

to yield an unusual quantity both of casein and watery fluid, which could only be separated by melting the butter.

It is a common opinion in some districts, that by adding hot water to the churn, more butter is obtained than by using cold water. Experiments made for the express purpose did not show that the weight increased very much, and it was attended with a perceptible deterioration in quantity, giving it generally the appearance of over-churning.

The results of the experiments above detailed are,—

1st. That the addition of some cold water, during churning, facilitates the process, or the separation of the butter, especially when the cream is thick, and the weather hot.

2nd. That cream alone is more easily churned than a mixture of cream and milk.

3rd. That butter produced from sweet cream has the finest flavour when fresh, and appears to remain the longest period without becoming rancid.

4th. That scalded cream, or the Devonshire method, yields the largest quantity of butter; but if intended to be salted is most liable to acquire a rancid flavour by keeping.

5th. That churning the milk and cream together, after they have become slightly acid, is the most economical process for districts where buttermilk can be sold; whilst at the same time it yields a large amount of excellent butter.

Mr. Rowlandson further observes, that milk is composed of casein, butter, sugar, water, and a small amount of inorganic salts; it has also been stated that the covering of the fatty globules of the milk is dissolved by acetic or lactic acid; seeing this, it is easy to conceive that cream or milk, a little aced, will "give" the butter with less labor in churning than when the milk cream is void of acidity. Milk like the juice of fruits, such as the grape, apple, pear, &c., contains the principal ingredients requisite for the vinous fermentation, viz., sugar, and a protean compound—soluble albumen—the latter liable to enter into rapid changes when exposed to the influence of the oxygen of the atmosphere; by which means it becomes converted into a ferment, which has the property of slowly, in the first instance, converting the sugar of the milk into alcohol, which latter, by further oxidation, is converted into lactic acid, the lactic acid acting upon the coating of the fatty globules as previously noticed. This action invariably takes place during warm weather, the original fermentative action being somewhat similar to that of the mode of brewing beer at a low temperature, as practised in Bavaria.—Dr. Lyon Playfair has, however, stated that in winter a different action takes place—namely, that during cold weather the temperature is not sufficiently elevated to cause vinous fermentation, and that the action of the oxygen, in the first instance, at this season, is confined to the casein, in other words, the putrefactive fermentation takes place. It is impossible, therefore, to make good butter from milk undergoing such a change

as is here named, for when incipient putrefaction has once commenced, it cannot be arrested by ordinary means, and is consequently imparted to the minute quantity of casein remaining in the butter, and is never wholly extracted; such butter speedily becomes rancid, even in winter, notwithstanding the low temperature of that season is unfavourable to the promotion of putrefactive changes.

The reason why sweet cream requires less churning than cream and milk mixed, arises from the circumstance that in cream alone the absorption of oxygen, which takes place at every agitation, is diffused throughout a much smaller quantity of liquid, the lactic acid formed is consequently much more concentrated, and acts with greater energy on the outer coating of the butter globules; butter, therefore, comes more quickly. It must be observed that, however sweet the cream may be, when placed in the churn, butter is never formed until after the formation of lactic acid. In making butter, sweet cream is a relative, rather than an absolute term, for in fact acedness commences within a few hours after the milk has been set to stand. In endeavouring to obtain butter from sweet milk alone, the labor required to form the butter is excessive, for in this instance the quantity of oxygen that can be absorbed through the influence of agitation is proportionally decreased in the ratio of the increased quantity of liquid throughout which the butter is diffused; whilst, at the same time, a larger amount of oxygen is required in order to convert a portion of the sugar of milk into alcohol, and ultimately into lactic acid. But in a closed churn a long time elapses before these changes take place; consequently, we need not be surprised to find that Dr. Traill and others failed to obtain butter from a sweet milk alone; yet on one occasion the experiment was tried in Carlisle, butter was obtained from new milk under the inspection of the writer, but it took upwards of five hours to produce it, and the butter was of inferior quality, having all the characteristics of overchurned butter. The reason why it is found requisite in practice to churn milk and cream mixed at a higher temperature has a marked influence in promoting chemical changes. Reasons have already been assigned why the lactic acid, formed in milk alone, must be in a much more diluted form than that which will be found in cream slightly aced; in order to compensate for this, a higher temperature and longer time is required to produce the desired effect.

The preceding phenomena are in strict accordance with the character of the churn used in the various districts where the lacteal products of the cow are churned in different forms. Almost invariably, certainly over the most extended area, the common barrel churn is used in those districts where cream is churned alone. By the barrel churn a large quantity of butter may be made from cream, with a moderate degree of rapidity, and at a comparatively slight expenditure of labour, particularly as cream, when put into the churn, is almost invariably in some degree aced, generally enough so for the purpose of obtaining the butter without requiring to be further