



A flavor survey of the milk produced by the Montana State College dairy herd
by Raymond R Hedrick

A THESIS Submitted to the Graduate Faculty In partial fulfillment of the requirements for the degree
of Master of Science In Dairy Manufacturing
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Abstract:

A one year milk flavor survey was made on the milk produced by the Montana State College purebred Holstein and Jersey herd, The survey began in December and continued throughout the dry feed and the pasture season until the next December, Milk samples were taken at approximately 14 day intervals throughout the year at each morning, noon and evening milking, The samples were cooled to 40°F until examined organoleptically which was within four hours after the last milking for the day was completed, The examination was made by experienced milk judges without their knowledge of the identity of the samples.

The results revealed that milk with fewer flavor criticisms Was produced when the cows were on dry feed than when they were on pasture. Feed flavor was the most predominant flavor defect found in the milk, regardless of the kind of feed. However, feed flavor was more prevalent in the Milk when the cows were on pasture than when they were on dry feed.

On the yearly average basis the flavor score of the Holstein milk was slightly Mgher than that of the Jersey milk, There was no statistical significance in the difference between the average score of the first and the following lactations-, Heithey was there any statistical significance in the average milk scores based on the age of the cows at freshening or in the average scores based on the morning, noon or evening milkings*¹

HARSONS BOND

100% COTTON FIBRE

93



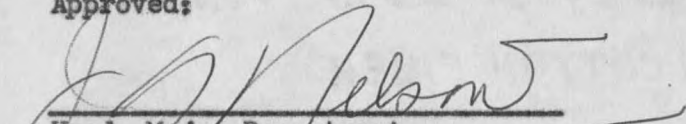
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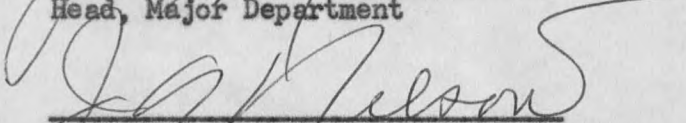
A FLAVOR SURVEY
OF
THE MILK PRODUCED
BY
THE MONTANA STATE COLLEGE DAIRY HERD

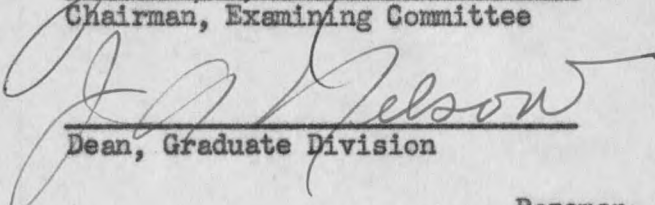
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Submitted to the Graduate Faculty
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ABSTRACT

A one year milk flavor survey was made on the milk produced by the Montana State College purebred Holstein and Jersey herd. The survey began in December and continued throughout the dry feed and the pasture season until the next December. Milk samples were taken at approximately 14 day intervals throughout the year at each morning, noon and evening milking. The samples were cooled to 40°F until examined organoleptically which was within four hours after the last milking for the day was completed. The examination was made by experienced milk judges without their knowledge of the identity of the samples.

The results revealed that milk with fewer flavor criticisms was produced when the cows were on dry feed than when they were on pasture. Feed flavor was the most predominant flavor defect found in the milk, regardless of the kind of feed. However, feed flavor was more prevalent in the milk when the cows were on pasture than when they were on dry feed.

On the yearly average basis the flavor score of the Holstein milk was slightly higher than that of the Jersey milk. There was no statistical significance in the difference between the average score of the first and the following lactations. Neither was there any statistical significance in the average milk scores based on the age of the cows at freshening or in the average scores based on the morning, noon or evening milkings.

INTRODUCTION

Abnormal flavors in milk constitute one of the major problems in the dairy industry. Consumers demand milk that is free of flavor defects. Both adults and children are sensitive to any off-flavor they encounter. Not knowing why milk does not have the flavor desired, consumers infer that milk with an off-flavor has been produced under insanitary conditions and is unwholesome.

Off-flavors in milk may be due to feed or to faulty production practices or to handling methods not related to sanitation. Consequently, off-flavors are often encountered in grade A milk. Nelson and Trout (113), MacCurdy and Trout (102) and Dahlberg, Adams and Held (39) reported that a high percentage of all market milk that is examined organoleptically is criticized for off-flavor. These investigators also reported that feed flavor is the most predominant.

A flavor defect in milk may also be the cause of a like flavor defect in any dairy product made from it. In order to improve the flavor of all dairy products to make them more acceptable to consumers, milk flavors should be given more attention. To ascertain the general occurrence of milk flavor defects in milk produced in a reasonably well managed dairy herd, this study was undertaken.

REVIEW OF LITERATURE

FEED FLAVORS

Alfalfa. Roadhouse and Henderson (130) and others (3,11,127, 128,129) reported that when alfalfa was fed as green pasture or as silage five hours before milking, it produced an off-flavor in the milk. The feed flavor in milk was more pronounced when alfalfa was fed two to three hours before milking. A pronounced feed flavor in the milk resulted when 20 to 25 pounds of freshly cut green alfalfa was fed to the cows two hours before milking. Gamble and Kelly (53) and MacCurdy and Trout (103) stated that when 15 to 20 pounds of alfalfa silage was fed immediately after milking there was no resulting off-flavor, but where only 0.4 pound of alfalfa silage was fed to the cows one hour before milking there was an off-flavor in the milk.

Clover. Roadhouse and Henderson (131) and other workers (46, 81,100,110,129,131,144,167) stated that clover hay, clover pasture, clover silage and other legumes had the same effect on the flavor of milk as alfalfa hay, pasture and legume silage.

Grass. Roadhouse and Henderson (131,132) found that when cows were pastured on sudan grass during the interval between the morning and evening milking, there was no objectionable flavor in the milk. Davies (45) stated that the quantity of milk produced was not affected when the cows were taken off pasture to control feed flavor for three

hours before milking. Other workers (20,55,57) reported grass silage of good quality, with molasses added, fed to dairy cows immediately after milking resulted in milk of good flavor. Other investigators (51,82,89) found that when silage of good quality was fed immediately after milking no silage flavor occurred in the milk.

Corn. Gamble and Kelly (53) and others (32,57,83,103,128,131) noted that when 0.79 pounds of corn silage was fed one hour before milking it produced an off-flavor in the milk. When 15 to 25 pounds of corn silage was fed immediately after milking no off-flavor was encountered. Babcock (11) stated that when dairy cows were fed 25 pounds of green corn one hour before milking, slight off-flavor appeared in the milk.

Soybeans. Gamble and Kelly (53), Woll and Humphrey (166) found that soybean silage fed to cows after milking caused an undesirable flavor and odor in the milk, but soybean silage may be fed to dairy cows when small amounts are mixed with corn silage immediately after milking without affecting the flavor. Williams and co-workers (163) and others (21,52,114,116) stated that when a ration containing up to 25 per cent of soybeans (whole, cracked or ground) or soybean hay was fed to cows, no undesirable flavor was observed in the milk.

Beets and Beet Pulp. Wing and Anderson (165) and others (16, 58) stated that dried beet pulp fed in liberal quantity one to two hours before milking had practically no effect on either the flavor or odor of the milk. Reece (126) and other workers (16,164) noted

that sugar beets can be fed to the dairy cows one to four hours before milking with practically no effect on either the odor or flavor of the milk produced. Trout and Taylor (157) concluded that sugar beet tops do not affect milk flavor unless more than 25 pounds per day are fed. Davies (44) and Granfield and Mackintosh (38) reported that when more than 9 lbs. of dried beet pulp containing molasses was fed to each cow per day, a fishy taint in milk was noticed.

Potatoes. Keyes and Nelson (87) and other workers (9,13,46, 47,164) found that dairy cows fed potatoes with the concentrate during milking did not impart an off-flavor to the milk.

Cabbage. According to Babcock (13), when a dairy cow consumes 14 lb. of cabbage one hour before milking she will produce milk having an off-flavor and odor. If fed immediately after milking it takes 25 pounds of cabbage to produce a like result.

Concentrate Feeds. The concentrate feeds such as rolled barley, coconut meal, cottonseed meal, or rolled oats, when fed one or two hours before milking, may produce a very slight off-flavor but not enough to make the milk undesirable to the average consumer. Five to seven pounds of wheat bran fed one hour before milking tends to improve the flavor of milk according to Roadhouse and Henderson (130). Trout and Horwood (159) stated that balbo-rye pasture did not have as adverse an effect on the flavor and odor of milk as did common rye.

Miscellaneous Feeds. Tarassuk and Roadhouse (150) and Barrett

et al (58) found that citrus pulp had about the same effect as beet pulp, with the exception that a bitter flavor frequently appeared in the milk when cows were fed over five pounds of dried orange pulp one hour before milking. Woodward and co-workers (168) noted that the feeding of prickly pear had no appreciable effect on the flavor of the milk. Olson and co-workers (117) reported that feeding tankage in the grain ration up to 50 per cent by weight had no effect on milk flavor even when fed one or two hours before milking. Lindsey, Holland and Smith (99) recorded that the feeding of distiller's grains or brewer's grains to cows would not adversely affect the flavor of the milk. Sunflower silage has no objectionable flavor effect according to Arnett and Tretsven (8). Babcock (12,15,16) discovered that green oats, green peas, pumpkins and carrots fed to cows either before or after milking in quantities up to 30 pounds had only a slight effect on the flavor and odor of the milk produced. When dairy cows were fed up to 30 pounds of green cowpeas, green rye, kale, rape or turnips one to two hours before milking, a slight to pronounced off-flavor resulted. Thirty pounds of these feeds consumed by cows after milking had no effect on the flavor of subsequent milkings.

WEED FLAVORS

Weed flavors and odors found in milk are apparently closely associated with feed flavors. Some kinds of weeds mixed with the hay, pasture weeds, weeds in silage and some weed seeds in the concentrate

cause off-flavor in milk if a sufficient quantity is consumed by the cow. This is especially true if consumed a short time before milking.

Aurand and Moore (10) stated that three different commercial mineral supplements, advertised to prevent weed flavor in milk, when given to cows failed to prevent off-flavors.

Tretsven and Nelson (155) found that ground fanweed seed eaten immediately after milking in amounts up to eight per cent of the total grain ration resulted in no off-flavor in milk. They also reported that 12 to 16 per cent of ground wild mustard seed in the concentrate could be eaten by the cows immediately after milking without imparting any objectionable flavor to milk.

Many research workers (1,7,14,17,18,70,101,104,105,107,119,120,121,130,137) determined that "bitter" weed, "carrotweed", "horseweed", "mayweed", "ragweed", land cress, wild oats, foxtail, filaree, wild onion, wild garlic, beardtongue, boneset, buckhorn, wild tansy, marestail, wild lettuce, dogfennel and foxglove caused undesirable flavor and odor in milk when a cow consumes sufficient quantity a short time before milking.

Wylie (169) and others (1,48,107) stated that the off-flavor caused by weeds was generally eliminated when cows were taken off pasture from three to four hours before milking.

Ensiled peppergrass with molasses as a preservative, and ensiled ragweed, clover and wheat stubble with molasses, did not cause off-flavor in milk when fed immediately after milking, according to Brubaker and

Reaves (31) and Pratt (120). Ten to 15 per cent wild onion and 85 to 90 per cent mixed grass silage with 225 pounds of ground corn per ton added as a preservative, when fed to cows produced an off-flavored milk (Brubaker and Reaves, 31).

OXIDIZED FLAVOR

Considerable experimental work has been done in an effort to determine the causes and methods of control of oxidized flavor in milk.

According to several workers (35,41,43,82,136,152), lecithin appeared to be the constituent of milk that is affected first when oxidized flavor develops. Swanson and Sommer (146) observed that spontaneous oxidized flavor in milk may be due to the oxidation of the phospholipids fraction of the fat globule membrane. Beck, Whitnah, and Martin (22) found no relation between the frequency of occurrence of oxidized flavor and the lecithin content of the milk.

A number of research workers (22,27,28,43,63) determined that the ascorbic acid content of the milk intensified the oxidized flavor.

Brown, Thurston and Dustman (24) reported that if a cow were fed a quart of either tomato or lemon juice daily, the susceptibility of her milk to oxidation was greatly reduced.

Other research workers (22,27,35,61) stated that when a cow was fed one gram of ascorbic acid daily it decreased the tendency for the milk to develop metal-induced oxidized flavor. Also, when carotene was consumed at the rate of 350 mg per day like results were obtained.

Anderson (2) and others (29) concluded that the level of the ascorbic acid in milk when drawn is not an important factor in the production of milk with low susceptibility to oxidized flavor.

Feed as a Factor in Oxidized Flavor. Spontaneous oxidized flavor in milk is influenced by feed according to Brown, Van Landingham and Weakley (28) and others (24,43,54,61,74,161). Green feeds such as pasture grass, green alfalfa, and clover decreased the occurrence of spontaneous oxidized flavor while dry feed tended to increase it.

Hening and Dahlberg (74) found that the oxidized flavors were not influenced by the plane of nutrition. According to Brown, Van Landingham and Weakley (28) high quality alfalfa hay, together with alfalfa leaf meal, reduced the development of metal-induced oxidized flavor.

Other researchers (56,58,73) noted that legume and grass silage produced milk with more resistance toward the development of oxidized flavor than feeding corn silage, molasses treated grass silage, phosphoric acid treated grass silage, mangels, beet pulp or dried citrus pulp.

According to Anderson (2) and others (6,22,26,106,162), low carotene intake was regularly associated with milk which developed oxidized flavor, while a high carotene intake decreased the oxidized flavor in milk.

Guthrie (66) found that when four cows were fed cod liver oil,

the milk produced became oily and after standing it developed either a "goaty" or oxidized flavor.

Krukovsky, Loosli and Whiting (93) and Krukovsky and Loosli (94) discovered a significant correlation between the tocopherol content of milk fat and the ability of milk to resist the reaction that produced oxidized flavor.

Brown, Thurston and Dustman (24) showed that there was variation among individual cows with respect to the tendency for oxidized flavor to develop in their milk. If milk susceptible to oxidation is mixed with non-susceptible milk from five or more cows, the tendency was to reduce its susceptibility.

Chilson (35) found that it was not necessary for the milk to come in contact with metals or metallic salts for the development of oxidized flavor. On the contrary, Tomlinson (153) stated that no samples of milk from individual cows would develop oxidized flavor without added copper.

Guthrie and Brueckner (62) and Dahle and Palmer (43) declared that breed of cows, stage of lactation, chlorine lactose ration and leucocyte content of the milk had no influence on the occurrence of spontaneous oxidized flavor.

Corbett and Tracy (37) reported that milk produced in the early part of the lactation period was more susceptible to oxidation than that produced later in lactation. They found this to be especially true of milk from heifers.

Chilson (35) and Dahle (40) stated that the oxidized flavor was due to an enzyme action, and the enzyme action could be prevented by heating the milk to 170°F for 10 minutes. Dahle and Palmer (43) found that the plasma and serum of the milk carried the enzyme-like factor responsible for the oxidized off-flavor.

Brown, and Olson (30), Thatcher and Dahlberg (151) and Tomlinson (153) stated that an oxidized flavor can be produced chemically without the aid of an enzyme. Further evidence was given that enzyme action was not involved in the production of oxidized flavor.

Roland and Tribler (136) and Corbett and Tracy (37) declared that there appeared to be no correlation between the development of oxidized flavor and the percentage of fat in milk.

Beck, Whitnah and Martin (22) observed that there may be a correlation between color intensity of the milk fat as produced by different breeds of cows and the development of oxidized flavor. The oxidized flavor was more prevalent in milk that was below breed average in fat color intensity.

Krukovsky, Loosli and Whiting (93) stated that there was a significant correlation between the tocopherol content of milk fat and the ability of milk to resist the reaction that involves ascorbic acid oxidation, which produced oxidized flavor.

Cone and Babcock (36) and others (6,18,42,95,136,154,161) reported that the growth of bacteria in milk may retard the development of oxidized flavor in raw milk.

Beck, Whitnah and Martin (22) stated that the development of oxidized flavor in raw milk was effectively prevented by feeding 206 milligrams of carotene daily to a cow that had been producing milk with oxidized flavor.

Brown, Dustman and Weakley (28) observed that the amount of carotene in milk might not be the substance responsible for the reduction in susceptibility of milk to oxidized flavor. It appeared that some substance or substances associated with it probably had a greater effect than did the carotene itself. Dahle (41) reported that carotene did not have antioxidative properties.

Anderson, Dowd and Stuewer (5) and Brown and Dustman (25) noted that there was no relationship between an apparent acidity of 0.19 per cent and the same milk standardized down to an acidity of 0.15 per cent in preventing the development of oxidized flavor.

The oxygen content of milk may vary from zero in the udder to about 11 milligrams per liter in the bottle, according to Guthrie (67). Several investigators (63,69,71,140,141,143) found that if the oxygen content of milk was kept below 0.4 to 0.5 milligrams per liter, there would be little difficulty with oxidized flavor.

RANCIDITY

Milk lipase apparently has little or no action on milk fat in the udder. The lipase in milk seems inactive at the time of milking.

Lactation. Eckles and Shaw (49) and other research workers (18, 49,50,84,85,118,130,134,147) stated that a cow may produce rancid milk

in the last stage of lactation and/or during the first month of lactation.

Herrington and Krukovsky (76) concluded that there was no apparent correlation between the length of the gestation period and the amount of milk the cow produced to rancid flavor in milk.

Kelly (86) found that when samples of milk were collected at frequent intervals from cows not bred, a definite relationship between the estrus cycle and the lipase activity existed.

Roehen and Sommer (133) reported no relationship between fat lipolysis in milk and the stage of lactation.

Tarassuk and Jack (149) and others (75,77,85,91,92,133,147) determined that hydrolysis of milk fat may be caused by two distinct sets of conditions: (1) it might result from certain specific treatments of raw milk such as shaking of warm milk and warming of pre-cooled milk to about 30°C, then cooling again to below 10°C. Such treatments result in the activation of lipase, another enzyme, or a group of enzymes present in raw milk; (2) it might also result from spontaneous action due to lipase activity.

Fouts and Weaver (50) and other research workers (79, 85,134,149) stated that rancid flavor was least noticeable during the spring and summer months when the cows are on pasture, and reaches a maximum in early winter.

Reder (122,123,124,125) studied the chemical composition and properties of normal and rancid Jersey milk and found a higher chloride

and a lower lactose content in rancid milk than in normal milk. The fat, total solids and protein content in general appeared to be higher in rancid milk than normal milk. Rancid milk usually had a higher titratable acidity and hydrogen-ion concentration than normal milk of the same period of lactation. The fatty acids and cholesterol content of the blood serum were generally the same for cows producing rancid milk and for cows producing normal milk during the corresponding periods of lactation.

Hlynka and Hood (80) and Castell (34) concluded that milk having a low surface tension after holding at 5°C would, other things being equal, have a less desirable odor than milk having a high surface tension. The flavor of the milk was therefore related to its lipase activity.

Gould's (59) studies showed that low pH values adversely and permanently affected activity and that milk lipase was a non-specific fat-splitting enzyme capable of producing lipolysis on a wide variety of fatty substrates under favorable conditions.

Tarassuk (147), Roberts and Wylie (134) and Tarassuk and Henderson (148) reported that mixing one part of milk that is subject to rancidity with four parts of normal milk within one hour after milking, will generally prevent rancid flavor.

According to Castell (34) the addition of ammonia accelerated the production of rancid flavor. From the results obtained it seemed doubtful that the concentration of ammonia in the atmosphere of the barn where the cows were being milked could cause rancidity to develop.

Anderson (3,4) found that when the rations of cows producing rancid milk were enriched with plant material of high carotene content, the production of very good flavor milk resulted after a period of 10 to 15 days.

Chemical Flavor. Lindquist (97) found that when cows' uteri were treated with iodoform capsules to clear up suppurative inflammation, they produced milk with a medicinal or chemical flavor. One cow's milk could taint over 200 gallons of mixed milk.

According to Mull and Fouts (111) 10 ppm of a quaternary ammonium compound (Roccal) added to milk could be detected by taste. The addition of 20 ppm resulted in a slight puckery sensation, a slight bitterness at 30 ppm, and a very bitter flavor at 40 ppm.

Nelson (112) stated that seed grain preserved with paradichlorobenzene resulted in milk with a foreign medicinal-like flavor. This foreign flavor continued in the milk for several days after the cows were fed an uncontaminated feed.

Lindquist and Donaldson (98) noted that potatoes grown in soil treated with benzene hexachloride when fed to cows, resulted in milk with a bitter taste. After 12 days of normal feed the bitter taste disappeared.

Bacteria. Hammer (68) and other research workers (33,115,137, 139) concluded that bacteria may cause feed flavor, salty flavor, bitter flavor and other off-flavors in milk, depending upon the kind of bacteria.

Miscellaneous. Roadhouse and Henderson (130) reported that salty milk may be produced from cows in the last stage of lactation.

According to Shaw (143) and Knott (90), milk produced by cows with various stages of ketosis might have "cowy", "feed", or "foreign" flavor, depending on the amount of ketone bodies which have passed into the milk from the blood.

EXPERIMENTAL PROCEDURE

A one year milk flavor survey was made on the milk produced by every milking cow in the Montana State College purebred Holstein and Jersey herd. In order to cover the dry feed and pasture seasons, and other environmental factors, the survey was undertaken in December 1952, and ended in December 1953.

Separate samples were taken from the milk produced by each cow at every milking for one day at approximately 14 day intervals. Clean, sanitized half-pint milk bottles were used to collect the samples. The samples were cooled immediately in running water to a temperature below 50°F and held cold until they were examined for flavor within four hours after the last samples for the day were taken. The samples were tempered to approximately 60°F and examined organoleptically for flavor and odor on the basis of the standard score card by experienced milk judges who did not know the identity of the samples or the milking from which they were taken. They were scored and criticized according to the intensity of the defect found. Milk with no flavor defect was given a score of 40. Samples with a slight flavor defect were given a score of 39 or 39.5 according to the intensity. The range for samples with more definite flavor defects was from 38.5 down to 37. Samples with pronounced flavor defects were scored below 37 points.

Effort was made to keep the feeding, management and milking practices of the herd as uniform as was possible throughout the year.

The only feed change was from dry feed conditions to pasture and return to dry feed after the pasture season was over.

FEEDING AND MANAGEMENT OF THE HERD

The milking cows were fed concentrate, the composition of which is given in Table 1. Beginning in December 1952, and ending June 30, 1953 Mixture A was fed. From July to December 1953 the cows were fed Mixture B.

TABLE 1

THE CONCENTRATE MIXTURES FED THE MILKING HERD DURING THE ONE YEAR SURVEY

Ingredients in the Concentrate Mixture	Mixture A	Mixture B
Steam rolled barley	285	385
Wheat bran	200	200
Dry beet pulp	300	300
Linseed oil meal	200	100
Bone meal	5	5
Salt	10	10
	<u>1000</u>	<u>1000</u>

The dry feeding season was in progress when the survey started in December 1952, and started again the last of September to December 1953. During this period concentrate was fed at the rate of one pound to four pounds of 4 per cent fat corrected milk produced. It was fed just before milking but some of it was consumed during milking. Good quality alfalfa hay was given the cows after each milking and at intervals between milking. Hay feeding time was at 6:30 a.m., 9:00 a.m., 2:30 p.m., 4:30 p.m. and 10:30 p.m. The hay was fed ad lib in outside feed racks. An attempt was made to feed the hay so that practically

all of it was consumed an hour before milking time, although it was not always possible to regulate the exact amount of hay to accomplish this.

At the beginning of the pasture season, the last of May, when the grass was not abundant, and at the end of the pasture season when the grass became short, some hay was fed in the evening to supplement the pasture grass. No hay was fed from June 1 to September 21 when the pasture grass was abundant. The irrigated pasture for the herd consisted of a mixture of orchard grass, tall fescue, Kentucky blue grass, white dutch and alsike clover. The legumes make up about 23 per cent of the forage. The cows were brought in from pasture from one fourth to one hour before milking, averaging time elapse about half an hour.

The cows were milked three times a day in December 1952, twice a day from January 1 to May 1, 1953, but the cows producing over 40 lbs. of milk per day were milked three times daily. From the first part of May the cows were milked three times a day again until the end of the survey in December, 1953.

When the cows were milked three times a day, milking started at 4:00 a.m., 12:00 noon and 8:00 p.m. When milked twice a day they were milked at 4:00 a.m. and 3:30 p.m.

Fast machine milking was practiced. It required from one and one third to one and three-fourths hours to milk the herd which varied from 41 to 53 milking cows. The milk from each cow was immediately

removed from the barn after it was drawn and a representative sample taken for examination.

Since this was a survey to determine the milk flavor defects encountered over a one year period, effort was made to keep the feeding, milking and management routine as uniform from day to day and season to season as was possible.

EXPERIMENTAL RESULTS

FLAVOR CRITICISMS

Table 2 gives the percentage distribution of the occurrence of off-flavor in the milk when the cows were on dry feed compared to when they were on pasture. When the cows were on dry feed there were twelve different off-flavors encountered compared to eight different off-flavors when the cows were on pasture.

TABLE 2

THE PERCENTAGE DISTRIBUTION OF MILK FLAVOR DEFECTS FOUND DURING DRY FEED SEASON AND THE PASTURE SEASON

Dry Feed Season	Per Cent	Pasture Season	Per Cent
No criticism	26.0	No criticism	0.9
Feed	59.3	Feed	81.3
Salty	6.5	Rancid	7.9
Barny	3.2	Feed-salty	4.4
Rancid	2.9	Salty	4.5
Feed-salty	0.3	Fermented feed	0.4
Tallowy	0.3	Feed-bitter	0.3
Fermented feed	0.3	Feed-rancid	0.2
Smothered	0.3	Feed-barny	0.1
Salty-bitter	0.3		
Oxidized	0.3		
Foreign	0.2		
Salty-oxidized	0.1		
TOTAL	100.0		100.0
Number of samples examined	2095	Number of samples examined	1182

When the cows were on dry feed there was no flavor criticism on

26 per cent of the samples. Only 0.9 per cent of the samples were without flavor criticism when the cows were on pasture.

PERCENTAGE DISTRIBUTION OF FLAVOR DEFECTS

Figure 1 shows that feed flavor was more predominant in the milk when the cows were on pasture than when they were on dry feed. Twenty six per cent of the samples produced on dry feed were not criticised on flavor. Fifty nine and three tenths per cent of the samples were criticised for feed flavor when the cows were on dry feed as compared to 81.3 per cent when the cows were on pasture. This conformed to the reports of Trout, McGee and Harrison (158) that when the cows are pastured on a mixture of legumes and grasses and milked three times daily, they produce milk with a definite objectionable flavor. MacCurdy and Trout (102), in a study covering six months (January to June) obtained similar results and reported that 57 per cent of the milk samples observed had an off-flavor.

Salty, rancid, and other miscellaneous flavors which are generally less predominant in milk, occurred so seldom that the kind of feed could not be indicated as a factor in their occurrence. Mattick and Kay (109) reported that there was no marked seasonal variation in the occurrence of rancid flavor in milk.

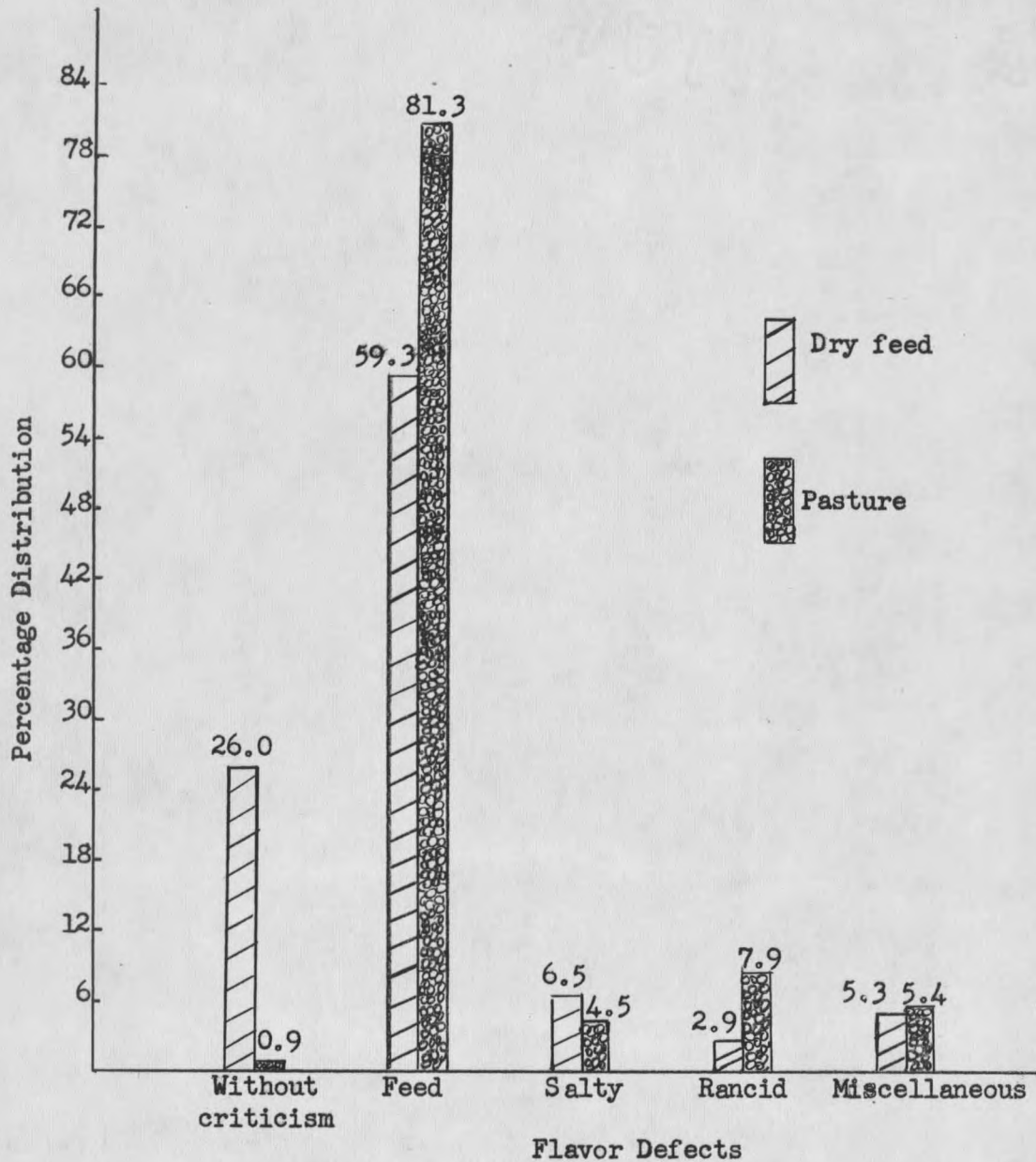


Figure 1. PERCENTAGE DISTRIBUTION OF THE FLAVOR DEFECTS IN MILK PRODUCED BY COWS ON DRY FEED AND ON PASTURE GRASS.

PERCENTAGE DISTRIBUTION OF FLAVOR SCORES

The percentage distribution of flavor scores of the milk produced on dry feed compared with that produced on pasture is given in Figure 2.

When the cows were on dry feed there was no flavor criticism on 27.3 per cent of the samples. Ten per cent scored 39.5 and 27.3 per cent scored 39 when the cows were on dry feed. This is the range in which the judges considered the criticisms as slight. Only 11.8 per cent of the milk produced when the cows were on dry feed scored 38.5 and only 15.5 per cent scored 38. The judges considered the off-flavor in this range as definite.

When the cows were on pasture only 0.9 per cent of the samples were without criticism. Three and eight tenths per cent scored 39.5 and 16.0 per cent scored 39. In the definite range 22.0 per cent scored 38.5 and 30.0 per cent scored 38. Flavor scores of 37.5 or below, which the judges considered as pronounced, were more prominent in the milk produced by cows on pasture than those on dry feed.

FLAVOR SCORE IN RELATION TO LACTATION

Figure 3 gives the combined flavor score of the Holstein and Jersey milk in the different lactations. The average flavor score of the second, third and fourth lactations was only very slightly above that of the first lactation. This was not statistically significant

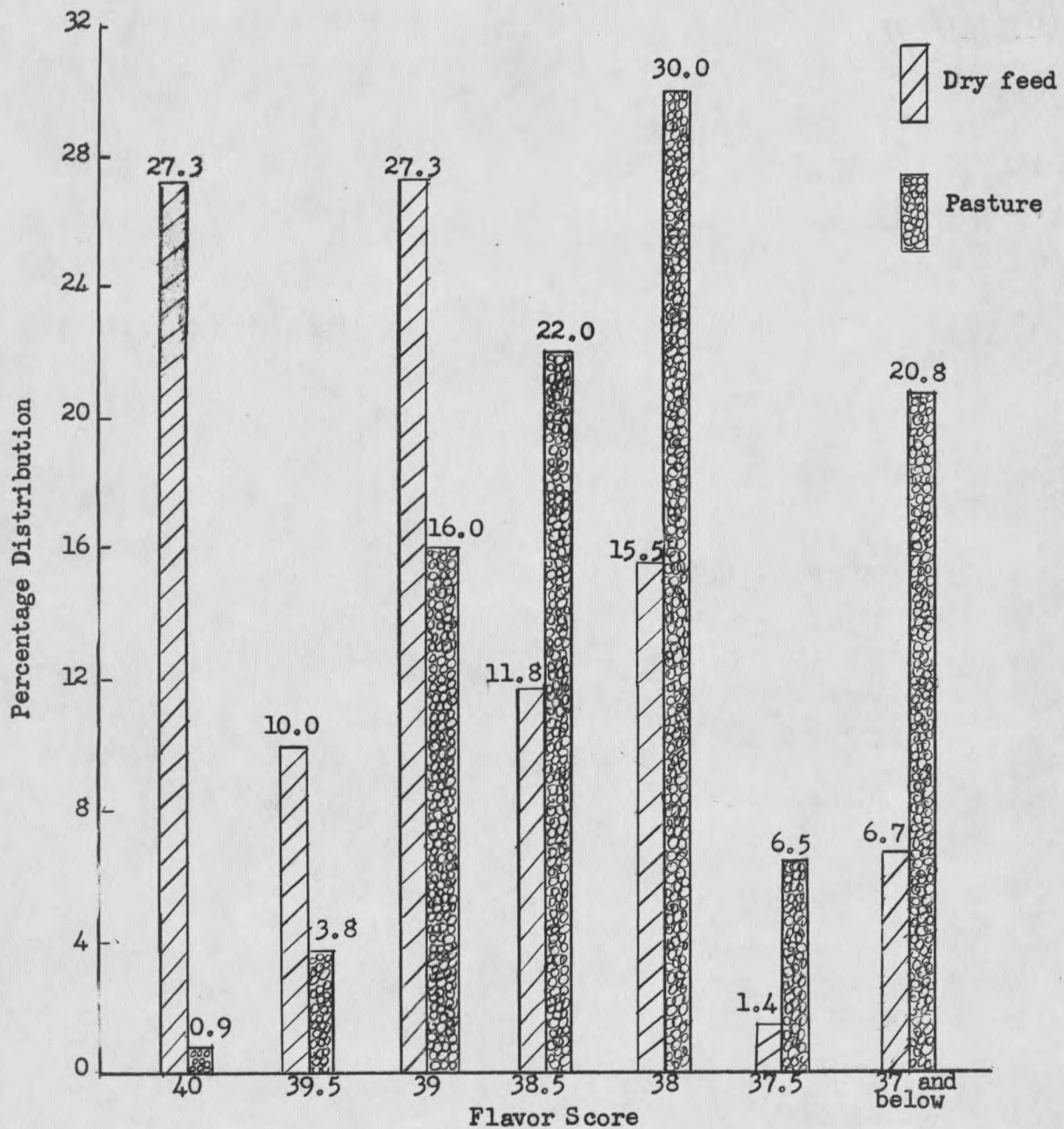


Figure 2. PERCENTAGE DISTRIBUTION OF FLAVOR SCORES OF MILK PRODUCED ON DRY FEED AND GRASS

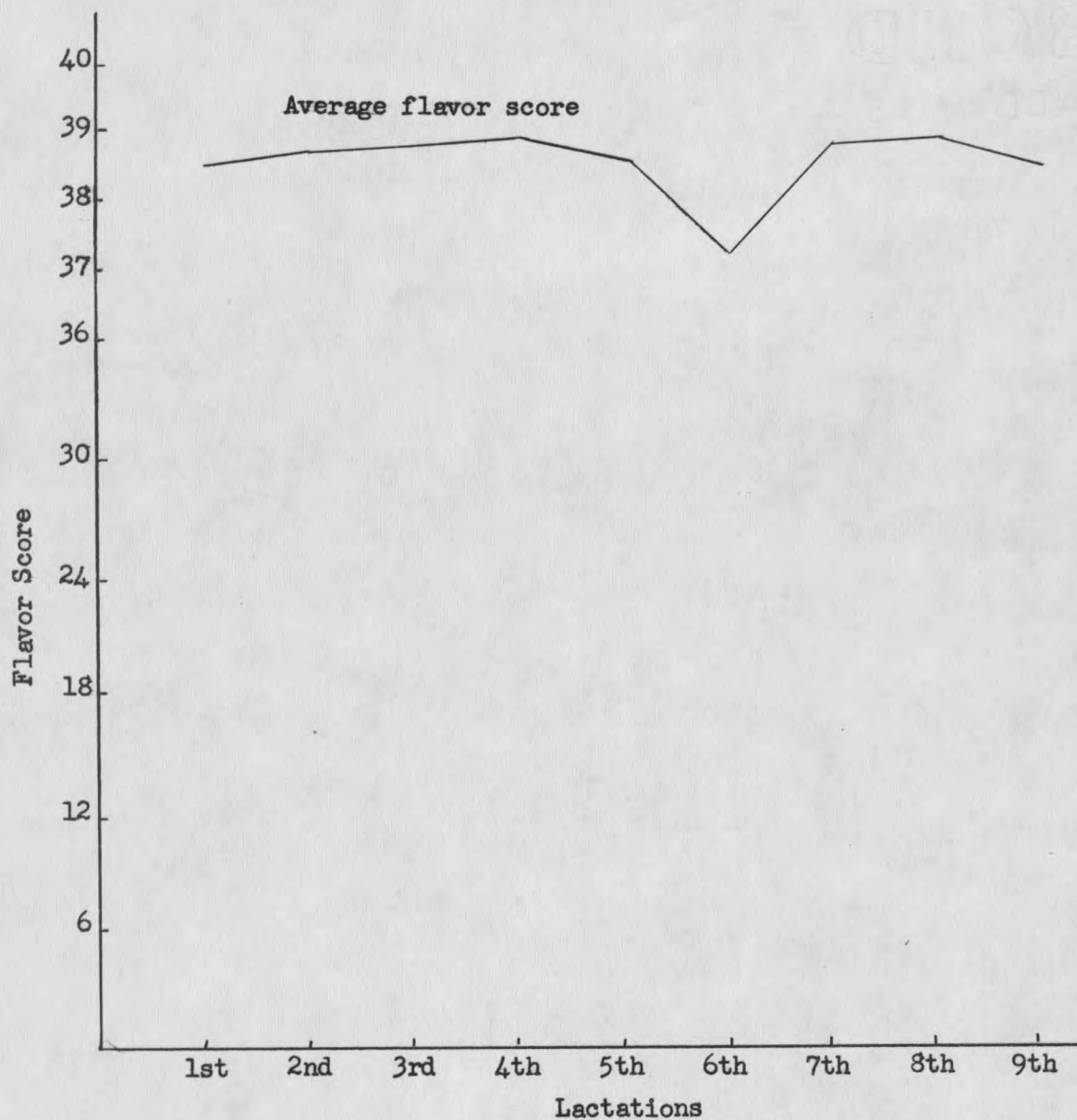


Figure 3. COMBINED AVERAGE FLAVOR SCORES OF HOLSTEIN AND JERSEY MILK PRODUCED IN THE DIFFERENT LACTATIONS.

(Snedecor 145). The number of cows in the fifth through the ninth lactations was not large enough to warrant a true average. In the sixth lactation there were a few rancid samples. The flavor score of the milk in the last three lactations was not significantly different from that of the first five.

FLAVOR SCORES BY MILKINGS

Figure 4 gives the average flavor scores on the samples of milk taken from the morning, noon and the night milkings.

The yearly average flavor score for each milking was: morning, 38.7; noon, 38.5; and night milk, 38.4.

The average score for the morning, noon and night milkings followed the same general trend.

The variation in the scores of the milk for the different milkings was only 0.3 of a point for the entire year. This difference in the scores of the different milkings was not statistically significant (Snedecor 145).

AGE OF THE COW

Figure 5 shows the average flavor score of the milk samples according to the age of the cows at freshening. There was only a very slight increase in flavor score in the milk from cows up to five years of age. The flavor scores of the milk from cows above five years of age fluctuated slightly more. The difference in scores between all

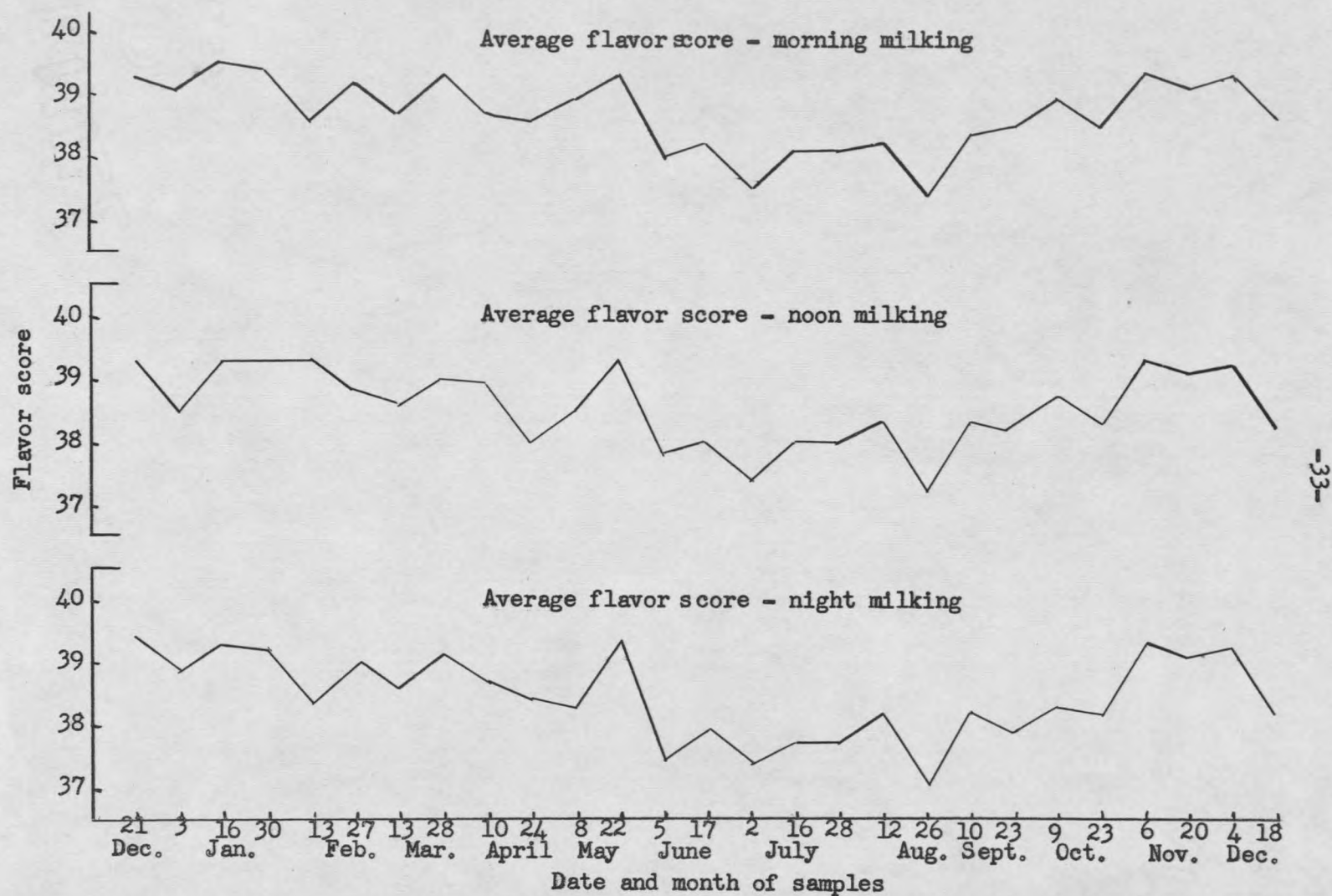


Figure 4. AVERAGE MILK FLAVOR SCORES BY MILKINGS

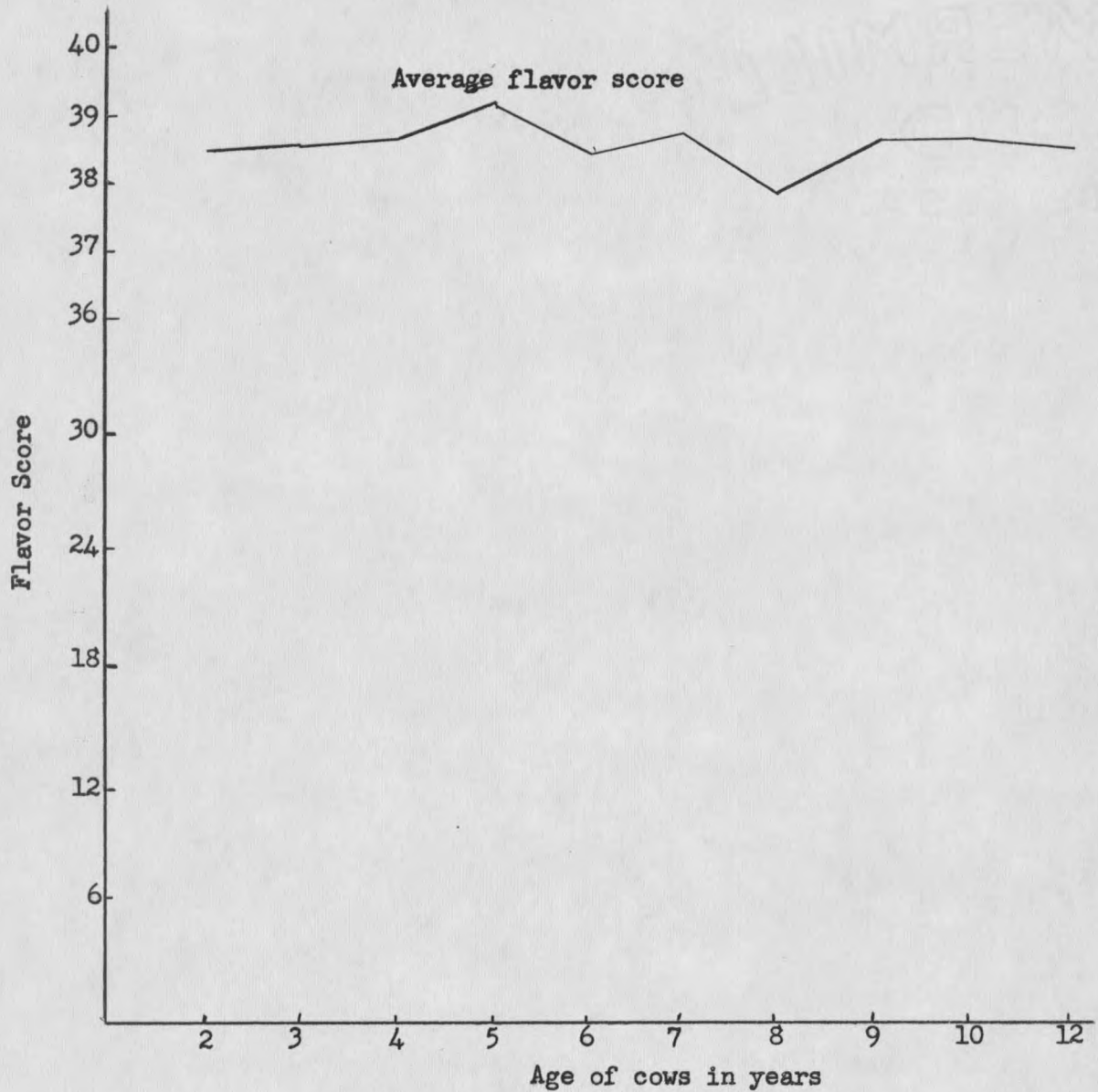


Figure 5. FLAVOR SCORES OF THE MILK ACCORDING TO THE AGE OF THE COWS AT THE TIME OF FRESHENING

ages was not statistically significant (Snedecor 145).

FLAVOR SCORE BY BREEDS

Figure 6 shows a comparison of the average monthly flavor score of the milk from Holsteins and from Jerseys. The average flavor score for the Holstein milk (38.7) was slightly higher than the Jersey milk (38.4) for the year. The monthly average scores of the Jersey milk fluctuated more than the scores of Holstein milk. Like results were reported by Weaver, Kuhlman and Fouts (160) on the flavor of Holstein and Jersey milk.

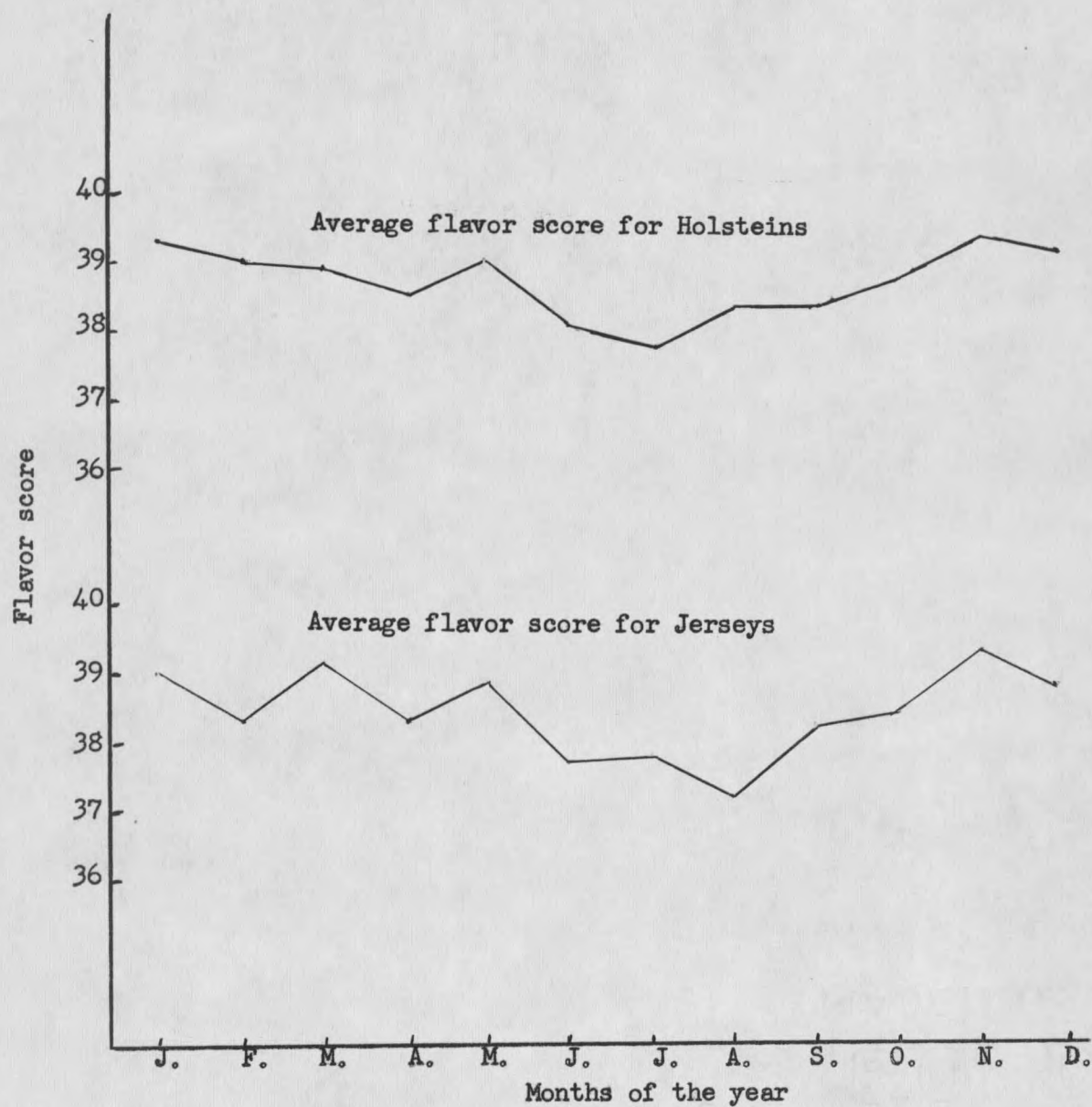


Figure 6. THE AVERAGE FLAVOR SCORE BY MONTHS OF THE HOLSTEINS AND THE JERSEYS

DISCUSSION OF RESULTS

Of the 2095 samples taken when the cows were on dry feed, 26 per cent were without flavor criticism. Of the 1182 samples taken when the cows were on pasture, only 0.9 per cent were free of flavor criticism. The average flavor score of the milk was considerably higher when the cows were on dry feed than when they were on pasture. Feed flavor was the most predominant defect. It occurred in 59.3 per cent of the samples during the dry feed season as compared to 81.3 per cent during the pasture feeding season.

When the cows were on dry feed sixty-five per cent of the samples scored 39 to 40 inclusive, and only 27.3 per cent of the samples scored between 38 and 38.5 inclusive. Eight and one tenth per cent scored below 37.5.

When the cows were on pasture 4.7 per cent of the samples scored 39 to 40 inclusive, and 67 per cent scored 38 to 39 inclusive. Twenty eight and three tenths per cent scored 37.5 or below.

The age of the cow, the lactation and the breed did not seem to have any significant influence on the flavor scores. There was no significant difference in the flavor scores of the morning, noon or night milkings. The scores for all three milkings seemed to follow the same general pattern.

CONCLUSIONS

1. More cows produced milk without a flavor criticism when fed on dry feed than when on pasture.
2. "Feed" flavor was the most predominant flavor defect found in milk regardless of whether the cows were fed on dry feed or were on pasture.
3. "Feed" flavor occurred more often in milk when the cows were on pasture compared to when they were fed on dry feed.
4. The lactation, age of the cows at freshening, or milking time in the day did not reveal any statistically significant differences in the flavor score of the milk.
5. The one year average flavor score of the Holstein milk was slightly higher than the one year average flavor score of the Jersey milk.

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