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Effect of Increasing Live Weight From 220 to 300 Pounds on Pork Carcass Characteristics

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SUMMARY AND CONCLUSIONS

Carcass cut-out, chemical analyses and quality determinations were studied on 240 "meat type" hogs at weight intervals of 220±10; 240±10; 260±10; 280±10; and 300±10 pounds. The study was comprised of two replicate experiments (I and II) with 24 hogs per weight group per experiment.

Dressing percent tended to increase as weight increased. Length, backfat, and loin eye area all consistently increased as weight increased while backfat per cwt. of carcass significantly ($P<.05$) decreased. Differences in percent four lean cuts between weight groups were small; however, the lightest weight groups had the highest percentages. Weight did not significantly ($P<.05$) affect percent five primal cuts in the hogs from Experiment II, but this effect was significant ($P<.05$) in Experiment I, with the lightest groups having the highest values.

Percent fat trim tended to increase as weight increased in the hogs of Experiment I, while in Experiment II a similar pattern of change was not as evident.

No significant ($P<.05$) difference was found, as weight increased, in physically dissected lean, total fat, intermuscular fat, subcutaneous fat, bone, or skin of 23 untrimmed hams from Experiment II.

Chemical analyses revealed no significant ($P<.05$) differences in percent fat, protein, potassium, sodium, moisture, or ash of the soft tissue from untrimmed hams of either experiment.

Warner-Bratzler shear values were not significantly ($P<.05$) different by weight group or experiment. Percent cooking loss of loin chops was not affected by weight but the values were lower for Experiment II.

Visual desirability in bacon decreased slightly as weight increased but the trend was not consistent.

Percent separable fat in bacon was not significantly affected by weight group. No consistent relationship was observed between weight groups and percent cooking loss of bacon.

Under the conditions of this study the following conclusions can be made:

1. Length, backfat and loin eye area gradually increased as weight increased from 220 to 300 pounds.
2. Hogs can be fed to heavier weights without greatly changing percent of lean cuts, primal cuts and fat trim.
3. The chemical and physical constituents of the ham, when expressed in percent, did not differ greatly as weight increased from 220 to 300 pounds.
4. Tenderness, as measured by shear force, did not change significantly as live weight increased from 220 to 300 pounds.
5. Visual desirability of bacon was slightly less at heavier weights while the percent separable fat in bacon did not significantly change as weight increased.

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INTRODUCTION

Leanness and quality are two important factors in pork carcass evaluation. Carcasses which are low in fat and acceptable in quality of lean produce the most desirable cuts. Producers have been able to improve market hogs, in this respect, primarily through genetics.

It is important that researchers continue to evaluate the composition of hogs as producers improve the hogs marketed. Physical dissection and chemical composition studies are accurate but are difficult and costly methods of determining carcass composition, while carcass cut-out data has been a useful method for many years in breed and carcass improvement.

Since porcine composition continually changes during growth and fattening, it is necessary to study composition at different stages of development. Traditionally, it has been the practice of producers to market hogs at 200 to 230 pounds. Due to genetic improvement hogs may be very acceptable in the market at heavier weights.

The primary objective of this study was to determine the effect of increasing weight of physical, chemical, and certain quality characteristics of hogs from a commercial "meat type" herd.

REVIEW OF THE LITERATURE

Carcass Characteristics

Carcasses from hogs slaughtered at six different weights ranging from 150 to 400 pounds were studied by Loeffel *et al.* (1943). The dressing percent increased from 10 percent from the lightest to the heaviest hogs, while average backfat increased from 0.69 to 2.44 inches. Percent lean cuts of the carcass decreased as weight increased.

In studying carcasses from hogs slaughtered at weights from 100 to 210 pounds, Emerson *et al.* (1964) found that as slaughter weight increased there was an increase in carcass length, dressing percent, and loin eye area, and a decrease in percent four lean cuts and percent primal cuts. Varney *et al.* (1962) found similar results in light (159 lbs.) and heavy weight (215 lbs.) hogs. A decrease ($P < .01$) in loin eye area per cwt. of carcass was found as weight increased while backfat in inches per cwt. of carcass showed no significant difference. Field *et al.*

(1961) also reported that lighter hogs (160 lbs.), on a percent basis, produced significantly ($P<.05$) more lean and primal cuts than 220 pound hogs.

McCampbell and Baird (1961) found that dressing percent was quite similar in hogs slaughtered at 170, 190, 210, and 230 pounds. Backfat per cwt. of carcass was not significantly different between weight groups, while the lightest group was significantly ($P<.01$) higher than the heaviest group for carcass length per cwt. and loin eye area per cwt. In a related study, Mullins *et al.* (1960) compared carcasses from 160 and 220 pound hogs and found that percent lean cuts was approximately 4 percent greater and percent fat was about 5 percent less from the lighter hogs. The heavier group dressed higher and had thicker backfat. Usborne *et al.* (1968), using slaughter weight groups of approximately 160, 190, 220, 250, and 280 pounds, found that length and average backfat increased linearly ($P<.01$) with increased weight, while percent lean cuts decreased linearly ($P<.01$) as weight increased. Similar results were found by Stant *et al.* (1968) in hogs slaughtered at 50, 100, 150, and 200 pounds.

Zobrisky *et al.* (1958) reported on the physical composition of hogs slaughtered at live weights of 50, 100, 150, 200, 250, and 300 pounds. As the live weight increased, yield of four lean cuts decreased in percent from 59.74 in the 50 pound weight group to 43.72 in the 300 pound group. Also, the yield of five primal cuts decreased significantly ($P<.005$). The percent belly on a carcass basis did increase ($P<.005$) with an increase in live weight.

Physical and Chemical Composition

After extensive research in meat animal composition, Callow (1947) stated:

> As growth and fattening proceeds, the extra chemical fat which is laid down is partitioned unequally among the tissues. A larger and larger proportion of the fat goes into the fatty tissues, and a smaller and smaller proportion into the muscular tissues. Moreover, in the fatty tissues themselves, a larger and larger proportion of the extra fat goes into the subcutaneous fatty tissue and a smaller and smaller proportion into the intermuscular fatty tissue.

Zobrisky *et al.* (1958), used data published by McMeekan (1940), Loeffel *et al.* (1943) and Hankins and Ellis (1945) and graphically illustrated that the physical composition of the ham was indicative of the physical composition of the carcass. Zobrisky *et al.* (1958) also reported that the fat, lean, and bone tissues of the ham, when raised to given mathematical powers, are proportional to the fat, lean, and bone tissues of the carcass. In analyzing the component parts of hams from different weight hogs, Zobrisky *et al.* (1958) reported that the percentages of the lean of the untrimmed ham weights were not significantly ($P<.01$) different for the 200 and 250 pound weight groups. These percentages were significantly ($P<.01$) higher than the percent lean of the 300 pound weight group. The percent bone of the untrimmed ham weights were not significantly different ($P<.01$) in the 200, 250, and 300 pound weight groups.

The composition of hog carcasses weighing approximately 110, 150, and 202 pounds was investigated by Cuthbertson and Pomeroy (1962). In these carcasses, the percent of muscle considerably exceeded that of the other tissues at 110 and 150 pounds while at 202 pounds the percentages of muscle and fat in the carcass were similar (43.53 and 41.37, respectively).

Lawrie *et al.* (1963) worked with the same group of hogs as Cuthbertson and Pomeroy (1962), and found that muscles from the three weight groups increased in overall nitrogen (fat-free) as weight increased. A significant inverse relationship was found between nitrogen (fat-free) and moisture (fat-free) ($r = -0.88$). Price *et al.* (1957) found a negative correlation ($r = -0.63$) between protein in the ham and backfat and between moisture in the ham and backfat ($r = -0.67$) in hogs that averaged 200 pounds live weight. A positive correlation ($r=0.67$) was found between ether extract and backfat.

In a study of litter mate hogs at 150, 200, and 250 pounds live weight, Lawrie and Pomeroy (1963) found that percent sodium did not differ significantly lower ($P<.01$) in the older hogs. Chrystall (1967) did not find this relationship in a study of swine growth in animals from 2 to 241 days. He found that percent potassium increased with age and that percent sodium declined. Additionally, the study revealed that fat increased with age and that it contributed greatest to change in chemical composition. Percent protein increased with age up to 120 days.

Mullins (1968) reported that the chemical composition of the right side was highly associated with each of the following: percent ham, loin, ham and loin, four lean cuts and fat trim.

Quality Factors

Bull and Longwell (1929) reported that hogs slaughtered at 175, 225 and 275 pounds did not produce cuts that were significantly different in quality. Loeffel *et al.* (1943) found little difference in palatability of roasts from different weight hogs, but found that dripping loss of the roasts did increase with fatness.

In work with loins from hogs that varied in backfat, Murphy and Carlin (1961) reported that drip loss from pork chops increased from 3.5 to 7 percent as backfat increased from 1.0 to 2.3 inches. The amount of backfat did not have an effect on the tenderness, juiciness, or flavor of braised pork chops. Onate and Carlin (1963) also reported that flavor, tenderness, and juiciness of rib roasts were not affected by original backfat thickness. Thornton *et al.* (1968) reported similar results, in that a panel was unable to detect a significant difference in palatability between loin roasts from hogs of high and low backfat. Shear-press readings and panel scores for 82 loins, covering the range of marketable weights, as found by Tuomy *et al.* (1966), indicated that tenderness and overall texture were acceptable for heavy loins and slightly more acceptable for light loins.

No significant quality differences in pork chops from four weight groups (100 to 210 lbs.) of light weight hogs were found by Emerson *et al.* (1964). The shear values of the loin chops were not significantly different, nor were taste panel results for flavor, tenderness, and juiciness. Field *et al.* (1961) reported that retailers and consumers preferred cuts from 160 pound hogs over 200 pound hogs. The primary consumer complaint about heavier cuts stemmed from an increase in fat associated with the heavier cuts. No difference was found by the Warner-Bratzler shear or taste panel in cuts from these light and intermediate weight hogs. Cooking losses in loin roasts from the 220 pound hogs were significantly higher.

In another consumer study of light weight hogs (125, 165 and 205 lbs.), Zobrisky *et al.* (1960) found that general acceptability and palatability were not a function of slaughter weight.

Usborne *et al.* (1968), using five weight groups ranging from 160 to 280 pounds, reported that Warner-Bratzler shear values showed a significant linear relationship, with the heaviest weight group shearing the most tender. This relationship was not detected by a laboratory panel.

MATERIALS AND METHODS

This study was a cooperative effort involving a commercial packing company and the University of Missouri Agricultural Experiment Station. The hogs were supplied by the packer and were fed at the company's swine research farm. The hogs used in the study were of desirable "meat type" and known genetic background.

Experimental Hogs

Hogs fed during the fall and winter of 1966-67 made up Experiment I. Hogs fed during the spring and summer of 1967 made up Experiment II. Procedures between experiments were not intentionally varied except that the hogs used in Experiment II were sired by different boars than the hogs used in Experiment I.

The experimental hogs were equally divided into five pens, with minimum variation between pens. This was accomplished by taking littermates and randomly assigning them to different pens. Twenty-four hogs per pen were used in both experiments.

The test hogs were selected at 50 to 60 pounds live weight and each hog was weighed and earmarked. The hogs were housed in an open front building with a concrete floor and a self-feeder for each pen. A ration containing 15 percent protein was given to the hogs from the time they were put on test until they reached 125 pounds. From that time on a ration containing 11 percent protein was fed until the animals were slaughtered. The slaughter weights by pens were 200 ± 10; 240 ± 10; 260 ± 10; 280 ± 10; and 300 ± 10 pounds. The hogs were weighed weekly. When individual hogs reached the desired weight, they were transported approximately 20 miles to the packing plant.

The hogs were weighed on arrival at the plant and were slaughtered the following day. Hot carcass weights were taken immediately after slaughter and the carcasses were then chilled 20 to 24 hours. Before cutting, backfat and carcass length were measured and the chilled carcasses were weighed. The carcasses were cut conventional packer style. Weights of all cuts and trimmings were recorded and the loin eye was measured at the tenth rib. A sample of two to five untrimmed hams were selected randomly from each lot and were frozen for further analysis. A one inch thick chop was taken at the tenth rib from each carcass, vacuum packaged, and frozen. Three samples (1-½ in. thick) were cut from the blade, center, and flank sections of the conventionally cured bacon. These samples were also vacuum packaged and frozen. The frozen products were taken to the University of Missouri for analysis.

Ham Composition

The hams of Experiment II were dissected in the manner described by Zobrisky *et al.* (1958). The weights of the untrimmed ham, lean, subcutaneous fat, intermuscular fat, skin, and bone of each ham were recorded. The hams of Experiment I were skinned and deboned.

Ground samples of fat and lean from the untrimmed hams of both experiments were analyzed for fat, nitrogen, potassium, sodium, moisture, and ash. The analyses were carried out in the Experiment Station Chemical Laboratories following A.O.A.C. (1965) procedures.

Analysis of the Loin Chops

The chops were removed from the freezer and thawed in a 38° F cooler for approximately 24 hours. The samples were weighed and deep fried in 300° F fat, to an internal temperature of 155° F. The chops were then tempered in a 150° F oven for five minutes and reweighed. Sample cores, one-half inch in diameter, were removed from the lateral, central, and medial locations of the *longissimus* muscle. The cores were sheared with a Warner-Bratzler shear device.

Bacon Analysis

Two slices of bacon from each center section were evaluated by a six member laboratory panel. The panel was asked to evaluate overall desirability according to a hedonic scale ranging from one to four, with one being the most desirable. After panel evaluation, the same slices were frozen. While in the frozen state, the fat was dissected from the lean and the weights of the fat and lean were recorded.

Two slices from the blade, center and flank sections were weighed and placed on a metal rack in a pan, to allow the bacon to drip freely. The bacon was cooked in a forced air oven at 300° F until crisp. The slices were allowed to cool at room temperature on paper towels and were weighed.

Statistical Analysis

The data were subjected to analysis of variance as outlined by Snedecor and Cochran (1967), the mean separation technique used was that employed by Duncan (1965). Simple correlation coefficients were calculated according to the proceedures of Snedecor and Cochran (1967).

RESULTS AND DISCUSSION

Table 1 shows that farm and slaughter weights were slightly higher for Experiment II than those for all comparable weight groups of Experiment I. Hot and cold carcass weights were likewise higher for each weight group in Experiment II. Dressing percent did not change consistently as weight increased but the overall tendency was for dressing percent to increase as weight increased (Table 1).

Length and backfat gradually increased, while backfat per cwt. decreased consistently as weight increased. The average length of the 300 pound hogs in Experiment I was significantly ($P<.05$) greater than that of all other lots. Loin eye area increased as weight increased, but the increases were greater between lots in Experiment II. Average loin eye was 1.06 inches larger for the 300 pound lot of Experiment II than for the 220 pound lot; the difference was 0.7 inch for these two weight groups in Experiment I. Means for loin eye area per cwt. decreased with increasing weight in Experiment I while in Experiment II the means for the 220, 240, 260, and 280 pound lots were not significantly ($P<.05$) different.

Percent four lean cuts, based on cold carcass weight, decreased consistently in Experiment I while this consistency was not found in Experiment II (Table 2). The trend for a decrease in percent four lean cuts as weight increased was evident in Experiment II, but means of the 240, 260, 280, and 300 pound lots were not significantly ($P<.05$) different. The percent four lean cuts of the 220 pound lot of Experiment II (52.94 percent) was significantly ($P<.05$) higher than that of all other lots. The yields of lean cuts were definitely higher in Experiment II, which indicates that these hogs were meatier than the Experiment I hogs. Data in Table 3 indicate a trend for percent primal cuts to decrease as weight increases, but none of the percentage means of Experiment II are significantly ($P<.05$) different. The percentage means of the 240, 260, 280, and 300 pound lots of Experiment I are not significantly ($P<.05$) different.

Pounds of fat trim increased as weight increased but percent fat trim of the carcass did not consistently increase (Table 4). The greatest difference in the percentage means of Experiment I is 1.5 percent while the largest difference in Experiment II is 1.8 percent. The percentage means for fat trim in Experiment II are not significantly ($P<.05$) different among the 240, 260, 280, and 300 pound lots but the percentage mean for the 220 pound lot is lower ($P<.05$) than all other means. The 220 pound lot of Experiment II contained the lowest percent of fat trim and the highest percent of four lean cuts whereas the 300 pound lot

Table 1 MEANS FOR LIVE ANIMAL AND CARCASS CHARACTERISTICS BY EXPERIMENT AND WEIGHT GROUP

	Experiment I Weight Group					Experiment II Weight Group				
Item	220	240	260	280	300	220	240	260	280	300
Av. days on test	94.8	109.4	129.2	136.5	152.6	108.3	115.8	127.6	138.8	153.6
Farm weight	224.1^{a}	242.4	263.1	280.9	296.6^{b}	229.3^{a}	249.1	269.7	286.8	299.2^{b}
Slaughter weight	219.1^{a}	236.3	258.3^{b}	275.7^{c}	291.2^{d}	223.0^{a}	242.9	264.8^{b}	280.2^{c}	295.4^{d}
Hot carcass weight	162.0^{a}	174.0	192.1	203.9	217.9	165.9^{a}	182.3	197.2	211.4	223.9
Cold carcass weight	158.0^{a}	170.0	187.7	200.2	213.1	162.0^{a}	178.7	192.9	206.3	219.1
Dressing %	72.02^{a}	71.93^{a}	72.69^{ab}	72.58^{ab}	73.18^{bcd}	72.66^{ab}	72.56^{c}	73.12^{bc}	73.63^{cd}	74.18^{d}
Length	31.00^{a}	31.51^{b}	32.22	32.88^{cd}	33.66	31.15^{a}	31.74^{b}	32.55^{c}	32.67^{c}	33.03^{d}
Av. backfat (in.)	1.51^{ab}	1.59^{bc}	1.65^{cd}	1.73^{cd}	1.82^{c}	1.46^{a}	1.50^{ab}	1.59^{bc}	1.66^{cd}	1.69^{cd}
Av. backfat/cwt.	0.96^{a}	0.93^{ab}	0.88^{bcd}	0.86^{cd}	0.85^{cde}	0.90^{bc}	0.84^{cde}	0.82^{def}	0.77^{f}	0.77^{f}
Loin eye area (sq. in.)	4.12^{a}	4.39^{ab}	4.52^{bc}	4.76^{cd}	4.82^{d}	4.46^{b}	4.62^{cd}	5.08^{e}	5.31^{ef}	5.52^{f}
Loin eye area/cwt.	2.65^{ab}	2.58^{abc}	2.41^{cde}	2.37^{de}	2.26^{e}	2.76^{a}	2.59^{abc}	2.64^{ab}	2.58^{abc}	2.53^{bcd}

a,b,c,d,e,f All means, on the same line, with common superscripts do not differ significantly ($P < .05$).

Table 2 MEANS OF PERCENT FOUR LEAN CUTS OF THE COLD CARCASS BY EXPERIMENT AND WEIGHT GROUP

Weight Group	Experiment I	Experiment II
220	50.45^{a}	52.94
240	50.35^{a}	51.42^{a}
260	49.16^{b}	51.65^{a}
280	48.61^{b}	51.01^{a}
300	48.01^{b}	50.56^{a}

a,b All percentage means which bear common superscripts do not differ significantly (P < .05).

Table 3 MEANS OF THE PERCENT FIVE PRIMAL CUTS OF THE COLD CARCASS BY EXPERIMENT AND WEIGHT GROUP

Weight Group	Experiment I	Experiment II
220	69.15^{abc}	70.21^{a}
240	68.88^{bcd}	69.45^{ab}
260	68.18^{cd}	69.40^{abc}
280	67.76^{d}	69.65^{ab}
300	67.83^{d}	69.08^{abc}

a,b,c,d All percentage means which bear common superscripts do not differ significantly (P < .05).

of Experiment I contained the highest percent of fat trim and the lowest percent four lean cuts.

Tables 2, 3, and 4 show that "meat type" hogs can be fed to heavy weights without substantially increasing fat trim or substantially decreasing the percent four lean or five primal cuts. This is more evident in Experiment II than in Experiment I. The superiority of the hogs in Experiment II can be primarily attributed to the boars which sired these hogs. The seasonal difference between experiments may also have been a factor.

The carcass cut-out data of both experiments, when expressed in percentages, revealed only small differences as weight increased. Means for both loin eye area and backfat increased gradually as weight increased. This indicates that the hogs were still in the growth stage as they reached 300 pounds live weight. The small changes in percent lean cuts and percent fat trim indicate that the experimental hogs had not reached the point where weight is increased principally by the production of fat.

The data from the physical dissection of the hams in Experiment II are in Table 5. Percent lean of the untrimmed ham was not significantly (P<.05) different for the different weight groups. The difference in percent lean between the

Table 4 MEANS OF FAT TRIM WEIGHT AND PERCENT FAT TRIM OF THE COLD CARCASS BY EXPERIMENT AND WEIGHT GROUP

Weight Group	Fat Trim (lbs.)		Fat Trim %	
	Experiment I	Experiment II	Experiment I	Experiment II
220	24.9^{a}	21.6	15.7^{fg}	13.3
240	26.1^{a}	26.6^{a}	15.4^{fgh}	14.9^{gh}
260	30.3^{bc}	29.2^{b}	16.1^{ef}	15.1^{gh}
280	33.6^{d}	30.3^{bc}	16.8^{e}	14.6^{h}
300	36.0	32.0^{cd}	16.9^{e}	14.5^{h}

a,b,c,d All fat trim means which bear common superscripts do not differ significantly ($P < .05$).
e,f,g,h All fat trim percentage means which bear common superscipts do not differ significantly ($P < .05$).

Table 5 PERCENTAGE MEANS OF HAM TISSUES OF THE UNTRIMMED HAMS OF EXPERIMENT II BY WEIGHT GROUP[a]

Item	Weight Group				
	220 (4)[b]	240 (4)	260 (5)	280 (5)	300 (5)
Lean	53.56	53.73	54.91	55.85	54.44
Total fat	33.32	33.07	31.80	31.97	33.69
Intermuscular fat	5.96	5.87	5.70	5.93	5.53
Subcutaneous fat	27.36	27.20	26.10	26.04	28.16
Bone	7.84	7.72	7.84	7.38	7.51
Skin	4.97	5.00	5.08	4.51	4.40

a All percentage means on the same line do not differ significantly ($P < .05$).
b The number of hams per lot are presented in parentheses.

220 and 300 pounds lots was only 0.88 percent. The means of percent total fat of the untrimmed ham likewise were not significantly ($P<.05$) different for the five lots. The means from the 260 and 280 pound hogs were the lowest. The differences in percent bone of the untrimmed ham were also very slight and the differences in percent skin were small. The percentage means of intermuscular fat of the untrimmed ham varied less than 0.5 percent for the weight groups studied. Percent subcutaneous fat of the untrimmed hams also did not change significantly ($P<.05$) among the five lots. The 280 pound weight group, on a percent basis, contained the least subcutaneous fat while the 300 pound group contained the most.

The data from the physical dissection of the hams from Experiment II were in general agreement with the carcass cut-out data. On a percent basis, there were only slight differences in the lean, fat, bone, and skin. All components of the ham seem to have increased proportionally as weight of the live animal increased. Zobrisky *et al.* (1958) concluded from a study of the physical composition of swine that if the fattening phase of a hog's life was that time when weight of fat increased faster than the weight of lean or bone, then hogs of that study were fattening from 49.6 pounds to 303.5 pounds live weight. The physical dissection data of the hams of Experiment II do not indicate that the hogs had reached the fattening stage at the weights studied.

Percent four lean cuts was positively ($P<.05$) correlated ($r=0.46$) with percent lean of the untrimmed ham in Experiment II and negatively correlated ($r=-0.40$) with percent total fat of the untrimmed ham.

The percentage means obtained from chemical analysis of the untrimmed ham samples are presented in Table 6. The differences in percent protein were so small in the chemically analyzed hams that no trend could be found, as live weight increased from 220 to 300 pounds. In work with lighter hogs, Stant *et al.* (1968) reported a linear decrease ($P<.05$) in percent protein of the carcass as live weight increased from 50 to 200 pounds.

Chemically determined protein in the hams of Experiments I and II was positively ($P<.05$) correlated ($r=0.36$) with percent four lean cuts, while ether extract fat was negatively ($P<.05$) correlated ($r = -0.34$) with the lean cuts.

Percent potassium and sodium only changed slightly between weight groups (Table 6). Lawrie and Pomeroy (1963) also found that percent sodium did not change in hogs at 150 and 250 pounds live weight, but that percent potassium was lower in the heavier hogs. In hogs of vastly different weights, Chrystall (1967) found that percent potassium increased with age while percent sodium declined.

Percent ether extractable fat (Table 6) was noticeably lower in Experiment II; however, all means of both experiments were alike ($P<.05$). One obvious difference in the physical dissection and chemical data of the hams was the 300 pound lot of Experiment II. This lot possessed 4.4 percent more chemical fat than the 220 pound lot, while the difference in physically separated fat of the two lots was only 0.38 percent. The greater difference in chemical fat may be ex-

Table 6 PERCENTAGE MEANS OF THE CHEMICAL COMPONENTS OF THE SOFT TISSUES OF THE UNTRIMMED HAMS BY EXPERIMENT AND WEIGHT GROUP[a]

Item	Experiment I Weight Group					Experiment II Weight Group				
	220 (3)[b]	240 (3)	260 (3)	280 (5)	300 (2)	220 (4)	240 (4)	260 (5)	280 (5)	300 (5)
Fat	35.1	34.9	33.8	35.3	34.4	30.6	33.1	31.7	31.4	35.0
Protein (N x 6.25)	14.38	14.25	14.56	14.62	14.56	14.81	14.56	14.81	15.00	14.44
Potassium	0.25	0.25	0.25	0.24	0.26	0.25	0.25	0.25	0.26	0.25
Sodium	0.05	0.05	0.06	0.05	0.06	0.06	0.06	0.06	0.06	0.05
Moisture	50.0	50.2	50.6	50.3	50.6	53.9	51.7	53.1	53.0	50.1
Ash	0.76	0.81	0.78	0.74	0.78	0.80	0.80	0.80	0.80	0.72

[a] All percentage means on the same line do not differ significantly ($P < .05$).
[b] The number of hams per lot are presented in parentheses.

Table 7 MEANS OF WARMER-BRATZLER SHEAR FORCE VALUES AND PERCENT COOKING LOSS OF LOIN CHOPS BY EXPERIMENT AND WEIGHT GROUP

Weight Group	Shear Force Value (lbs.)[a]		Cooking Loss %	
	Experiment I	Experiment II	Experiment I	Experiment II
220	8.44	8.35	30.26[b]	29.46[bc]
240	8.37	8.77	30.76[b]	28.49[bc]
260	8.42	9.15	28.68[bc]	27.78[c]
280	8.37	8.75	28.97[bc]	28.54[bc]
300	9.10	9.30	29.09[bc]	27.32[c]

[a] All shear means do not differ significantly ($P < .05$).
[b,c] All cooking loss percentage means which bear common superscripts do not differ significantly ($P < .05$).

plained in part by a probable increase in intramuscular fat as weight increased. The 300 pound lot of Experiment II contained the lowest percent protein of Experiment II, which indicated that the synthesis of fat may have increased over protein synthesis at this weight. Ellis and Hankins (1925) reported that swine reached a maximum percent of protein at about 150 to 200 days of age. The weight which corresponds to this physiological age, where percent protein reaches a maximum, may have been in the 300 pound weight group. The data do not indicate that this stage is reached at a lower weight.

Percent moisture tended to be higher in Experiment II, as would be expected, since Experiment II hams contained less fat. Percent ash did not change appreciably between lots.

Means of Warner-Bratzler shear values for loin chops were not significantly ($P<.05$) different by experiment or weight group (Table 7). Cooking loss percentage means (Table 7) were higher ($P<.05$) for Experiment I than Experiment II but no significant ($P<.05$) differences were found between lots in the two experiments.

Table 8 MEANS FOR VISUAL DESIRABILITY OF BACON BY EXPERIMENT AND WEIGHT GROUP[a]

Weight Group	Experiment I	Experiment II
220	1.88^{bcd}	1.70^{d}
240	1.78^{bd}	1.65^{d}
260	2.04^{bc}	1.65^{d}
280	2.01^{bc}	1.98^{bc}
300	2.13^{c}	1.90^{bcd}

[a] Based on a hedonic scale 1-4, 1 being the most desirable.
[b,c,d] All visual desirability means which bear common superscripts do not differ significantly ($P < .05$)

Means of bacon visual desirability, in Table 8, reveal a slight trend for a decrease in overall desirability with increased weight. The 300 pound lot in Experiment I was rated the least desirable while in Experiment II, the 280 pound lot was rated the least desirable. Experiment II means were generally lower (more desirable) than the means of Experiment I. This difference may be due in part to a change in panel members in the two experiments.

Means of percent separable fat and percent cooking loss in bacon are presented in Table 9. No significant ($P<.05$) difference in percent separable fat was found between the lots of Experiment I or Experiment II, but there was a significant ($P<.05$) difference between experiments, with Experiment I having the highest percent of fat. Cooking loss percentage means reveal that the cooking loss was greater in Experiment II but that no significant ($P<.05$) differences were present between the means of Experiment II. The unexpected increase in

Table 9 MEANS OF PERCENT SEPARABLE FAT AND PERCENT COOKING LOSS IN BACON BY EXPERIMENT AND WEIGHT GROUP

Weight Group	Separable Fat %		Cooking Loss %	
	Experiment I	Experiment II	Experiment I	Experiment II
220	63.25^{abc}	61.11^{bc}	64.48^{d}	68.65^{g}
240	61.93^{abc}	59.82^{c}	65.81^{def}	67.87^{g}
260	63.14^{abc}	59.54^{c}	64.70^{d}	68.28^{fg}
280	64.86^{ab}	62.33^{abc}	66.89^{efg}	68.50^{g}
300	65.29^{a}	61.70^{abc}	65.74^{de}	67.38^{efg}

a,b,c All separable fat percentage means which bear common superscripts do not differ significantly ($P < .05$).
d,e,f,g All cooking loss percentage means which bear common superscripts do not differ significantly ($P < .05$).

cooking loss in Experiment II over Experiment I may have stemmed from year to year variability in cooking procedure.

Overall quality differences in loin chops and bacon, as shown in Tables 7, 8, and 9, are slight or non-existant for the increased live weights tested. Zobrisky *et al.* (1960) concluded that acceptability and palatability were not a function of slaughter weight in hogs studied at 125 to 205 pounds live weight and this conclusion is applicable to the heavier weights of this study. The lack of difference in percent cooking loss of loin chops with increased weight was also found by Emerson *et al.* (1964) in lighter hogs. Since the chops were all trimmed uniformly before cooking, this may have partially accounted for the small variations in cooking losses.

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