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# FEEDING FAT INTO MILK.

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As a manufacturer of salt, I have been brought into somewhat close connection with the dairy interests of the country; and the promotion of these interests have occupied a portion of my thoughts and studies for several years. Naturally the subject of feeding fat into milk has claimed a share of attention.

Numerous attempts have been made by private investigators and at the experiment stations to devise a food ration that would increase the percentage of butter fat in cows, milk. The dominating factor in these experiments has been a reliance on two classes of substances. namely. those known as carbohydrates and hydrocarbons The former include the starches, sugars, etc., existing naturally in or obtained artificially from vegetable sources. The hydrocarbons include the various fats and oils. Both the carbohydratEs and hydrocarbons are composed of the elements, carbon, hydrogen and oxygen united together in various ways and proportions.

The experiments thus far made with these food substances have been disappointing as the hoped-for result, notable increase of butter fat, has not been obtained Increase in the entire volume of milk has followed the use of some of these rations, and with this naturally an increase of the total amount of butter fat produced in a given time, but the percentage of butter fat has not been materially altered. For instance, a cow whose milk usually contains three per cent. of butter fat may, by the special diet, yield a larger quantity of milk, but its richness in fat will remain the same It will not be increased to four per cent. The reverse of this is also true ; if a cow that naturally gives five per cent. fat is placed on a restricted diet, her flow of milk will be reduced, but it will still retain its customary proportion of fat.

The organic compounds consisting of the elements carbon, oxygen. and hydrogen are not the only ones that enter into the dietary of cows. Nitrogen also finds its place, but under ordinary circumstances, to a limited extent only. The organic compounds containing nitrogen, include albumin, casein, gluten and many others which are conveniently grouped under the general name of "proteids" or "protein." We have then three important organic compounds which will be found in varying proportion in the ordinary and special diet of milch cows. The following table abridged from a recent publication will give an idea of the distribution of the principal ingredients contained in some of the substances used for this purpose.

The table shows the amount of the several classes of food-stuffs contained in 100 pounds of the raw material. The figures indicate pounds and fractions thereof:

| | Carbohydrates. (Starches, sugar, etc.) | Hydrocarbons. (Fats and oils) | Proteids. |
|---|---|---|---|
| Oats | 43.5 | 1.3 | 4.7 |
| Hay from flat pea | 36 | 2.4 | 13.5 |
| Alfalfa | 39.9 | 1.2 | 10.6 |
| Wheat (grain) | 64.2 | .9 | 9 1 |
| Bran | 45 5 | 2.6 | 10.4 |
| Linseed Meal | 24. | 16.9 | 24.4 |
| Cotton seed meal | 18. | 12. | 37. |
| Potatoes | 16.1 | .1 | 2.4 |

The thought that would naturally first occur to the investigator would be that if you wish to get an increased amount of fat out of a cow you must put an increased amount into her. To this end cotton seed and linseed meal both containing a large proportion of vegetable fat, and even pure tallow, have been fed, but without securing the expected and desired result. Next it was hoped that feeding freely with carbohydrates, first cousins as it were, to the hydrocarbons, would prove more successful. Such, however, was not found to be the case. This left only the proteins which exist largely in linseed and cottonseed meals. A recent writer sums up the matter of protein feeding as follows:

"There have been many experiments with dairy cows in this country, where some have been fed a ration rich in protein, while others in the same group received a ration less rich in protein. Now if we consider these two groups, it will be found that the cows getting the ration containing the most protein give milk a little richer in fat than those getting the ration less rich in protein. The difference is not over two-tenths of one per cent. Even here we are not sure that the difference is due to the protein, for it is often true that the protein ration contained more nutriment than the one fed in opposition to it. I think it very possible that time will show that rations rich in protein give milk slightly richer, perhaps one-tenth of one per cent. than rations equally nutritious, but with less protein. This difference is so small that it would not be noticed by a practical dairyman, though it is of great interest to the student and to the breeder."

A correspondent in the *Country Gentleman* writes as follows:

"The Hand-book of Experiment Station Work, which gives a summary of experiment station results up to 1893, in discussing the effect of food upon the quality of milk, mentions but one experiment out of a large number, where a direct and important change in the kind of milk appeared to be due to the variations in the food, viz , an experiment at the Iowa station in which gluten meal was substituted for corn meal This experiment seems to stand as an anomaly among the numerous results obtained along the lines of investigation."

Although it is not distinctly stated, the quotation above given implies the gluten meal did increase the butter fat. If such was the case it is surprising that the experiment was not repeated in order to ascertain whether the result was purely accidental or whether it would be depended on as a general rule. If it should be found that gluten meal will increase butter fat, the rest is simply a question of mathematics. Find out by experiment the relative increase of fat per ton of gluten, and compare the market values of the meal and the butter. In other words can it be used economically at all seasons, or at any seasons of the year? If the meal costs more dollars than than the increased amount of butter will sell for, manifestly gluten meal will not be largely employed in making up a standard ration.

There is, however, a scientific feature of this experiment that appears to have been overlooked; namely, the fact that gluten meal contains a very considerable amount of nitrogen. In other words it is a protein compound.

A correspondent of the *Practical Dairyman* (April, 1896) states that he has been feeding his cows with skimmed milk and has noticed a material increase of the butter yield. Here we have a ration composed of carbohydrates (milk-sugar) and protein (casein) with a small amount of mineral salts and a large amount of water. Is it then the milk-sugar or the casein that affects the result?

At this point let us turn to the teachings of physiology and see if it will throw any light on the subject. To this end I will quote a paragraph from Foster's Text Book of Physiology (*Sixth Am. Edition*, Phila., 1895) as follows:

"The secretion of milk then would appear to illustrate, even more fully and clearly than do other glands, the truth on which we have so often insisted, that a certain secretion is eminently the result of the metabolic activity of the secreting cell. The blood is the ultimate source of milk, but it becomes milk only through the activity of the cell, and that activity consists largely in a metabolic manufacture by the cell, and in the cell, of the common things brought by the blood into the special things present in the milk Experimental results tell the same tale. Thus the quantity of fat present in milk is largely increased by proteid, but not increased—on the contrary diminished—by fatty food. This effect on the mammary gland in particular is in accordance wtth what we shall presently learn to be the general effect on the body of proteid in contrast to that of fatty food; proteid food seems to increase the general metabolic activity of the body, while fatty food tends to lessen it. Moreover, the proteid food seems actually to furnish the fat; and we have already suggested a manner in which proteids may give rise to fat. That the fat of the milk need not necessarily come from the fat of the food is shown by the following experiment: A bitch fed on meat for a given period gave off more fat in her milk than she could possibly have taken in her food; and this moreover took place while she was gaining in weight and laying on fat, so she could not have supplied the mammary gland with fat by simply transferring fat from the store previously existing in the adipose tissue of her body; she apparently obtained the fat ultimately from the proteids of her food And the historical facts given above favor the view that the formation of fat out of the proteids in such cases t kes place in the cells of the alveoli The experimental then, as well, as the histological evidence goes to show that the fat of milk is formed in the cell and by the cell, and is not simply gathered out of the blood."

The facts now before us are, that protein feeding has been practiced to a limited extent and with beneficial effect as regards the increase of butter fat; carbodydrate and hydrocarbon feeding have not been followed by an increased ratio of fat; physiology offers an explanation of the unlooked for results.

Under the circumstances it would certainly seem desirable for the experiment stations to thoroughly investigate the question of protein feeding. If the results should prove negative no great harm would result, while if the addition of protein to the customary ration should be found to increase the value of the butter yield over and above the cost of the food, every buttermaker would be the gainer.

The most available protein at the command of the dairyman is contained in the skimmed milk, now used chiefly for the production of veal, pork and filled cheese. Let, then, the intelligent dairyman whose herd is healthy and who skims his own milk, feed back the skim mixed with the customary food.

When, however, the milk is taken to a skimming station and each patron receives back his proportion of the skim, its direct feeding is not to be advised, for reasous very forcibly pointed out by Prof. Conn.: namely, the danger of spreading tuberculosis.

Fortunately the tubercle bacillus is readily destroyed by heat. Let, then, the skimmed milk from the station stand until it sours. It should then be boiled until the curd separates, and when the whey is drained off, the curd mixed with the proper grain or meal ration may be fed to the cows with comparatively little danger of spreading tuberculosis.

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