The problem of low solids-not-fat in milk

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LOW
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IN MILK

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(Based on a Paper read at the Annual Conference of the Australian Institute of Dairy Factory Managers and Secretaries, 19/3/1959.)

To the consumer of milk, the solids-not-fat fractions is of prime importance. This contains the protein, the minerals and the milk-sugar which collectively make milk such a valuable and palatable food. If we wish to encourage increased consumption of milk as a health food it is essential that quality must be maintained and if possible improved. Producers and distributors must always remember that if maximum sales are to be obtained, the needs of the consumer must remain paramount.

Under present regulations, fluid milk for human consumption must contain at least 8.5 per cent. solids-not-fat. When this conventional legal minimum was established it appeared to be a generous one for the producers. In most tables of foodstuff composition, milk is listed as containing something like 8.8 or 8.9 per cent. solids-not-fat. Thirty years ago most milk was of this quality. In those days the cows which were popular in English-speaking countries in fact secreted milk which in most cases contained at least 8.7 per cent. solids-not-fat. But since the early 1940's there has been a steady decline in the percentage of solids-not-fat in the milk being made available for human consumption. Professor Kay (1956), for example, has drawn attention to the steady deterioration in the quality of the milk sold in England since World War II. Most of the milk being sold is still above the standard laid down by law but only just so. This decline in milk quality is a serious matter for the consumer in particular. What factors have operated to produce such a world-wide change in a vital foodstuff?

BREED

There is no doubt that a change in the breed which dominates the national dairy herd is the main factor. Throughout America, Britain, Australia and New Zealand, Friesians have become universally popular. And there can be no argument that Friesians as a breed produce milk which barely satisfies the minimum standards. British figures show that on average Friesian milk contains only 8.58 per cent. solids-not-fat. English Short-horns are not much better with an average of 8.70 per cent. but this does give a
better margin for safety. Ayrshires are a shade better with 8.75 per cent, while the Channel Islanders average close to 9.00 per cent. In 1954, in a survey made in Gippsland, Wilson reports a similar variation according to breed.

In summertime the Friesian herds yielded milk with a range in value for solids-not-fat of 8.45 to 8.9 per cent. The bulk milk was quite satisfactory but here again the margin of safety was inadequate. In the wintertime the milk from these Gippsland Friesians fell to a range of 7.7 to 8.6 per cent. for solids-not-fat. The milk from Jersey herds showed a comparable decline during the winter months but because of the high margin of safety the bulk milk remained above standard.

The importance of breed in determining milk quality was demonstrated very clearly in an investigation carried out at Penrith, N.S.W. (Monro and Bailey, 1958). For 12 months milk samples were collected each week for analyses from pure-bred herds representative of the major breeds. All herds were situated close together and were dependent mainly on improved pasture. The Jersey herd, which averaged 2½ gallons of milk per cow daily throughout the year, never yielded bulk milk with less than 9 per cent. solids-not-fat or less than 4.4 per cent. butterfat. The Guernsey herd with an average daily yield of three gallons, on one occasion (when feed was scarce) produced milk containing only 8.5 per cent. solids-not-fat. The bulk milk, however, was never below standard. In contrast, both the A.I.S. and Friesian herds produced sub-standard milk when feed was in short supply.

No one disputes this breed factor. Many dairymen have already taken positive action to correct the position. Stud-breeders are sorting out strains within the Friesian breed which have an inherent capacity to produce milk reasonably high in solids-not-fat. Genetical studies indicate that high milk production and better-than-average solids-not-fat can be combined and transmitted to progeny. Meantime for immediate correction of a solids-not-fat problem Channel Island cattle are being introduced into Friesian and A.I.S. herds. In some cases, however, it may be necessary to add 30 per cent. of Channel Islanders to a herd of productive Friesians in order to make sure the milk never falls below standard. One can forgive a lover of Friesians for hesitating to make such a drastic change as this.

Some wholemilk producers have set out to improve the position by using high class Jersey or Guernsey bulls on their Friesian cows. Excellent first-cross heifers have been obtained this way. In fact considerable experimental evidence is now being accumulated which shows that dairy cows from pure-bred mothers but sired by bulls of another breed in general produce significantly more than their dams or pure-bred half-sisters.

At present the breeder who sets out to establish blood lines in which milk production and solids-not-fat are both dependable, is handicapped because it is not usual to test the milk of individual cows for solids-not-fat.

It is conceded, of course, that where the butterfat content is high, so also in general will be the solids-not-fat. More definite information about solids-not-fat values is needed, however, by the breeders of Friesians in particular. Given this information there is no doubt that full use will be made of families with an inherited capacity to produce heavy yields of good quality milk.

FEEDING

Emphasis has been given to the importance of breed in determining the quality of milk because there has been a tendency for those in control to ignore or side-step the obvious. When it comes to helping the dairy industry, however, it is probable that an understanding of the importance of feeding will be of more immediate value. Changes in breeding practice can only be of help in future years, whereas correct feeding can do much to eliminate the problem right now.

For many years it was taken for granted that the quality of a cow's milk was determined by the breeding of the cow. To a certain degree this is true. If a cow which normally produces rich milk is starved, it produces less milk rather than milk of poorer quality. But we now know that feeding practice can also have an important effect on quality. A classic example is the fall in butterfat content which occurs when the cow's ration is deficient in roughage. In a similar manner it has...
been shown that lack of readily available energy can cause a significant fall in the solids-not-fat fraction. Extensive research has been carried out overseas, particularly by the National Institute of Dairy Research at Reading in England. It has been shown (Bailey, 1952) that the solids-not-fat fraction of milk varies directly with the intake of energy (starch equivalent) and inversely with the dry matter. In other words a shortage of readily digested energy food can produce a fall in the percentage of solids-not-fat as well as a fall in yield. Likewise, if a ration becomes too bulky, i.e., it contains too much roughage, this can depress the solids-not-fat fraction in the milk. Of further interest is the fact that a lack of energy in the ration can cause a more marked fall in the protein content of the milk than will a lack of protein in the diet (Kay, 1950).

The research findings fit in very well with practical observations. It is significant that a depression in the solids-not-fat fraction of commercial milk occurs during those seasons of the year when feed is scarce and the cows are falling in condition. For example, on non-irrigated farms, trouble is seen towards the end of summer when the dry feed is of little value and hay is fed in large amounts. With the advent of rain and green feed the problem disappears. In contrast, on irrigated farms the depression in solids-not-fat is seen after the rains when the growth of pasture on low lying land is very slow, and hay again becomes an important item of diet. Incidentally I always associate a solids-not-fat problem with a lean herd, or at least with a herd where the top cows are lean.

Where milk is being produced which is low in solids-not-fat, the recommendations can be simple and clear cut. Palatable, readily-digested, high energy supplements must be fed at a generous level. Crushed cereal grains, pollard and commercial dairy meals all appear to be effective. In most cases the increase in the concentrate ration has a dramatic effect in improving milk quality and milk yield. Farmers who hesitated to provide this extra feed because of the costs involved have admitted that the increased yield paid for the extra feed. The main object, of course, is to tide the herd over a period of food shortage during which there is a risk of prosecution for selling sub-standard milk.

My only variation from what will be accepted as orthodox advice is to stress the importance of phosphatic supplements, particularly to cows on dry feed. In Western Australia it is also important to make sure that adequate cobalt is consumed. It is vital that dairy cows should have robust appetites and adequate cobalt is essential to maintain this appetite. It is of more than passing interest that areas affected with marginal deficiencies of cobalt are more extensive than formerly was considered to be the case.

Excessive roughage can cause a fall in solids-not-fat chiefly because roughage reduces the cow’s capacity to ingest high energy food. Those who have followed Professor Boutflour will remember that he obtained fantastic production by feeding the maximum amount of concentrates and the minimum amount of roughage to Friesian cows. It is not surprising that milk from many of his “gun” cows contained only the minimum of butterfat but the Professor made no secret of the fact that he had no intention of supplying any more butterfat than he was paid for. I know nothing of the solids-not-fat content of the milk produced but no doubt every care was taken to see that it was above standard. The use of high energy, low fibre rations would be expected to produce milk with better-than-average solids-not-fat.

Breeding and feeding are the two variables of most importance in determining the solids-not-fat content of milk. Other factors are of minor significance but should be mentioned.

DISEASE

When a cow becomes infected with mastitis the milk becomes abnormal and may be deficient in solids-not-fat. Likewise, in metabolic diseases which reduce yield, the milk tends to become sub-standard. One would expect this, of course, because in ketosis or acetonemia the fall in milk yield is due to starvation, that is, to a lack of the readily digestible food which is so important if milk quality is to be maintained. It is generally accepted, however, that disease is unlikely to become sufficiently prevalent in any one herd, to affect the quality of the bulk milk.
SEASON

The decline in solids-not-fat is generally seasonal. Here again it is the level of feeding which produces the change rather than the actual climatic conditions. All over the world disturbing falls in solids-not-fat occur during that season of the year when nutrition is at the lowest ebb. This in itself seems to confirm the opinion that with herds close to the borderline the supply of palatable food as such can be of prime importance in maintaining solids-not-fat at the required level.

STAGE OF LACTATION

The solids-not-fat content of milk varies with the stage of lactation and the age of the cow. Here again the variations are not likely to affect the quality of bulk milk. The solids-not-fat content in general is at a minimum about a month after calving. Likewise, cows producing at their peak in the prime of life (say six years of age) tend also to reach their minimum as regards percentage of solids-not-fat. Possibly if a farmer has a lot of mature cows calving together the quality of the milk could show a significant decline but this could only be of consequence in a herd where the general average was close to minimum requirements.

There can be a marked variation in the percentage of butterfat in morning and evening milk, where there is a difference in the intervals between milking. In general, however, the percentage of solids-not-fat does not vary. Certainly it is no solution of a solids-not-fat problem to mix morning and evening milk.

GENERAL

During recent years there has been a decline in the solids-not-fat content of the milk which has been available for human consumption. Because this decline has been so general suggestions have been made that the official standards laid down by the Health Act should be relaxed. It is well to remember, however, that milk holds its place as a valuable food because of the goodness it contains. In addition, much of the attractive flavour is due directly to the solids-not-fat fraction. In fact, the producers of whole milk could quickly lose business by agreeing to a reduction in standards. Discerning housewives are already using increasing quantities of dried milk powders as substitutes for natural milk. The realistic way to counter this trend is to improve the quality of the fresh milk so that the purchaser obtains better value, rather than less.

It is apparent from the facts presented in this article that with correct breeding and feeding practice, the dairy industry could produce milk which is richer in solids-not-fat. Unfortunately the dairy farmer is paid no more for rich milk than for milk which just satisfies the legal requirements. It follows that the profitable cows are those which produce a lot of milk rather than those which produce rich milk. It seems, therefore, that consideration should be given to the merits of contracts under which producers of milk for human consumption are paid according to the quality of the product.

REFERENCES

H. D. Kay (1956):
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