carcass measurements (Trial III)

Hog No.	Sex	Feedlot wt.	Slaughter wt.	Cold carcass wt.	Av. backfat	Carcass length	Area 10th L.D.	Area last L.D.
		lb.	lb.	lb.	in.	in.	sq.in.	sq.in.
Lot 76								
X 102-8	M	201	195	147.5	1.47	29.8	4.07	4.24
X 108-6	F	196	187	139.0	1.37	30.2	4.44	4.60
X 115-8	M	206	189	142.0	1.27	31.0	2.76	3.25
X 101-10	M	201	192	139.5	1.57	30.1	3.45	4.11
X 109-4	F	200	190	138.0	1.40	29.5	4.28	4.19
X 118-8	M	200	192	143.5	1.60	30.4	3.57	4.05
Av.		200.7	190.8	141.58	1.45	30.17	3.76	4.07
Lot 77								
X 104-11	M	201	192	143.0	1.73	28.5	3.83	4.12
X 102-7	M	208	198	149.5	1.65	29.8	4.23	4.18
X 105-1	F	203	198	149.0	1.53	29.7	5.04	5.72
X 107-10	M	198	188	142.0	1.40	29.1	4.33	4.08
X 102-3	F	202	194	144.5	1.37	30.2	4.40	4.55
X 103-7	M	197	190	143.0	1.67	30.2	3.83	4.07
Av.		201.5	193.3	145.17	1.56	29.58	4.28	4.45
Lot 78								
X 112-9	M	211	201	150.0	1.80	30.1	3.67	3.71
X 102-4	F	196	188	140.5	1.17	29.7	5.02	5.55
X 109-9	M	211	200	149.0	1.60	29.5	3.99	4.01
X 107-8	M	210	200	148.0	1.67	30.5	4.42	4.95
X 106-6	M	207	198	148.0	1.83	29.3	3.89	4.15
X 108-2	F	202	193	144.0	1.37	30.0	5.11	5.21
Av.		206.2	196.7	146.58	1.57	29.85	4.35	4.60
Lot 79								
X 104-12	M	206	198	148.5	1.87	28.7	3.50	3.79
X 108-8	M	211	202	149.5	1.57	30.0	3.66	4.06
X 102-9	M	210	202	153.5	1.73	28.8	4.54	4.67
X 105-8	M	200	197	141.0	1.57	28.3	4.14	3.77
X 117-1	F	201	195	147.5	1.47	29.8	4.61	4.89
X 99-4	F	195	190	142.5	1.47	30.2	4.09	4.70
Av.		203.8	197.3	147.08	1.61	29.30	4.09	4.31
Lot 80								
X 107-6	M	200	191	140.0	1.47	29.7	4.78	4.20
X 97-5	M	203	193	141.5	1.43	30.0	3.76	4.37
X 102-11	M	205	196	147.0	1.63	29.0	3.95	4.04
X 108-5	F	205	196	146.5	1.53	31.0	3.89	4.37
X 99-2	F	195	190	141.0	1.40	30.5	3.96	4.86
X 115-2	F	198	190	140.5	1.23	31.5	4.53	4.65
Av.		201.0	192.7	142.75	1.45	30.28	4.14	4.42

Appendix C. Physical and chemical composition of right side (Trial I & II)

	HAM							
Animal No.	Untr'd ham	Tr'd ham	Boneless ham	Ham skin	Ham bone	% protein	% fat	% moisture
	lb.	lb.	lb.	lb.	lb.			
Lot 44								
Y-16-6	17.30	13.80	14.70	0.70	1.80	16.34	27.43	55.95
D Y-77-8	17.20	12.30	15.10	0.90	1.20	14.80	34.69	49.74
Y-12-1	16.50	12.70	14.40	0.80	1.40	14.88	31.83	51.98
Y-24-5	16.60	12.50	14.30	0.85	1.50	14.42	34.58	50.70
Y-19-2	17.50	13.90	15.20	0.70	1.50	16.76	26.65	56.57
Sum	85.10	65.20	73.70	3.95	7.40	77.20	155.18	264.94
Mean	17.02	13.04	14.74	0.79	1.48	15.44	31.03	52.98
Lot 44 A								
DY-88-13	15.30	11.70	13.20	0.80	1.30	14.13	37.14	48.15
Y-27-5	18.90	14.90	16.30	0.70	1.40	16.52	27.30	55.65
Y-23-2	17.00	12.70	14.70	0.70	1.50	15.36	34.08	50.76
DY-77-14	17.70	13.05	15.70	0.80	1.30	15.06	34.40	50.69
DY-88-14	16.00	12.10	14.00	0.60	1.40	13.17	38.31	47.83
Sum	84.90	64.45	73.90	3.60	6.90	74.24	171.23	253.08
Mean	16.98	12.89	14.78	0.72	1.38	14.84	34.24	50.61
Lot 45								
Y-13-9	17.50	14.20	15.00	0.80	1.70	16.67	35.24	51.43
Y-18-7	18.30	12.80	16.00	0.90	1.40	14.54	36.16	48.91
Y-15-10	17.45	12.90	15.20	0.90	1.30	14.70	34.13	50.42
Y-14-2	18.10	13.60	16.10	0.60	1.40	16.22	31.33	52.74
DY-77-4	17.50	13.80	14.90	1.00	1.40	17.12	33.45	50.08
Sum	88.85	67.30	77.20	4.20	7.20	79.25	170.31	253.58
Mean	17.77	13.46	15.44	0.84	1.44	15.85	34.06	50.72
Lot 45 A								
DY-88-2	18.90	13.70	16.20	1.00	1.60	15.27	35.28	49.58
Y-24-2	17.85	14.00	15.20	1.15	1.60	17.34	23.79	58.42
DY-88-10	18.30	12.70	15.60	1.10	1.60	14.18	36.10	49.14
Y-27-9	17.40	12.80	15.40	1.20	1.40	15.68	30.77	53.13
Y-25-4	17.40	12.75	15.30	0.70	1.50	13.62	38.29	46.67
Sum	89.85	65.95	77.70	5.15	7.70	76.09	164.23	256.94
Mean	17.97	13.19	15.54	1.03	1.54	15.21	32.85	51.39
Lot 46								
Y-14-3	16.80	13.60	14.20	1.00	1.50	16.98	27.50	56.73
Y-19-1	16.30	12.50	14.20	0.80	1.30	15.75	31.47	52.81
Y-12-11	15.50	12.30	13.40	0.70	1.40	15.89	31.91	52.30
Y-24-4	16.50	12.10	14.30	0.80	1.40	14.49	34.70	50.68
DY-77-2	18.30	14.20	15.70	1.10	1.40	16.44	27.34	55.61
Sum	83.40	64.70	71.80	4.40	7.00	79.55	152.92	268.13
Mean	16.68	12.94	14.36	0.88	1.40	15.91	30.58	53.62

Appendix C. Physical and chemical composition of right side (Trial I & II) (continued)

Animal No.	HAM Untr'd ham lb.	Tr'd ham lb.	Boneless ham lb.	Ham skin lb.	Ham bone lb.	% protein	% fat	% moisture
Lot 46 A								
Y-23-7	15.20	11.40	13.10	0.70	1.40	15.36	33.72	50.57
Y-25-5	16.60	12.50	14.40	0.70	1.50	15.02	42.10	46.72
Y-15-12	16.00	12.60	13.80	0.60	1.30	16.00	31.24	52.55
DY-77-3	18.42	14.20	16.20	0.80	1.40	16.11	31.44	52.95
DY-88-5	18.00	13.50	15.80	0.60	1.40	16.08	30.75	52.50
Sum	84.22	64.20	73.30	3.40	7.00	78.57	169.25	255.29
Mean	16.84	12.84	14.66	0.68	1.40	15.71	33.85	51.06
Lot 47								
Y-16-4	17.20	14.20	14.60	0.80	1.80	16.95	23.23	59.30
Y-15-11	18.20	13.50	15.70	0.80	1.50	15.69	31.36	52.85
DY-77-1	19.10	14.60	16.70	0.80	1.40	15.74	31.02	52.82
Y-24-6	16.70	12.50	14.50	0.90	1.30	15.53	32.66	51.54
Y-19-5	18.10	14.40	15.90	0.60	1.50	17.50	31.90	51.77
Sum	89.30	69.20	77.40	3.90	7.50	81.41	150.17	268.28
Mean	17.86	13.84	15.48	0.78	1.50	16.28	30.03	53.65
Lot 47 A								
Y-25-8	16.10	12.70	13.90	0.70	1.40	15.38	28.43	55.82
Y-27-6	16.80	13.70	14.50	0.70	1.40	17.62	23.89	58.07
DY-88-1	19.10	15.00	16.80	0.80	1.40	15.13	35.45	49.23
DY-77-11	18.20	13.50	15.70	0.90	1.50	15.05	34.53	50.27
Y-19-6	17.80	13.40	15.40	1.10	1.40	16.18	43.15	40.26
Sum	88.00	68.30	76.30	4.20	7.10	79.36	165.45	253.65
Mean	17.60	13.66	15.26	0.84	1.42	15.87	33.09	50.73
Lot 48								
DY-77-13	17.50	13.00	15.20	0.91	1.40	14.83	31.78	52.72
Y-24-1	17.70	13.10	15.10	1.10	1.40	15.10	35.93	48.94
DY-77-12	17.50	12.90	15.20	0.88	1.37	14.91	35.42	49.91
Y-15-9	17.80	13.70	15.20	0.90	1.70	15.48	30.44	53.50
Sum	70.50	52.70	60.70	3.79	5.87	60.32	133.57	205.07
Mean	17.63	13.18	15.18	0.95	1.47	15.08	33.39	51.26
Lot 48 A								
DY-77-7	19.20	14.40	16.80	0.90	1.50	15.82	30.94	52.73
Y-23-10	15.60	11.50	13.30	0.70	1.60	15.60	31.84	52.68
DY-88-6	17.30	13.00	15.20	0.70	1.40	14.86	35.63	49.26
DY-88-12	17.30	12.20	15.00	0.90	1.20	14.07	36.25	49.43
Y-25-1	17.25	12.70	15.20	0.70	1.80	15.18	34.22	50.23
Sum	86.65	63.80	75.50	3.90	7.50	75.53	168.88	254.33
Mean	17.33	12.76	15.10	0.78	1.50	15.10	33.77	50.86

Appendix C. Physical and chemical composition of right side (Trial I & II) (continued)

Animal No.	LOIN Untr'd loin	Tr'd loin	Boneless loin	Loin bone	Loin skin	% protein	% fat	% moisture
	lb.	lb.	lb.	lb.	lb.			
Lot 44								
Y-16-6	17.90	12.00	14.90	2.30	0.60	12.54	45.61	41.95
DY-77-8	16.10	10.20	13.60	1.70	0.80	11.75	48.81	39.27
Y-12-1	15.90	10.30	13.30	1.70	0.90	11.91	48.03	39.62
Y-24-5	17.80	10.00	15.30	1.60	0.80	9.99	57.37	32.72
Y-19-2	16.50	11.70	13.80	1.80	0.80	13.93	43.13	44.81
Sum	84.20	54.20	70.90	9.10	3.90	59.92	222.62	198.33
Mean	16.84	10.84	14.18	1.82	0.78	11.98	44.52	39.67
Lot 44 A								
DY-88-13	15.90	9.30	14.05	1.25	0.50	10.17	54.99	34.78
Y-27-5	18.00	12.10	15.40	1.80	0.70	13.57	42.83	43.43
Y-23-2	16.10	10.70	13.20	2.10	0.70	13.00	45.78	41.53
DY-77-14	19.90	10.85	17.00	2.00	0.90	10.34	56.82	33.14
DY-88-14	17.00	9.90	14.90	1.60	0.50	9.81	57.67	32.69
Sum	86.90	52.85	74.55	8.75	3.30	56.89	258.09	185.57
Mean	17.38	10.57	14.91	1.75	0.66	11.37	51.61	37.11
Lot 45								
Y-13-9	19.90	12.50	16.80	2.30	0.60	11.59	51.02	37.66
Y-18-7	19.10	10.30	16.60	1.70	0.75	10.05	56.30	33.99
Y-15-10	19.70	10.80	15.00	1.96	0.70	10.58	54.86	34.63
Y-14-2	17.60	10.90	14.90	1.85	0.90	12.62	46.57	40.67
DY-77-4	17.30	10.90	14.40	1.80	1.10	12.77	51.04	38.09
Sum	93.60	55.40	77.70	9.61	4.05	57.61	259.79	185.04
Mean	18.72	11.08	15.54	1.92	0.81	11.52	51.95	37.00
Lot 45 A								
DY-88-2	18.40	11.10	15.20	2.20	0.90	11.92	51.55	36.79
Y-24-2	17.80	13.00	14.30	2.40	1.20	14.90	35.70	49.09
DY-88-10	16.90	10.00	14.30	1.80	0.80	10.95	57.63	33.58
Y-27-9	18.70	10.85	16.30	1.70	0.70	10.71	55.02	34.00
Y-25-4	16.70	8.95	14.60	1.60	0.50	10.57	56.88	32.92
Sum	88.50	53.90	74.70	9.70	4.10	59.05	236.78	186.38
Mean	17.70	10.78	14.94	1.94	0.82	11.81	47.35	37.27
Lot 46								
Y-14-3	16.40	10.60	13.80	1.80	0.70	13.01	44.34	42.34
Y-19-1	15.10	9.80	12.80	1.60	0.70	12.87	45.36	41.99
Y-12-11	15.40	9.50	13.35	1.57	0.48	11.90	49.71	38.30
Y-24-4	17.80	9.80	15.20	1.80	0.80	10.42	57.90	32.29
DY-77-2	16.00	11.10	13.10	1.80	1.10	11.12	41.39	46.25
Sum	80.70	50.80	68.25	8.57	3.78	59.38	238.70	201.17
Mean	16.14	10.16	13.65	1.72	0.76	11.87	47.74	40.23

Appendix C. Physical and chemical composition of right side (Trial I & II) (continued)

Animal No.	Untr'd loin	tr'd loin	Boneless loin	Loin bone	Loin skin	% protein	% fat	% moisture
	LOIN							
	lb.	lb.	lb.	lb.	lb.			
Lot 46 A								
Y-23-7	15.80	9.20	13.20	2.00	0.60	10.80	56.14	33.53
Y-25-5	15.70	9.10	13.20	1.90	0.60	11.04	53.13	34.66
Y-15-12	18.20	11.20	15.30	1.80	0.60	12.00	49.63	38.25
DY-77-3	15.20	10.60	12.70	1.70	0.80	14.03	41.46	44.63
DY-88-5	17.50	11.00	14.80	1.70	0.70	12.47	49.06	38.84
Sum	82.40	51.10	69.20	9.10	3.30	60.34	249.42	189.91
Mean	16.48	10.22	13.84	1.82	0.66	12.06	49.88	37.98
Lot 47								
Y-16-4	16.80	11.20	14.00	2.00	0.80	13.32	43.10	43.41
Y-15-11	18.70	10.30	16.10	1.80	0.60	11.09	39.85	48.16
DY-77-1	15.60	10.60	13.00	1.78	0.62	13.40	43.29	43.32
Y-24-6	18.85	10.80	15.70	2.10	0.90	11.08	52.56	36.54
Y-19-5	15.40	10.70	13.00	1.80	0.60	14.78	38.07	46.97
Sum	85.35	53.60	71.80	9.48	3.52	63.67	216.87	218.40
Mean	17.07	10.72	14.36	1.90	0.70	12.73	43.37	43.68
Lot 47 A								
Y-25-8	14.90	9.80	12.40	1.30	0.80	12.92	45.18	41.91
Y-27-6	15.50	11.70	12.60	1.80	0.65	15.89	34.69	49.61
DY-88-1	18.20	11.50	15.60	1.80	0.60	11.40	34.28	50.53
DY-77-11	17.00	9.60	14.20	1.80	0.90	10.08	55.95	34.10
Y-19-6	16.50	10.35	13.80	1.90	0.80	12.88	47.15	40.26
Sum	82.10	52.95	68.60	8.60	3.75	63.49	217.25	216.41
Mean	16.42	10.59	13.72	1.72	0.75	12.70	43.45	43.28
Lot 48								
DY-77-13	16.50	9.80	14.00	1.70	0.85	11.31	51.33	37.41
Y-24-1	16.60	10.30	14.00	1.80	0.90	11.89	52.31	36.19
DY-77-12	17.50	10.10	15.00	1.70	0.70	10.57	52.98	36.10
Y-15-9	16.70	10.00	14.10	1.90	0.70	11.62	51.88	38.64
Sum	67.30	40.20	57.10	7.10	3.15	45.39	208.50	148.34
Mean	16.83	10.05	14.28	1.78	0.79	11.34	52.12	37.08
Lot 48-A								
DY-77-7	18.00	11.10	15.40	1.80	0.90	12.03	50.45	38.82
Y-23-10	15.80	9.80	13.00	2.10	0.70	11.72	49.56	38.52
DY-88-6	16.40	10.20	13.60	2.10	0.70	11.02	53.49	36.72
DY-88-12	16.80	9.40	14.60	1.40	0.80	10.26	56.26	33.59
Y-25-1	17.00	10.20	14.30	1.90	0.70	11.90	51.77	36.48
Sum	84.00	50.70	70.90	9.30	3.80	56.93	261.53	184.13
Mean	16.80	10.14	14.18	1.86	0.76	11.38	52.31	36.82

Appendix C. Physical and chemical composition of right side (Trial I & II) (continued)

Animal No.	SHOULDER							
	Untr'd shldr	Tr'd shldr	Boneless shldr	Shldr bone	Shldr skin	% protein	% fat	% moisture
	lb.	lb.	lb.	lb.	lb.			
Lot 44								
Y-16-6	15.20	11.90	13.00	1.50	0.70	13.21	38.54	47.84
DY-77-8	15.10	12.10	13.30	1.20	0.60	13.52	36.79	49.49
Y-12-1	13.90	12.10	11.93	1.38	0.55	14.53	32.18	52.63
Y-24-5	15.40	12.70	13.50	1.20	0.70	12.82	41.53	46.05
Y-19-2	16.20	13.70	14.10	1.40	0.70	14.29	33.34	52.28
Sum	75.80	62.50	65.83	6.68	3.25	68.37	182.38	248.29
Mean	15.16	12.50	13.17	1.34	0.65	13.67	36.47	49.65
Lot 44 A								
DY-88-13	14.90	11.95	13.00	1.00	0.40	12.74	40.92	45.75
Y-27-5	15.30	12.90	13.45	1.40	0.45	15.84	29.67	54.13
Y-23-2	14.00	11.70	12.10	1.40	0.50	14.86	33.28	51.65
DY-77-14	15.00	11.80	13.25	1.25	0.60	12.46	41.08	46.35
DY-88-14	15.10	11.60	13.10	1.40	0.50	12.13	42.96	44.91
Sum	74.30	59.95	64.90	6.45	2.45	68.03	187.91	242.79
Mean	14.86	11.99	12.98	1.29	0.49	13.60	37.58	48.55
Lot 45								
Y-13-9	16.30	13.70	14.20	1.30	0.70	13.89	37.06	49.19
Y-18-7	16.10	12.50	14.20	1.30	0.70	12.71	38.79	47.52
Y-15-10	15.80	12.30	13.80	1.30	0.60	13.21	40.58	45.72
Y-14-2	15.70	12.20	13.70	1.20	0.80	14.01	34.02	52.52
DY-77-4	15.80	13.30	13.30	1.70	0.80	14.48	37.43	51.62
Sum	79.70	64.00	69.20	6.80	3.60	68.30	187.88	246.57
Mean	15.94	12.80	13.84	1.36	0.72	13.66	37.57	49.31
Lot 45 A								
DY-88-2	15.30	12.60	13.30	1.40	0.50	14.04	37.70	48.69
Y-24-2	15.30	12.90	13.10	1.50	0.80	16.28	29.77	57.00
DY-88-10	15.30	12.70	13.10	1.40	0.80	13.91	36.83	49.60
Y-27-9	13.95	11.50	12.10	1.40	0.50	14.51	34.38	50.85
Y-25-4	16.60	12.60	14.70	1.30	0.70	11.84	45.71	42.27
Sum	76.45	62.30	66.30	7.00	3.30	70.58	184.39	248.41
Mean	15.29	12.46	13.26	1.40	0.66	14.11	36.87	49.68
Lot 46								
Y-14-3	16.10	12.70	13.70	1.45	0.95	14.38	33.08	50.85
Y-19-1	13.80	11.50	11.90	1.30	0.60	13.96	34.24	51.14
Y-12-11	14.90	12.40	13.00	1.35	0.45	13.77	37.04	50.95
Y-24-4	14.80	12.10	12.80	1.30	0.70	13.21	38.48	48.46
DY-77-2	14.30	12.60	12.40	1.30	0.60	15.96	26.30	56.61
Sum	73.90	61.30	63.80	6.70	3.30	71.28	169.14	258.01
Mean	14.78	12.26	12.76	1.34	0.66	14.25	33.82	51.60

Appendix C. Physical and chemical composition of right side (Trial I & II) (continued)

Animal No.	SHOULDER Untr'd shldr lb.	Tr'd shldr lb.	Boneless shldr lb.	Shldr bone lb.	Shldr skin lb.	% protein	% fat	% moisture
Lot 46 A								
Y-23-7	14.50	12.20	12.60	1.40	0.50	13.46	41.58	45.57
Y-25-5	14.90	12.20	12.80	1.40	0.70	13.21	35.74	49.51
Y-15-12	17.60	14.40	15.50	1.30	0.60	13.96	37.74	48.22
DY-77-3	15.40	13.00	13.40	1.35	0.60	15.42	32.82	52.78
DY-88-5	14.60	12.10	12.80	1.20	0.50	15.32	32.92	51.89
Sum	77.00	63.90	67.10	6.65	2.90	71.37	180.80	247.97
Mean	15.40	12.78	13.42	1.33	0.58	14.27	36.16	49.59
Lot 47								
Y-16-4	14.10	11.90	12.00	1.50	0.60	15.23	30.70	54.24
Y-15-11	15.30	12.20	13.50	1.30	0.50	13.86	38.60	47.89
DY-77-1	15.10	12.60	13.20	1.23	0.55	14.31	34.15	51.46
Y-24-6	15.20	12.20	13.30	1.10	0.70	13.68	37.49	48.59
Y-19-5	14.70	13.90	12.90	1.30	0.50	16.18	27.84	55.44
Sum	74.40	62.80	64.90	6.43	2.85	73.26	168.78	257.62
Mean	14.88	12.56	12.98	1.29	0.57	14.65	33.75	51.52
Lot 47 A								
Y-25-8	14.30	11.70	12.30	1.40	0.60	14.79	33.85	51.68
Y-27-6	14.50	12.90	12.40	1.30	0.60	16.66	24.82	58.14
DY-88-1	13.40	11.40	11.50	1.20	0.40	15.15	35.45	49.23
DY-77-11	15.20	12.00	13.20	1.40	0.60	13.19	39.35	47.79
Y-19-6	16.45	13.50	14.60	1.25	0.80	14.87	35.68	49.63
Sum	73.85	61.50	64.00	6.55	3.00	74.66	169.15	256.47
Mean	14.77	12.30	12.80	1.31	0.60	14.93	33.83	51.29
Lot 48								
DY-77-13	14.30	11.80	12.40	1.20	0.70	13.35	35.11	50.75
Y-24-1	15.10	13.00	13.00	0.80	0.80	14.04	38.32	48.20
DY-77-12	15.00	11.70	13.20	1.20	0.50	12.94	38.09	48.42
Y-15-9	15.00	12.50	12.95	1.45	0.60	14.52	33.32	51.88
Sum	59.40	49.00	51.55	4.65	2.60	54.85	144.84	199.25
Mean	14.85	12.25	12.89	1.16	0.65	13.71	36.21	49.81
Lot 48 A								
DY-77-7	15.90	13.20	14.00	0.70	1.40	14.35	34.37	51.14
Y-23-10	13.80	11.15	12.00	1.30	0.50	13.63	37.25	48.90
DY-88-6	15.80	13.10	13.60	1.40	0.60	13.22	38.69	47.44
DY-88-12	14.50	12.40	12.60	1.20	0.70	14.18	36.72	49.94
Y-25-1	15.70	12.15	13.90	1.30	0.50	13.45	39.82	47.15
Sum	75.70	62.00	66.10	5.90	3.70	68.83	186.85	244.57
Mean	15.14	12.40	13.22	1.18	0.74	13.76	37.37	48.91

Appendix C. **Physical and chemical composition of right side (Trial I & II) (continued)**

Animal No.	BELLY Untr'd belly	Tr'd belly	Boneless belly	Belly skin	% protein	% fat	% moisture
	lb.	lb.	lb.	lb.			
Lot 44							
Y-16-6	9.50	7.30	8.60	0.90	11.03	52.10	36.88
DY-77-8	11.20	8.20	10.40	0.80	9.38	57.79	32.64
Y-12-1	9.70	7.40	9.00	0.70	10.88	52.15	36.84
Y-24-5	11.50	8.80	10.70	0.80	8.55	59.61	31.05
Y-19-2	10.10	7.80	9.30	0.80	11.27	50.32	39.08
Sum	52.00	39.50	48.00	4.00	51.11	271.97	176.49
Mean	10.40	7.90	9.60	0.80	10.22	54.39	35.29
Lot 44 A							
DY-88-13	13.30	10.95	12.50	0.60	7.77	63.97	27.65
Y-27-5	11.20	8.40	10.50	0.70	11.63	50.44	38.11
Y-23-2	10.20	7.70	9.50	0.60	10.13	54.57	34.93
DY-77-14	11.50	9.20	10.90	0.70	9.15	60.96	30.29
DY-88-14	10.20	8.00	9.50	0.70	8.32	63.00	28.67
Sum	56.40	44.25	52.90	3.30	47.00	292.94	159.65
Mean	11.28	8.85	10.58	0.66	9.40	58.58	31.93
Lot 45							
Y-13-9	11.70	8.80	10.80	0.90	10.29	54.09	34.96
Y-18-7	12.30	9.70	11.60	0.80	9.38	60.20	31.08
Y-15-10	10.50	8.40	9.80	0.70	9.38	59.49	31.87
Y-14-2	11.80	9.60	11.00	0.90	9.83	57.12	33.11
DY-77-4	12.00	9.60	10.90	1.10	10.36	60.01	30.34
Sum	58.30	46.10	54.10	4.40	49.24	296.91	161.36
Mean	11.66	9.22	10.82	0.88	9.84	58.18	32.27
Lot 45 A							
DY-88-2	11.00	9.10	10.20	0.80	10.10	56.67	34.25
Y-24-2	10.20	8.05	9.30	1.00	12.40	46.50	41.08
DY-88-10	10.70	8.40	9.90	0.80	9.82	58.13	32.11
Y-27-9	11.10	8.85	10.40	0.70	9.97	56.17	33.58
Y-25-4	11.00	8.90	10.20	0.80	7.92	58.40	34.24
Sum	54.00	43.30	50.00	4.10	50.21	275.87	175.26
Mean	10.80	8.66	10.00	0.82	10.04	55.17	35.05
Lot 46							
Y-14-3	11.70	8.40	10.80	0.90	10.31	52.32	35.77
Y-19-1	12.40	9.30	11.40	1.00	9.86	55.84	33.68
Y-12-11	10.40	7.50	9.70	0.70	10.42	56.40	33.07
Y-24-4	10.60	8.30	9.80	0.80	8.76	59.00	31.68
DY-77-2	10.00	7.80	8.80	1.10	10.83	49.63	39.35
Sum	55.10	41.30	50.50	4.50	50.18	273.19	173.55
Mean	11.02	8.26	10.10	0.90	10.03	54.63	34.71

Appendix C. Physical and chemical composition of right side (Trial I & II) (continued)

Animal No.	BELLY						
	Untr'd belly lb.	Tr'd belly lb.	Boneless belly lb.	Belly skin lb.	% protein	% fat	% moisture
Lot 46 A							
Y-23-7	13.40	10.90	12.60	0.80	8.69	62.45	29.31
Y-25-5	13.00	9.60	12.10	1.00	9.10	59.21	31.40
Y-15-12	10.40	7.80	9.50	0.90	10.82	56.07	33.93
DY-77-3	10.40	8.40	9.60	0.80	10.69	54.92	34.65
DY-88-5	11.20	8.50	10.40	0.80	10.54	54.92	34.65
Sum	58.40	45.20	54.20	4.30	49.84	287.57	163.94
Mean	11.68	9.04	10.84	0.86	9.96	57.51	32.78
Lot 47							
Y-16-4	9.40	7.20	8.60	0.70	11.03	51.67	37.02
Y-15-11	10.20	8.30	9.60	0.60	9.27	57.80	32.63
DY-77-1	10.80	7.50	9.90	0.90	10.01	54.98	35.13
Y-24-6	12.20	9.00	11.40	0.70	10.09	58.44	31.90
Y-19-5	11.70	8.30	10.90	0.80	10.91	51.30	37.50
Sum	54.30	40.30	50.40	3.70	51.31	274.19	174.18
Mean	10.86	8.06	10.08	0.74	10.26	54.83	34.83
Lot 47 A							
Y-25-8	9.70	7.50	9.00	0.60	10.35	51.95	37.35
Y-27-6	8.90	6.90	8.10	0.80	13.95	41.96	44.28
DY-88-1	11.30	8.70	10.50	0.70	10.15	56.66	33.23
DY-77-11	13.40	11.30	12.50	0.90	8.78	61.43	30.59
Y-19-6	11.75	9.50	10.90	0.90	10.62	54.57	34.74
Sum	55.05	43.90	51.00	3.90	53.85	266.57	180.19
Mean	11.01	8.78	10.20	0.78	10.77	53.31	36.03
Lot 48							
DY-77-13	10.80	8.60	9.90	1.00	9.75	56.25	34.35
Y-24-1	11.40	8.70	10.60	0.80	8.80	64.00	27.86
DY-77-12	12.00	8.90	11.15	0.85	9.45	57.60	32.63
Y-15-9	9.70	7.70	8.80	0.80	9.78	55.77	33.93
Sum	43.90	33.90	40.45	3.45	37.78	233.62	128.77
Mean	10.98	8.48	10.11	0.86	9.44	58.40	32.19
Lot 48 A							
DY-77-7	10.85	9.00	10.20	0.70	10.26	55.36	34.30
Y-23-10	10.20	8.00	9.50	0.70	9.99	56.20	35.42
DY-88-6	13.40	10.50	12.50	0.90	8.86	60.35	30.20
DY-88-12	10.90	8.30	10.00	0.90	9.82	57.01	33.47
Y-25-1	10.50	8.00	9.90	0.60	9.71	58.71	31.39
Sum	55.85	43.80	52.10	3.80	48.64	287.63	164.78
Mean	11.17	8.76	10.42	0.76	9.72	57.52	32.95

Appendix D. Carcass data (Trial I & II)

Animal No.	Left ham	Right ham	Left loin	Right loin	Left shldr	Right shldr	Left belly	Right belly	Total primal cuts	Total lean cuts	Primal cuts % of carcass wt.	Lean cuts % of carcass wt.	% tr'd rt. ham of carcass
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	%	%	%
Lot 44													
Y-16-6	13.8	13.8	12.6	12.0	10.9	11.9	8.3	7.3	90.6	75.0	64.71	53.57	9.86
DY-77-8	12.5	12.3	10.1	10.2	10.9	12.1	9.3	8.2	85.6	68.1	62.25	49.53	8.94
Y-12-1	12.6	12.7	11.0	10.3	12.7	12.1	7.7	7.4	86.5	71.4	65.28	53.89	9.58
Y-24-5	12.3	12.5	10.5	10.0	12.0	12.7	10.1	8.8	88.9	70.0	61.74	48.61	8.68
Y-19-2	13.6	13.9	12.2	11.7	11.6	13.7	9.4	7.8	93.9	76.7	65.89	53.82	9.75
Mean	12.96	13.04	11.28	10.84	11.62	12.50	8.96	7.90	89.10	72.24	63.97	51.88	9.36
Lot 44 A													
DY-88-13	11.9	11.7	9.2	9.3	10.3	12.0	9.4	11.0	84.7	64.4	63.92	48.57	8.83
Y-27-5	14.6	14.9	14.0	12.1	12.4	12.9	8.8	8.4	98.1	80.9	66.51	54.85	10.10
Y-23-2	13.4	12.7	11.2	10.7	11.2	11.7	7.9	7.7	86.5	70.9	64.55	59.91	9.48
DY-77-14	12.5	13.1	10.1	10.9	11.3	11.8	10.3	9.2	89.1	69.6	60.99	47.64	8.97
DY-88-14	11.8	12.1	10.0	9.9	11.5	11.6	9.0	8.0	83.9	66.9	60.80	48.48	8.77
Mean	12.84	12.90	10.90	10.58	11.34	12.00	9.08	8.86	88.46	70.54	63.35	51.89	9.23
Lot 45													
Y-13-9	13.2	14.2	11.5	12.5	13.0	13.7	8.8	8.8	95.7	78.1	63.63	51.93	9.44
Y-18-7	13.2	12.8	10.7	10.3	12.2	12.5	10.7	9.7	92.1	71.7	60.20	46.86	8.37
Y-15-10	12.9	12.9	10.8	10.8	11.3	12.3	9.7	8.4	89.1	71.0	60.82	48.46	8.80
Y-14-2	13.6	13.6	10.8	10.9	11.9	12.2	9.9	9.6	92.5	73.0	63.14	49.83	9.28
DY-77-4	13.5	13.8	11.2	10.9	12.6	13.3	9.3	9.6	94.2	75.3	65.64	52.47	9.62
Mean	13.28	13.46	11.00	11.08	12.20	12.80	9.68	9.22	92.72	73.82	62.69	49.91	9.10
Lot 45 A													
DY-88-2	13.3	13.7	10.6	11.1	12.5	12.6	9.4	9.1	92.3	73.8	63.84	51.04	9.48
Y-24-2	13.8	14.0	12.4	13.0	13.2	12.9	8.3	8.1	95.7	79.3	66.89	55.45	9.79
DY-88-10	13.0	12.7	10.0	9.9	11.8	12.7	9.3	8.4	87.8	70.1	60.76	48.51	8.79
Y-27-9	12.6	12.8	12.1	10.9	11.4	11.5	8.9	8.9	89.0	71.3	62.24	49.82	8.95
Y-25-4	12.1	12.8	10.0	9.0	12.1	12.6	9.3	8.9	86.7	68.5	60.63	47.90	8.95
Mean	12.96	13.20	11.02	10.78	12.20	12.46	9.04	8.68	90.30	72.60	62.87	50.54	9.19

Appendix D. Carcass data (Trial I & II)(continued)

Animal No.	Left ham	Right ham	Left loin	Right loin	Left shldr	Right shldr	Left belly	Right belly	Total primal cuts	Total lean cuts	Primal cuts % of carcass wt.	Lean cuts % of carcass wt.	% tr'd rt. ham of carcass
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	%	%	%
Lot 46													
Y-14-3	13.7	13.6	11.2	10.6	12.2	12.7	8.3	8.4	90.7	74.0	63.87	52.11	9.58
Y-19-1	12.7	12.5	11.4	9.8	12.4	11.5	8.5	9.3	88.1	70.3	63.38	50.60	8.99
Y-12-11	12.4	12.3	10.9	9.5	13.1	12.4	7.4	7.5	85.5	70.6	63.33	52.30	9.11
Y-24-4	11.6	12.1	9.9	9.8	11.4	12.1	9.8	8.3	85.0	66.9	60.50	47.61	8.61
DY-77-2	14.0	14.2	11.8	11.1	13.2	12.6	7.4	7.8	92.1	76.9	66.02	55.12	10.18
Mean	12.88	12.94	11.04	10.16	12.46	12.26	8.28	8.26	88.28	71.74	63.42	51.55	9.29
Lot 46 A													
Y-23-7	11.1	11.4	9.4	9.2	12.1	12.2	10.8	10.9	87.1	65.4	63.12	47.39	8.26
Y-25-5	12.4	12.5	9.5	9.1	12.0	12.2	9.9	9.6	87.2	67.7	63.19	49.06	9.06
Y-15-12	14.7	12.6	11.4	11.2	12.3	14.4	8.8	7.8	93.2	76.6	65.87	54.13	8.90
DY-77-3	14.7	14.2	11.4	10.6	13.2	13.0	8.0	8.4	93.5	77.1	69.26	57.11	10.52
DY-88-5	14.7	13.5	10.8	11.0	12.2	12.1	8.9	8.5	91.9	74.3	65.64	53.07	9.64
Mean	13.52	12.84	10.50	10.22	12.36	12.78	9.28	9.04	90.58	72.22	65.42	52.15	9.28
Lot 47													
Y-16-4	13.5	14.2	11.5	11.2	11.2	11.9	7.9	7.2	88.6	73.5	65.63	54.44	10.52
Y-15-11	13.1	13.5	11.0	10.3	13.3	12.2	8.4	8.3	90.1	73.4	62.14	50.62	9.31
DY-77-1	15.1	14.6	11.5	10.6	13.2	12.6	7.3	7.5	92.4	77.4	65.30	54.84	10.32
Y-24-6	12.7	12.5	9.8	10.8	11.7	12.2	9.3	9.0	88.0	69.7	61.54	48.74	8.74
Y-19-5	15.0	14.4	11.0	10.7	13.8	13.9	7.8	8.3	94.9	78.8	67.54	56.08	10.25
Mean	13.88	13.84	10.96	10.72	12.64	12.56	8.14	8.06	90.80	74.56	64.43	52.94	9.83
Lot 47 A													
Y-25-8	13.6	12.7	10.6	9.8	13.3	11.7	7.6	7.5	86.8	71.7	69.44	57.36	10.16
Y-27-6	14.3	13.7	12.5	11.7	11.9	12.9	6.6	6.9	90.5	77.0	71.22	60.59	10.79
DY-88-1	14.8	15.0	11.5	11.5	12.3	11.4	9.7	8.7	94.9	76.5	66.36	53.50	10.49
DY-77-11	13.2	13.5	10.4	9.6	13.4	12.0	10.2	11.3	93.6	72.1	62.82	48.39	9.06
Y-19-6	13.7	13.4	11.1	10.4	11.0	13.5	9.2	9.5	91.8	73.1	63.72	50.73	9.30
Mean	13.92	13.66	11.22	10.60	12.38	12.30	8.66	8.78	91.52	74.08	66.71	54.11	9.96

Appendix D. Carcass data (Trial I & II)(continued)

Animal No.	Left ham	Right ham	Left loin	Right loin	Left shldr	Right shldr	Left belly	Right belly	Total primal cuts	Total lean cuts	Primal cuts % of carcass wt.	Lean cuts % of carcass wt.	% tr'd rt. ham of carcass
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	%	%	%
Lot 48													
DY-77-13	13.1	13.0	10.6	9.8	12.4	11.8	7.1	8.6	86.4	70.7	63.06	51.60	9.49
Y-24-1	13.0	13.1	10.7	10.3	11.6	12.7	8.4	8.7	88.5	71.4	62.54	50.46	9.26
DY-77-12	12.9	12.9	10.8	10.1	13.7	11.7	8.0	8.9	89.0	72.1	62.24	50.42	9.02
Y-15-9	13.9	13.7	10.4	10.0	14.0	12.5	7.9	7.7	90.1	74.5	63.45	52.46	9.65
Mean	13.22	13.18	10.62	10.05	12.92	12.18	7.85	8.48	88.50	72.18	62.82	51.24	9.36
Lot 48 A													
DY-77-7	13.7	14.4	11.2	11.1	12.2	13.2	9.3	9.0	94.1	75.8	64.86	52.24	9.93
Y-23-10	11.5	11.5	9.9	9.8	10.5	11.2	7.9	8.0	80.3	64.4	61.73	49.50	8.85
DY-88-6	12.7	13.0	10.7	10.2	12.6	13.1	10.4	10.5	93.2	72.3	63.84	49.52	8.90
DY-88-12	12.4	12.2	9.6	9.4	11.5	12.4	9.7	8.3	85.5	67.5	61.96	48.91	8.84
Y-25-1	11.7	12.7	10.6	10.2	11.0	12.2	8.8	8.0	85.0	68.3	62.04	49.82	9.27
Mean	12.40	12.76	10.40	10.14	11.56	12.42	9.22	8.76	87.62	69.66	62.89	50.00	9.16

Appendix E. Physical and chemical composition of right side (Trial III)

Animal No.	HAM Untr'd ham	Tr'd ham	Boneless ham	Ham skin	Ham bone	% protein	% fat	% moisture
	lb.	lb.	lb.	lb.	lb.			
Lot 76								
X-102-8	17.90	14.10	15.70	0.80	1.40	15.91	31.64	52.47
X-108-6	17.45	14.05	15.20	1.00	1.20	16.85	29.43	53.76
X-115-8	17.30	13.50	15.10	0.80	1.40	14.50	34.97	50.23
X-101-10	16.25	13.40	14.00	1.00	1.30	15.91	30.15	53.63
X-109-4	17.80	14.30	15.70	0.70	1.40	16.31	28.57	54.96
X-118-8	17.80	14.30	15.70	0.70	1.30	16.04	31.13	52.73
Sum	104.50	83.65	91.40	5.00	8.00	95.52	185.89	317.78
Mean	17.42	13.94	15.23	0.83	1.33	15.92	30.98	52.96
Lot 77								
X-104-11	18.30	14.30	16.00	0.90	1.40	14.63	33.09	51.97
X-102-7	19.20	14.65	16.80	1.20	1.30	15.81	30.44	53.44
X-105-1	20.10	16.15	17.80	1.00	1.40	15.72	32.47	55.47
X-107-10	17.25	14.00	15.20	0.80	1.45	15.41	32.69	51.81
X-102-3	19.60	15.90	17.40	0.90	1.30	15.91	27.32	56.46
X-103-7	17.60	12.90	15.50	0.80	1.25	14.13	36.79	47.90
Sum	112.05	87.90	98.70	5.60	8.10	91.61	192.80	317.05
Mean	18.68	14.65	16.45	0.93	1.35	15.27	32.13	52.84
Lot 78								
X-112-9	18.45	14.00	15.75	1.20	1.50	14.97	34.25	50.48
X-102-4	18.70	14.90	15.40	0.80	1.50	15.63	29.43	54.51
X-109-9	18.30	14.55	16.00	0.90	1.50	14.66	32.55	52.29
X-107-8	17.50	14.40	16.50	0.70	1.30	16.29	27.41	56.08
X-106-6	18.50	12.90	16.60	0.80	1.20	14.35	37.39	48.05
X-108-2	18.80	14.60	16.60	0.90	1.30	16.44	30.05	53.56
Sum	110.25	85.35	97.85	5.31	8.30	92.34	191.08	314.97
Mean	18.38	14.23	16.31	0.88	1.38	15.39	31.85	52.49
Lot 79								
X-104-12	17.80	14.00	16.50	0.90	1.40	13.82	39.53	46.42
X-108-8	18.10	14.00	15.90	0.80	1.45	15.63	35.20	49.59
X-102-9	19.95	16.20	17.65	0.90	1.45	15.00	35.11	49.82
X-105-8	18.25	14.60	16.00	0.70	1.50	15.16	33.71	50.64
X-117-1	19.30	15.80	17.00	0.80	1.40	15.76	29.15	54.64
X-99-4	19.30	15.00	17.20	0.90	1.20	16.57	30.35	52.70
Sum	112.70	89.60	100.25	5.00	8.40	91.94	203.05	303.81
Mean	18.78	14.93	16.71	0.83	1.40	15.32	33.84	50.63
Lot 80								
X-107-6	17.35	13.40	15.20	0.80	1.50	16.04	30.74	52.93
X-97-5	19.15	15.25	12.00	0.90	1.40	15.91	30.27	54.24
X-102-11	17.45	14.10	15.40	0.70	1.40	14.54	35.62	49.49
X-108-5	18.60	14.10	16.30	0.80	1.40	15.28	33.60	50.77
X-99-2	19.80	15.70	17.20	0.90	1.60	16.66	28.33	54.91
X-115-2	18.20	14.30	15.80	0.70	1.35	16.26	29.58	53.93
Sum	110.55	86.85	91.40	4.80	8.65	94.69	188.14	316.27
Mean	18.42	14.48	15.32	0.80	1.44	15.78	31.36	52.71

Appendix E. Physical and chemical composition of right side (Trial III) (continued)

Animal No.	LOIN Untr'd loin lb.	Tr'd loin lb.	Boneless loin lb.	Loin bone lb.	Loin skin lb.	% protein	% fat	% moisture
Lot 76								
X-102-8	18.80	12.20	16.10	2.00	0.75	12.06	49.21	38.74
X-108-6	16.20	11.30	13.30	2.00	0.80	14.53	39.22	45.91
X-115-8	14.85	9.80	12.70	1.50	0.65	11.85	50.14	37.66
X-101-10	17.00	10.70	14.30	1.90	0.90	12.38	48.85	38.79
X-109-4	17.30	12.00	14.30	2.10	0.80	13.25	43.54	43.16
X-118-8	17.40	11.50	14.90	1.60	0.80	12.97	45.79	41.42
Sum	101.55	67.50	85.60	11.10	4.70	77.04	276.75	245.68
Mean	16.93	11.25	14.27	1.85	0.78	12.84	46.12	40.94
Lot 77								
X-104-11	16.65	10.80	13.90	2.00	0.75	12.13	45.67	41.94
X-102-7	17.70	11.30	15.20	1.70	0.90	13.10	44.44	42.34
X-105-1	16.25	11.80	13.90	1.50	0.90	13.94	37.12	48.12
X-107-10	16.20	10.55	14.10	1.50	0.60	12.01	48.07	39.46
X-102-3	17.30	11.85	14.90	1.60	0.80	13.32	41.83	44.62
X-103-7	18.90	11.60	16.35	1.60	0.85	10.53	54.25	34.92
Sum	103.00	67.90	88.35	9.90	4.80	75.03	271.38	251.40
Mean	17.17	11.32	14.73	1.65	0.80	12.50	45.23	41.90
Lot 78								
X-112-9	19.60	10.90	16.45	2.10	1.00	9.35	57.03	32.96
X-102-4	16.80	11.80	14.45	1.70	0.80	14.41	38.21	47.19
X-109-9	17.00	11.10	14.40	1.75	0.60	12.16	47.65	40.21
X-107-8	19.45	12.45	16.80	2.00	0.65	12.63	48.09	39.95
X-106-6	18.70	10.60	16.50	1.40	0.60	10.63	53.53	35.47
X-108-2	17.00	12.40	14.50	1.60	0.80	14.03	43.68	42.67
Sum	108.55	69.25	93.10	10.55	4.45	73.21	288.19	238.45
Mean	18.09	11.54	15.52	1.76	0.74	12.20	48.03	39.74
Lot 79								
X-104-12	18.60	10.30	16.30	1.50	0.80	9.85	58.75	31.24
X-108-8	17.20	11.00	14.70	1.80	0.80	11.69	49.51	38.53
X-102-9	19.15	11.80	16.70	1.70	0.80	11.79	50.73	37.42
X-105-8	16.85	10.65	14.20	1.70	0.75	11.97	49.31	38.94
X-117-1	16.80	10.80	14.50	1.40	0.80	12.72	43.58	43.45
X-99-4	17.40	12.10	14.80	1.90	0.60	14.13	43.40	42.66
Sum	106.00	66.65	91.20	10.00	4.55	72.15	295.28	232.24
Mean	17.67	11.11	15.26	1.67	0.76	12.02	49.21	38.70
Lot 80								
X-107-6	17.30	11.00	14.70	1.80	0.80	12.75	46.61	40.49
X-97-5	15.82	10.80	13.50	1.80	0.60	13.35	43.71	42.33
X-102-11	18.10	11.30	15.50	1.90	0.60	11.16	52.38	36.15
X-108-5	16.70	11.50	14.20	1.80	0.75	14.91	37.26	47.63
X-99-2	16.70	11.90	14.20	1.80	0.70	13.47	41.54	44.65
X-115-2	17.90	12.80	15.00	2.00	0.80	13.88	40.57	45.52
Sum	102.52	69.30	87.10	11.10	4.25	79.52	262.07	256.77
Mean	17.09	11.55	14.52	1.85	0.71	13.25	43.68	42.79

Appendix . Physical and chemical composition of right side (Trial 3)
(continued)

	SHOULDER							
Animal No.	Untr'd shldr lb.	Tr'd shldr lb.	Boneless shldr lb.	Shldr bone lb.	Shldr skin lb.	% protein	% fat	% moisture
Lot 76								
X-102-8	16.50	13.60	14.50	1.47	0.60	13.57	38.61	47.75
X-108-6	14.85	12.45	12.65	1.35	0.85	15.57	30.47	53.89
X-115-8	14.00	11.70	12.20	1.30	0.55	13.35	37.70	48.64
X-101-10	15.20	12.75	13.10	1.25	0.80	14.47	34.19	51.40
X-109-4	15.10	13.05	13.10	1.40	0.60	14.85	33.08	51.69
X-118-8	14.95	12.20	13.10	1.20	0.50	14.85	33.47	51.72
Sum	90.60	75.75	78.65	7.97	3.90	86.66	207.52	305.09
Mean	15.10	12.63	13.11	1.33	0.65	14.44	34.58	50.84
Lot 77								
X-104-11	16.35	13.50	14.20	1.40	0.70	12.81	36.08	49.62
X-102-7	16.80	13.00	14.90	1.20	0.80	14.35	39.53	47.44
X-105-1	15.70	13.30	13.80	1.30	0.70	14.94	30.45	54.26
X-107-10	16.20	13.40	14.40	1.30	0.60	12.85	39.58	47.39
X-102-3	15.50	13.30	13.50	1.30	0.70	15.19	32.33	52.50
X-103-7	13.85	11.10	12.05	1.15	0.50	13.19	38.10	48.13
Sum	94.40	77.60	82.85	7.65	4.00	83.33	216.07	299.34
Mean	15.73	12.93	13.81	1.28	0.67	13.88	36.01	49.89
Lot 78								
X-112-9	15.90	13.05	14.00	1.32	0.60	12.35	40.54	46.16
X-102-4	15.20	12.80	13.10	1.40	0.65	14.50	31.64	52.42
X-109-9	17.30	14.55	15.00	1.50	0.75	12.79	39.35	47.79
X-107-8	15.60	12.95	13.90	1.25	0.45	14.32	34.65	50.91
X-106-6	15.40	11.80	13.80	1.10	0.50	13.10	38.59	47.88
X-108-2	14.70	12.50	12.60	1.40	0.60	15.60	28.57	56.27
Sum	94.10	77.65	82.40	7.97	3.55	82.66	213.34	301.43
Mean	15.68	12.94	13.73	1.33	0.59	13.77	35.55	50.23
Lot 79								
X-104-12	15.25	12.40	13.50	1.20	0.70	12.78	42.20	45.15
X-108-8	16.30	13.60	14.40	1.30	0.60	13.44	38.70	47.83
X-102-9	17.20	14.10	15.25	1.20	0.80	13.19	40.89	45.97
X-105-8	15.20	12.60	13.20	1.30	0.60	13.47	37.70	48.43
X-117-1	16.30	13.60	14.40	1.20	0.60	14.19	33.49	51.64
X-99-4	13.80	11.20	12.10	1.20	0.50	15.94	29.37	53.99
Sum	94.05	77.50	82.85	7.40	3.80	83.01	222.35	293.01
Mean	15.68	12.92	13.81	1.23	0.63	13.83	37.05	48.83
Lot 80								
X-107-6	14.70	12.35	12.90	1.30	0.50	14.88	34.08	51.28
X-97-5	15.70	13.00	13.85	1.20	0.65	14.38	34.68	50.66
X-102-11	16.75	13.70	14.70	1.40	0.60	13.13	39.39	47.01
X-108-5	15.40	12.90	13.35	1.40	0.55	14.78	32.94	52.07
X-99-2	14.80	12.00	12.90	1.20	0.60	15.57	33.39	53.34
X-115-2	14.70	12.30	12.80	1.25	0.60	16.01	32.49	53.50
Sum	92.05	76.25	80.50	7.75	3.50	88.75	206.97	307.86
Mean	15.34	12.71	13.42	1.29	0.58	14.79	34.49	51.31

Appendix . Physical and chemical composition of right side (Trial
(continued)

Animal No.	BELLY Untr'd belly lb.	Tr'd belly lb.	Boneless belly lb.	Belly skin lb.	% protein	% fat	% moisture
Lot 76							
X-102-8	11.75	9.45	10.90	0.90	10.51	55.88	33.62
X-108-6	11.60	9.50	10.40	1.30	10.32	51.15	37.27
X-115-8	12.70	10.20	11.30	0.90	8.44	58.63	32.95
X-101-10	11.80	8.90	10.80	1.00	9.85	55.19	34.08
X-109-4	9.45	7.50	8.70	0.70	11.28	48.65	38.51
X-118-8	11.00	9.20	10.25	0.75	10.85	52.78	36.35
Sum	68.30	54.75	62.35	5.55	61.25	322.28	212.78
Mean	11.38	9.13	10.39	0.93	10.20	53.71	35.46
Lot 77							
X-104-11	11.40	9.20	10.50	0.90	9.29	56.78	33.15
X-102-7	11.35	9.25	10.50	0.90	11.22	51.85	36.97
X-105-1	11.50	9.50	10.60	0.80	11.50	49.17	39.16
X-107-10	10.70	8.50	10.10	0.60	8.72	60.94	29.98
X-102-3	11.15	9.35	10.30	0.80	10.82	52.26	36.96
X-103-7	11.00	9.10	10.30	0.70	8.94	60.13	30.83
Sum	67.10	54.90	62.30	4.70	60.49	331.13	207.05
Mean	11.18	9.15	10.38	0.78	10.08	55.18	34.50
Lot 78							
X-112-9	10.50	8.75	9.50	1.00	9.19	57.58	32.28
X-102-4	10.90	9.50	9.90	1.10	11.10	50.80	37.89
X-109-9	11.60	9.40	10.80	0.85	9.44	55.83	34.75
X-107-8	12.10	9.60	11.25	0.85	10.66	53.63	35.68
X-106-6	11.50	9.40	10.80	0.60	9.10	59.86	30.73
X-108-2	11.30	9.40	10.35	0.90	11.47	50.66	38.04
Sum	67.90	56.05	62.60	5.30	60.96	328.36	209.37
Mean	11.32	9.34	10.43	0.88	10.16	54.72	34.89
Lot 79							
X-104-12	12.65	9.60	11.70	0.95	7.94	64.48	27.55
X-108-8	12.65	10.35	11.65	1.00	9.60	58.55	31.66
X-102-9	12.60	10.20	11.70	0.90	9.35	59.28	31.23
X-105-8	11.00	9.10	10.20	0.80	9.38	57.73	32.82
X-117-1	11.30	9.10	10.40	0.90	10.60	52.72	36.81
X-99-4	11.40	9.00	10.50	0.80	11.69	50.58	37.65
Sum	71.60	57.35	66.15	5.35	58.56	343.34	197.72
Mean	11.93	9.56	11.03	0.89	9.76	57.22	32.95
Lot 80							
X-107-6	10.20	8.15	9.40	0.80	10.63	58.40	33.20
X-97-5	10.50	8.45	9.70	0.80	10.69	52.55	36.14
X-102-11	11.70	9.70	11.10	0.60	9.07	61.46	29.55
X-108-5	11.80	9.90	10.80	0.90	9.91	55.90	34.07
X-99-2	9.90	7.90	9.10	0.80	11.13	52.25	36.56
X-115-2	10.00	8.00	9.20	0.80	11.29	51.28	37.48
Sum	64.10	52.10	59.30	4.70	62.72	331.84	207.00
Mean	10.68	8.68	9.88	0.78	10.45	55.30	34.50

Appendix F. Carcass data (Trial III)

Animal No.	Left ham	Right ham	Left loin	Right loin	Left shldr	Right shldr	Left belly	Right belly	Total primal cuts	Total lean cuts	Primal cuts % of carcass wt.	Lean cuts % of carcass wt.	% tr'd rt. ham of carcass
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	%	%	%
Lot 76													
X-102-8	14.6	14.1	13.0	12.2	13.3	13.6	8.9	9.5	99.1	80.8	67.15	54.74	9.56
X-108-6	13.3	14.1	11.2	11.3	12.5	12.5	8.5	9.5	92.7	74.8	66.69	53.78	10.14
X-115-8	12.8	13.5	12.6	9.8	11.4	11.7	10.0	10.2	92.0	71.8	64.79	50.56	9.51
X-101-10	13.6	13.4	12.1	10.7	13.1	12.8	8.8	8.9	93.4	75.7	66.92	54.23	9.50
X-109-4	14.3	14.3	12.2	12.0	12.5	13.1	7.5	7.5	93.3	78.4	67.61	56.78	10.36
X-118-8	14.2	14.3	10.8	11.5	13.1	12.2	10.7	9.2	95.0	75.1	66.20	52.33	9.96
Mean	13.80	13.95	11.98	11.25	12.65	12.65	9.07	9.13	94.25	76.10	66.56	53.74	9.86
Lot 77													
X-104-11	14.0	14.3	11.1	10.8	13.1	13.5	8.5	9.2	94.5	76.8	66.08	53.71	10.00
X-102-7	15.0	14.7	12.5	11.3	13.7	13.0	9.5	9.3	98.9	80.1	66.12	53.58	9.83
X-105-1	16.4	16.2	13.2	11.8	13.8	13.3	8.8	9.5	103.0	84.7	69.09	56.81	10.87
X-107-10	13.2	14.0	12.2	10.6	12.8	13.4	7.7	8.5	92.3	76.1	65.00	53.59	9.86
X-102-3	17.0	15.9	12.1	11.9	13.3	13.1	8.4	9.4	100.9	83.2	69.83	57.54	11.00
X-103-7	13.6	12.9	11.3	11.6	12.0	11.1	10.3	9.1	91.9	72.5	64.26	50.70	9.02
Mean	14.87	14.67	12.07	11.33	13.12	12.90	8.87	9.17	96.92	78.90	66.73	54.32	10.10
Lot 78													
X-112-9	14.6	14.0	11.8	10.9	13.0	13.1	8.6	8.8	94.7	77.4	63.10	51.57	9.33
X-102-4	14.5	14.9	12.5	11.8	12.8	12.8	8.9	9.5	97.7	79.3	69.54	56.44	10.60
X-109-9	13.7	14.6	12.1	11.1	14.0	14.6	9.0	9.4	98.4	80.0	66.64	53.69	9.80
X-107-8	14.6	14.4	13.1	12.5	12.5	13.0	8.1	9.6	97.6	80.0	65.94	54.02	9.73
X-106-6	14.2	12.9	10.6	10.6	13.2	11.8	11.4	9.4	94.1	73.3	63.58	49.53	8.72
X-108-2	14.4	14.6	12.7	12.4	12.6	12.5	9.1	9.4	97.7	79.2	67.85	55.00	10.14
Mean	14.33	14.23	12.13	11.55	13.02	12.97	9.18	9.35	96.70	78.20	66.11	53.38	9.72

Appendix F. Carcass data (Trial III)(continued)

Animal No.	Left ham	Right ham	Left loin	Right loin	Left shldr	Right shldr	Left belly	Right belly	Total primal cuts	Total lean cuts	Primal cuts % of carcass wt.	Lean cuts % of carcass wt.	% tr'd rt. ham of carcass
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	%	%	%
Lot 79													
X-104-12	13.8	14.0	11.4	10.3	11.7	12.4	8.3	9.6	91.5	73.6	61.62	49.56	9.43
X-108-8	13.7	14.0	12.6	11.0	12.9	13.6	9.5	10.4	97.6	77.8	65.28	52.01	9.36
X-102-9	15.4	16.2	12.6	11.8	13.0	14.1	9.5	10.2	102.8	83.1	66.97	54.14	10.55
X-105-8	13.7	14.6	11.8	10.7	12.8	12.6	7.2	9.1	92.4	76.1	65.53	53.97	10.35
X-117-1	15.5	15.8	12.1	10.8	13.0	13.6	9.5	9.1	99.4	80.8	67.39	54.78	10.71
X-99-4	14.8	15.0	11.6	12.1	12.7	11.2	9.9	9.0	96.3	77.4	67.58	54.32	10.53
Mean	14.48	14.93	12.02	11.12	12.68	12.92	8.98	9.57	96.67	78.13	65.73	53.13	10.16
Lot 80													
X-107-6	13.2	13.4	11.8	11.0	13.0	12.4	8.5	8.2	91.4	74.8	65.28	53.39	9.57
X-97-5	15.4	15.3	11.8	10.8	13.0	13.0	7.7	8.5	95.4	79.2	67.38	55.97	10.81
X-102-11	14.5	14.1	11.7	11.3	12.5	13.7	10.1	9.7	97.6	77.8	66.39	52.92	9.59
X-108-5	13.7	14.1	11.7	11.5	12.6	12.9	10.1	9.9	96.5	76.5	65.87	52.22	9.62
X-99-2	15.4	15.7	12.0	11.9	12.2	12.0	9.8	7.9	96.9	79.2	68.72	56.17	11.13
X-115-2	14.3	14.3	12.5	12.8	11.4	12.3	9.5	8.0	95.7	77.6	67.69	55.23	10.18
Mean	14.42	14.48	11.92	11.55	12.45	12.72	9.28	8.70	95.58	77.52	66.89	54.30	10.15

Appendix G. Sum of protein, fat and moisture of untrimmed boneless cuts (right side)

Animal No.	% comp. Ham	% comp. Loin	% comp. Shoulder	% comp. Belly
Lot 44				
Y-16-6	99.72	100.10	99.59	100.01
DY-77-8	99.23	99.79	99.80	99.81
Y-12-1	98.69	99.56	99.34	99.87
Y-24-5	99.70	100.08	100.40	99.21
Y-19-2	99.98	101.67	99.91	100.67
Sum	497.32	501.20	499.04	499.57
Mean	99.46	100.24	99.80	99.91
Lot 44 A				
DY-88-13	99.42	99.94	99.41	99.39
Y-27-5	99.47	99.83	99.64	100.18
Y-23-2	100.20	100.31	99.79	99.63
DY-77-14	100.15	100.30	99.89	100.40
DY-88-14	99.31	100.17	100.00	99.99
Sum	498.55	500.55	498.73	498.59
Mean	99.71	100.11	99.74	99.91
Lot 45				
Y-13-9	103.34	100.27	100.14	99.34
Y-18-7	99.61	100.34	98.52	100.66
Y-15-10	99.25	100.07	99.51	100.74
Y-14-2	100.29	99.86	100.55	99.61
DY-77-4	101.25	101.90	102.53	100.71
Sum	503.74	502.44	501.25	501.06
Mean	100.74	100.48	100.25	100.21
Lot 45 A				
DY-88-2	100.13	100.26	100.43	101.02
Y-24-2	99.55	99.69	103.05	99.98
DY-88-10	99.42	102.16	100.34	100.06
Y-27-9	99.58	99.73	99.74	99.72
Y-25-4	98.58	100.37	99.82	98.56
Sum	497.26	502.21	503.38	499.34
Mean	99.45	100.44	100.67	99.86
Lot 46				
Y-14-3	101.21	99.69	98.31	98.40
Y-19-1	100.03	100.22	99.34	99.38
Y-12-11	100.10	99.97	101.76	99.89
Y-24-4	99.89	100.61	100.15	99.44
DY-77-2	99.39	98.76	98.87	99.81
Sum	500.60	499.25	498.43	496.92
Mean	100.12	99.85	99.68	99.38

Appendix G. Sum of protein, fat and moisture of untrimmed boneless cuts (right side) (continued)

Animal No.	% comp. Ham	% comp. Loin	% comp. Shoulder	% comp. Belly
Lot 46 A				
Y-23-7	99.65	100.47	100.61	100.45
Y-25-5	103.78	98.83	98.46	99.71
Y-15-12	99.79	99.88	99.92	100.82
DY-77-3	100.50	100.12	101.02	100.26
DY-88-5	99.33	100.37	100.13	100.11
Sum	503.05	499.67	500.14	501.35
Mean	100.61	99.93	100.02	100.27
Lot 47				
Y-16-4	99.48	99.83	100.17	99.72
Y-15-11	99.90	99.10	100.35	99.70
DY-77-1	99.58	100.01	99.92	100.12
Y-24-6	99.73	100.18	99.76	100.43
Y-19-5	101.17	99.82	99.46	99.71
Sum	499.86	498.94	499.66	499.68
Mean	99.97	99.78	99.93	99.93
Lot 47 A				
Y-25-8	99.63	100.00	100.32	99.65
Y-27-6	99.58	100.27	99.62	100.19
DY-88-1	99.81	99.53	99.83	100.04
DY-77-11	99.85	100.33	100.33	100.80
Y-19-6	99.59	100.24	100.18	99.93
Sum	498.46	500.37	500.28	500.61
Mean	99.69	100.07	100.05	100.21
Lot 48				
DY-77-13	99.33	100.05	99.21	100.35
Y-24-1	99.97	100.39	100.56	100.66
DY-77-12	100.24	99.65	99.45	99.68
Y-15-9	99.42	102.14	99.72	99.48
Sum	398.96	402.23	398.94	400.17
Mean	99.74	100.55	99.73	100.04
Lot 48 A				
DY-77-7	99.49	101.30	99.86	99.92
Y-23-10	100.12	99.80	99.78	101.61
DY-88-6	99.75	101.23	99.35	99.41
DY-88-12	99.75	100.11	100.84	100.30
Y-25-1	99.63	100.15	100.42	99.81
Sum	498.74	502.59	500.25	501.05
Mean	99.74	100.51	100.05	100.21

Appendix G. Sum of protein, fat and moisture of untrimmed boneless cuts (right side) (continued)

Animal No.	% comp. Ham	% comp. Loin	% comp. Shoulder	% comp. Belly
Lot 76				
X-102-8	100.02	100.01	99.93	100.01
X-108-6	100.04	99.66	99.93	98.74
X-115-8	99.70	99.65	99.69	100.02
X-101-10	99.69	100.02	100.06	99.12
X-109-4	99.84	99.95	99.62	98.44
X-118-8	99.90	100.18	100.04	98.98
Sum	599.19	599.47	599.27	596.31
Mean	99.86	99.91	99.87	99.38
Lot 77				
X-104-11	99.69	99.74	98.51	99.22
X-102-7	99.69	99.88	101.32	100.04
X-105-1	103.66	99.18	99.65	99.83
X-107-10	99.91	99.54	99.82	99.64
X-102-3	99.69	99.77	100.02	100.04
X-103-7	98.82	99.70	99.42	99.90
Sum	601.46	597.81	598.74	598.67
Mean	100.30	99.63	99.79	99.77
Lot 78				
X-112-9	99.70	99.34	99.05	99.05
X-102-4	99.57	99.81	98.56	99.79
X-109-9	99.50	100.02	99.93	100.02
X-107-8	99.78	100.67	99.88	99.97
X-106-6	99.79	99.63	99.57	99.69
X-108-2	100.05	100.38	100.44	100.07
Sum	598.39	599.85	597.43	598.59
Mean	99.73	99.97	99.57	99.76
Lot 79				
X-104-12	99.77	99.84	100.13	99.97
X-108-8	100.42	99.73	99.97	99.81
X-102-9	99.93	99.94	100.05	99.86
X-105-8	99.51	100.22	90.60	99.93
X-117-1	99.55	99.75	99.32	100.13
X-99-4	99.62	100.19	99.30	99.92
Sum	598.80	599.67	598.37	599.62
Mean	99.80	99.94	99.72	99.93
Lot 80				
X-107-6	99.71	99.85	100.24	102.23
X-97-5	100.42	99.39	99.72	99.38
X-102-11	99.65	99.69	99.53	100.08
X-108-5	99.65	99.80	99.79	99.88
X-99-2	99.90	99.66	102.30	99.94
X-115-2	99.77	99.97	102.00	100.05
Sum	599.10	598.36	603.58	601.56
Mean	99.85	99.72	100.59	100.26

Appendix H. Chemical and expressible moisture data of left <u>Longissimus dorsi</u> (Trials I & II)

Lot	Hog No.		% (oven dry) moisture	% Exp. moisture	pH	% ether extract
44	Y 16-6	(a)	74.76	50.54	5.40	1.70
		(b)		56.67		
	DY 77-8	(a)	72.12	64.93	5.29	5.49
		(b)		62.85		
	Y 12-1	(a)	72.49	48.68	5.40	4.12
		(b)		52.23		
	Y 24-5	(a)	74.72	51.34	5.70	1.56
		(b)		45.40		
	Y 19-2	(a)	75.65	42.10	5.80	0.90
		(b)		43.16		
44 A	DY 88-13	(a)	70.78	47.09	5.45	7.30
		(b)		43.23		
	Y 27-5	(a)	74.44	54.80	5.34	2.08
		(b)		48.81		
	Y 23-2	(a)	73.80	49.77	5.41	1.80
		(b)		41.45		
	DY 77-14	(a)	72.90	45.41	5.50	4.26
		(b)		51.64		
	DY 88-14	(a)	70.29	45.67	5.40	8.25
		(b)		47.30		
Mean			73.20	49.65	5.45	3.75
45	Y 13-9	(a)	73.95	47.51	5.40	1.12
		(b)		50.28		
	Y 18-7	(a)	74.54	61.96	5.46	1.18
		(b)		63.68		
	Y 15-10	(a)	71.18	61.72	5.47	5.80
		(b)		52.12		
	Y 14-2	(a)	74.23	62.93	5.51	0.66
		(b)		59.47		
	DY 77-4	(a)	73.46	45.51	5.48	2.56
		(b)		58.04		
45 A	DY 88-2	(a)	72.74	51.35	5.12	3.13
		(b)		49.62		
	Y 24-2	(a)	73.90	54.89	5.38	0.64
		(b)		59.93		
	DY 88-10	(a)	73.81	44.12	5.80	3.41
		(b)		47.45		
	Y 27-9	(a)	73.43	53.47	5.48	2.27
		(b)		55.97		
	Y 25-4	(a)	71.23	49.26	5.37	5.85
		(b)		47.42		
Mean			73.25	53.83	5.42	2.66

Appendix H. Chemical and expressible moisture data of left Longissimus dorsi (Trials I & II) (continued)

Lot	Hog No.		% (oven dry) moisture	% Exp. moisture	pH	% ether extract
46	Y 14-3	(a)	72.61	63.52	5.45	2.68
		(b)		56.60		
	Y 19-1	(a)	74.12	45.57	5.78	1.05
		(b)		53.83		
	Y 12-11	(a)	73.13	51.42	5.46	3.31
		(b)		47.83		
	Y 24-4	(a)	71.28	48.51	5.50	3.29
		(b)		46.25		
	DY 77-2	(a)	73.79	51.89	5.41	2.32
		(b)		50.97		
46 A	Y 23-7	(a)	72.88	47.93	5.51	4.02
		(b)		48.74		
	Y 25-5	(a)	72.66	48.22	5.45	3.86
		(b)		52.30		
	Y 15-12	(a)	73.28	51.86	5.50	2.98
		(b)		47.89		
	DY 77-3	(a)	73.86	50.17	5.34	2.48
		(b)		64.75		
	DY 88-5	(a)	72.74	52.57	5.55	2.84
		(b)		42.10		
Mean			73.04	51.09	5.48	2.88
47	Y 16-4	(a)	74.49	47.49	5.45	0.99
		(b)		47.13		
	Y 15-11	(a)	73.58	48.89	5.83	1.80
		(b)		47.93		
	DY 77-1	(a)	70.99	54.14	5.40	6.42
		(b)		57.33		
	Y 24-6	(a)	74.24	61.68	5.70	2.16
		(b)		57.60		
	Y 19-5	(a)	73.30	54.22	5.40	2.69
		(b)		61.66		
47 A	Y 25-8	(a)	73.66	48.49	5.33	3.09
		(b)		48.69		
	Y 27-6	(a)	73.43	67.66	5.47	1.48
		(b)		52.60		
	DY 88-1	(a)	72.45	60.27	5.40	4.71
		(b)		48.71		
	DY 77-11	(a)	73.96	49.03	5.40	3.24
		(b)		61.27		
	Y 19-6	(a)	74.13	50.44	5.61	1.58
		(b)		50.44		
Mean			73.42	53.88	5.48	2.82

Appendix H. Chemical and expressible moisture data of left Longissimus dorsi (Trials I & II) (continued)

Lot	Hog No.		% (oven dry) moisture	% Exp. moisture	pH	% ether extract
48	DY 77-13	(a)	74.21	63.25	5.41	1.74
		(b)		59.00		
	Y 24-1	(a)	74.04	49.45	5.60	0.75
		(b)		46.71		
	DY 77-12	(a)	73.84	58.31	5.40	4.07
		(b)		57.30		
	Y 15-9	(a)	73.01	61.95	5.40	4.12
		(b)		58.37		
48 A	DY 77-7	(a)	72.37	46.54	5.38	4.28
		(b)		48.31		
	Y 23-10	(a)	73.95	51.80	5.57	3.12
		(b)		55.80		
	DY 88-6	(a)	71.35	41.71	5.38	5.75
		(b)		41.02		
	DY 88-12	(a)	73.61	47.56	5.20	3.47
		(b)		51.59		
	Y 25-1	(a)	72.78	60.51	5.46	3.20
		(b)		60.10		
Mean			73.24	53.35	5.41	3.39

Appendix I. Chemical and expressible moisture data of left Longissimus dorsi (Trial III)

Lot	Hog No.		% (oven dry) moisture	% Exp. moisture	pH	% ether extract
76	X 101-10	(a)	72.30	54.44	5.30	4.74
		(b)		46.88		
		(c)		45.40		
	X 102-8	(a)	73.68	52.23	5.43	2.32
		(b)		54.21		
		(c)		65.96		
	X 108-6	(a)	73.48	44.51	5.20	2.10
		(b)		37.66		
		(c)		40.88		
	X 109-4	(a)	72.48	49.87	5.60	4.39
		(b)		52.85		
		(c)		59.64		
	X 115-8	(a)	73.50	50.36	5.40	3.52
		(b)		52.62		
		(c)		50.63		
	X 118-8	(a)	74.03	30.57	5.80	1.57
		(b)		28.64		
		(c)		32.03		
Mean			73.25	47.18	5.64	3.11
77	X 102-3	(a)	75.11	53.20	5.40	1.81
		(b)		54.29		
		(c)		49.94		
	X 102-7	(a)	74.70	58.30	5.42	1.80
		(b)		61.54		
		(c)		61.41		
	X 103-7	(a)	70.84	47.02	5.41	6.54
		(b)		44.61		
		(c)		42.67		
	X 104-11	(a)	73.50	57.62	5.50	4.05
		(b)		54.20		
		(c)		55.61		
	X 105-1	(a)	75.11	49.21	5.39	1.24
		(b)		46.90		
		(c)		45.18		
	X 107-10	(a)	72.54	49.70	5.22	4.06
		(b)		53.09		
		(c)		55.58		
Mean			73.63	52.22	5.60	3.25

Appendix I. Chemical and expressible moisture data of left *Longissimus dorsi* (Trial III continued)

Lot	Hog No.		% (oven dry) moisture	% Exp. moisture	pH	% ether extract
78	X 102-4	(a)	75.08	47.34	5.38	1.36
		(b)		48.93		
		(c)		53.90		
	X 106-6	(a)	72.68	36.06	5.43	4.16
		(b)		32.20		
		(c)		30.63		
	X 107-8	(a)	73.44	57.50	5.38	2.99
		(b)		55.04		
		(c)		56.93		
	X 108-2	(a)	73.39	37.37	5.35	2.32
		(b)		31.60		
		(c)		50.05		
	X 109-9	(a)	72.48	40.52	5.80	4.99
		(b)		44.62		
		(c)		46.65		
	X 112-9	(a)	72.74	55.46	5.27	2.84
		(b)		55.21		
		(c)		52.32		
Mean			73.30	46.24	5.63	3.11
79	X 99-4	(a)	74.06	33.23	5.40	2.00
		(b)		31.56		
		(c)		29.87		
	X 102-9	(a)	73.40	44.30	5.50	3.34
		(b)		48.31		
		(c)		44.28		
	X 104-12	(a)	70.37	44.85	5.55	7.55
		(b)		50.30		
		(c)		43.79		
	X 105-8	(a)	74.14	54.79	5.50	2.03
		(b)		54.12		
		(c)		57.09		
	X 108-8	(a)	73.11	46.29	5.20	3.97
		(b)		41.07		
		(c)		36.14		
	X 117-1	(a)	73.61	51.22	5.20	2.44
		(b)		45.61		
		(c)		46.01		
Mean			73.12	44.60	5.59	3.56

Appendix I. Chemical and expressible moisture data of left *Longissimus dorsi* (Trial III)(continued)

Lot	Hog No.		% (oven dry) moisture	% Exp. moisture	pH	% ether extract
80	X 97-5	(a)	73.88	35.52	5.40	2.05
		(b)		37.85		
		(c)		34.25		
	X 99-2	(a)	74.17	39.86	5.50	1.55
		(b)		42.63		
		(c)		41.07		
	X 102-11	(a)	73.23	42.10	5.60	3.42
		(b)		46.26		
		(c)		46.17		
	X 107-6	(a)	73.40	52.72	5.40	2.75
		(b)		51.14		
		(c)		56.16		
	X 108-5	(a)	73.34	38.85	5.30	2.92
		(b)		39.11		
		(c)		37.10		
	X 115-2	(a)	73.78	47.68	5.16	0.95
		(b)		47.47		
		(c)		47.94		
Mean			73.63	43.55	5.37	2.27

Appendix J. Palatability data of all animals from Trials I & II and Trial III

Animal No.	Warner-Bratzler shear[1]	Taste panel tenderness[2]	Taste panel juiciness	Taste panel flavor
Lot 44 & 44A				
Y-12-1	8.78	7.33	6.08	6.82
Y-16-6	10.16	6.25	7.08	6.00
Y-19-2	9.18	6.50	5.58	6.33
Y-24-5	6.75	7.25	6.00	6.50
DY-77-8	7.75	7.50	7.00	6.63
Y-23-2	10.69	5.83	5.08	6.08
Y-27-5	8.84	5.67	5.50	6.00
DY-77-14	8.56	7.42	6.83	6.75
DY-88-13	6.06	8.25	6.92	6.75
DY-88-14	7.59	7.08	6.33	6.75
Mean	8.50	6.91	6.24	6.47
Lot 45 & 45A				
Y-13-9	8.00	7.50	7.00	6.42
Y-14-2	11.34	5.17	5.33	6.58
Y-15-10	7.72	6.41	5.83	6.36
Y-18-7	8.22	6.67	6.33	6.58
DY-77-4	8.28	6.83	6.67	6.83
Y-24-2	8.81	6.67	6.17	5.67
Y-25-4	7.91	8.00	7.00	7.08
Y-27-9	8.31	7.42	6.75	6.67
DY-88-2	8.50	6.67	5.92	6.25
DY-88-10	6.56	7.92	7.67	7.08
Mean	8.37	6.93	6.47	6.55
Lot 46 & 46A				
Y-12-11	8.75	7.25	6.08	7.55
Y-14-3	10.78	5.75	5.75	6.36
Y-19-1	11.69	5.33	5.17	6.33
Y-24-4	8.59	6.92	6.17	6.25
DY-77-2	8.06	6.25	5.50	5.83
Y-15-12	9.63	5.83	5.67	6.00
Y-23-7	7.75	7.33	6.08	6.17
Y-25-5	8.97	6.25	6.42	6.50
DY-77-3	10.03	5.17	5.33	5.83
DY-88-5	6.41	8.00	6.33	6.92
Mean	9.07	6.41	5.85	6.37

[1]Warner-Bratzler shear values are expressed in pounds on 1/2 in. cores.
[2]Taste panel data based upon scale of 1-9.

Appendix J. Palatability data of all animals from Trials I & II and Trial III (continued)

Animal No.	Warner-Bratzler shear[1]	Taste panel tenderness[2]	Taste panel juiciness	Taste panel flavor
Lot 47 & 47A				
Y-15-11	9.16	6.50	5.58	6.42
Y-16-4	8.43	7.25	5.33	6.50
Y-19-5	9.34	5.75	5.75	6.42
Y-24-6	6.69	7.25	6.08	6.27
DY-77-1	8.75	6.33	6.83	6.67
Y-19-6	9.34	6.17	5.92	6.17
Y-25-8	8.72	6.58	5.83	6.17
Y-27-6	9.03	6.08	5.58	6.33
DY-77-11	6.91	7.42	5.58	6.92
DY-88-1	8.22	7.50	6.00	6.42
Mean	8.46	6.68	5.85	6.43
Lot 48 & 48A				
Y-15-9	12.78	4.92	5.08	6.50
Y-24-1	8.44	6.16	5.75	6.16
DY-77-12	5.78	7.08	6.33	6.27
DY-77-13	7.88	6.92	5.92	6.58
Y-23-10	7.66	7.75	6.75	6.00
Y-25-1	10.56	6.33	5.25	5.68
DY-77-7	10.31	6.92	6.67	6.33
DY-88-6	6.67	7.50	6.08	6.83
DY-88-12	6.34	8.25	7.50	7.17
Mean	8.49	6.87	6.15	6.39
Lot 76				
X-101-10	9.50	6.42	6.58	6.58
X-102-8	8.25	6.83	5.67	6.28
X-108-6	8.81	6.83	6.83	6.83
X-109-4	7.78	7.67	6.83	6.92
X-115-8	10.06	6.83	6.42	6.50
X-118-8	8.07	7.75	7.25	6.50
Mean	8.75	7.06	6.60	6.60
Lot 77				
X-102-3	10.09	4.80	5.92	6.00
X-102-7	10.16	5.58	6.33	6.25
X-103-7	9.59	6.25	6.08	6.08
X-104-11	10.22	6.67	6.00	6.42
X-105-1	7.09	6.92	6.25	6.42
X-107-10	8.91	6.50	5.92	6.58
Mean	9.34	6.12	6.08	6.29

[1]Warner-Bratzler shear values are expressed in pounds on 1/2 in. cores.
[2]Taste panel data based upon scale of 1-9.

Appendix J. Palatability data of all animals from Trials I & II and Trial III (continued)

Animal No.	Warner-Bratzler shear[1]	Taste panel tenderness[2]	Taste panel juiciness	Taste panel flavor
Lot 78				
X-102-4	7.41	7.33	6.17	6.92
X-106-6	7.88	6.92	6.83	6.25
X-107-8	8.22	6.58	5.83	6.25
X-108-2	8.47	6.00	6.25	6.00
X-109-9	6.78	7.33	6.50	6.33
X-112-9	8.16	6.25	6.17	6.67
Mean	7.82	6.74	6.29	6.40
Lot 79				
X-99-4	9.38	5.92	5.75	6.58
X-102-9	8.72	5.92	5.83	6.58
X-104-12	7.53	8.08	6.25	7.33
X-105-8	7.56	6.50	6.42	7.42
X-108-8	8.72	6.83	6.67	7.08
X-117-1	7.34	6.92	6.50	6.50
Mean	8.21	6.70	6.24	6.92
Lot 80				
X-97-5	10.44	6.50	6.50	6.92
X-99-2	7.44	5.58	5.92	6.58
X-102-11	8.88	6.17	5.25	6.67
X-107-6	9.47	5.33	6.08	6.25
X-108-5	10.31	6.00	6.08	6.58
X-115-2	9.78	6.75	6.25	6.50
Mean	9.39	6.06	6.01	6.58

[1]Warner-Bratzler shear values are expressed in pounds on 1/2 in. cores.
[2]Taste panel data based upon scale of 1-9.

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