Both carbohydrate and fat must be incorporated in the diet of hogs to provide proper nutrients. The conversion of carbohydrate into fat by the body has been known for a long time. Many theories have been advanced to explain how this is accomplished. Evidence has also been presented that fats can be converted to some extent into carbohydrates.

A large proportion of the total calories normally consumed are from the carbohydrates. In work with humans, Soskin and Levine (1946) found that the proportion of carbohydrate consumed in the diet of people in the United States has remained at about 50-60 percent of the total caloric intake. This percentage is probably higher for our farm animals.

McMeekan (1940) has studied the rate of growth and plane of nutrition effects on the pork carcass. His work indicates that muscle has the greatest rate of growth until the pigs are about 16 weeks of age, when it is overtaken by fat. Fat maintains this higher relative rate, with the result that at 24-28 weeks, about 50% more fat than muscle is being laid down in the body. McMeekan also suggests the plane of nutrition effects upon the body as measured by external and internal carcass measurements are in complete agreement with the behavior of the parts and tissues for which the respective measurements provide an index. Thus linear measures on the body surface, due to their relationship to the skeleton, show a proportionately smaller response to nutrition than internal carcass measures of muscle and fat. Brugman (1950) reported a significantly higher percentage of the total five trimmed primal cuts and lower percentage of total lard produced by limiting the feed intake to 70 percent of full feed up to 150 pounds and full feeding from then on until the animal reaches approximately 220 pounds live weight.

To show the effects of certain carbohydrate feeds on pork carcass quality, the literature dealing with corn, oats, wheat and barley will be considered first. Loeffel (1933) found the carcasses of barley fed pigs to be leaner than those of either wheat or corn fed pigs. This work is in agreement with Crampton and Ashton (1945). Their work indicates that wheat, when used as the sole basal feed of the ration, may be expected to cause a lowered carcass quality sufficient to materially reduce the cash returns of Canadian hogs. They found that replacement of barley with wheat tends toward greater depth of fat on the carcass. The greater fatness is reflected also in a decrease in the amount of lean as measured by the area of the eye muscle. A wheat-oats mixture proved exceptionally palatable. The carcass data, however, indicates that oats does not counteract the "wheat effect" on degree of fattening or lean development. Oregon workers (1941) reported that corn produced softer fat with a lower melting point than that produced by hogs fed wheat based on firmness of carcass, refractive index and penetrometer tests. Loeffel (1937) compared ground oats with corn and tankage. The average thickness of backfat of the corn-fed hogs was 1.53 inches while the oat-fed lots ranged from 1.08 to 1.18 inches. The fat content of these feeds, as well as rate of growth of the hogs, may account for part of the difference in fatness.
A limited amount of work has been published on the effects of feeding potatoes to pigs, particularly their effect on carcass firmness. Edwards and Massey (1934) found that sweet potatoes produced firmer pork than corn, but gains were not nearly as rapid as those secured with corn. Singletary's work (1948) indicated that when dehydrated sweet potatoes were fed as the source of carbohydrate all carcasses graded firm and showed a desirable finish. Two English workers, Woodman and Evans (1943), published work on the digestibility and nutritive value of cooked potatoes as a feed for bacon pigs. The pigs receiving the cooked potatoes produced carcasses suitable for Wiltshire sides in every respect.

Firmness of the carcass has been studied on a number of other feeds. Vestal and Shrewsbury (1932) indicated that soybeans, whether raw, cooked or roasted had a definite softening effect on the carcasses of hogs. Again this could be due to the fat content rather than source of carbohydrate. U.S.D.A. workers (1926) fed a ration of brewers rice and tankage that contained less than one percent fat. The body fat formed was very hard and composed primarily of the glycerides of oleic, palmitic and stearic acids. Bray and Gayden (1939) compared corn with rice screenings for fattening hogs. The carcasses graded choice in all lots. The carcasses of the corn lot graded slightly harder because they were a little fatter, but graded slightly lower on hardness of fat. Wilford (1936) found that any form of distilling slop fed alone will produce very soft and even oily carcasses.

Extensive use of hominy feed produces soft pork according to Vestal and Shrewsbury (1941). When pig rations contained 50 percent hominy feed the carcasses and bacon were on the borderline with respect to softness. When 75 and 100 percent hominy feed was fed, the pork was definitely inferior in firmness. Wiley et al. (1937) also fed hominy to pigs and found that it produced a high percentage of undesirable pork, as indicated by the refractive index readings of the backfat, chilled carcass scores, and firmness scores for the smoked ham and bacon.

Wilcox et al. (1953) fed 95 beef cattle and 12 swine varying amounts of sucrose for different time intervals before slaughter. Total sugars were determined by Oesting and Beach's modification of the Shaffer-Hartman-Somogyi method as described by Koch and Hanke (1935). A summary of the findings on the sucrose-fed swine shows that sugar feeding increased the carcass yield by 4.6 percent which was statistically significant. Differences were also significant for the carbohydrate content of the muscle and highly significant for the liver carbohydrate values. The muscle of the sugar-fed animals contained almost twice as much sugar as those of the controls while the livers contained over twice the amount found in the controls. Liver and heart weights were increased. Shear force differences were not quite significant. Quality appraisal tests showed that the sucrose-fed roasts had slightly better flavor and texture than the controls. The sucrose-fed livers were preferred for their flavor and texture. Only slight changes occurred in the pH values as a result of sucrose feeding. Color readings were similar.

Loeffel (1937) reported that pigs showed less finish as indicated by backfat thickness when molasses was fed. The molasses fed pigs graded as firm as the corn fed pigs. Woodman and Evans (1943) fed pigs molasses treated beet pulp as a supplement to the diet. The pulp-fed animals lacked the bloom of the pigs on the all meal diet; they were flabbier and lacked depth and finish. The greater leanness and poorer finish of the animals on
the pulp diet was confirmed by the slaughter data for dressing percentage, backfat, belly streak and factory grading. Teague and Hanson (1949) studied the value of cellulose in a purified diet for growing and fattening pigs. Carcass studies of pigs slaughtered at 100 pounds revealed no marked differences which could be attributed to the diets fed.

Summarizing the research work on carbohydrate it seems that most of the work was done with a small number of animals and firmness was the only carcass factor studied extensively. More detailed studies should be made on carcasses from hogs that have been fed on different carbohydrates.

BIBLIOGRAPHY


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MR. KLINE: We are going to move into a field now that is rather controversial, we are going to let Ralph Soule of Kansas State College present a paper on antibiotics and vitamin B12 as they affect pork carcass characteristics.

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