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NOTE ON THE CONCENTRATION OF CONDENSED MILK.

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IN the case of unsweetened condensed milk the method of calculating the concentration which has been effected, and the water required to dilute the product to its original strength, is of the simplest possible character. But in the case of sweetened condensed milk certain factors exist which, if not taken into account, may lead to a serious miscalculation as to the concentration. Thus, the "Milkmaid" brand, which is a typical and well-known make of sweetened condensed milk, contains, according to the analysis of Pearmain and Moor, 37·6 per cent. of milk-solids, 38·7 per cent. of cane-sugar, and 23·7 per cent. of water. The milk-solids are three times as high as in uncondensed milk of good quality, which may be taken as containing 12·5 per cent. of solids and 87·5 per cent. of water. The water originally associated with 37·5 per cent. of milk-solids would be $37·5 \times 3 = 262·5$, whereas the condensed milk contains only 23·7 parts of water for the same amount of milk-solids. Therefore, 238·8 parts of water out of 262·5 originally present, or about ten-elevenths of the whole, must have been evaporated. But the addition of cane-sugar dilutes the milk thus concentrated, so as to produce a finished product containing only three times the proportion of milk-solids present in unconcentrated milk. Hence the addition of twice its weight of water to the condensed milk will reduce the milk-solids to their original proportion. But, as the dilution is in practice effected by measure rather than by weight, the number of measures of water (W) required to reduce one measure of condensed milk to its original concentration may be found by the following equation:

$$\text{Measures of water required for dilution (W)} = \frac{\text{Milk-solids in condensed milk (C)} \times \text{sp. gr. (G)}}{\text{Milk-solids in diluted milk (D)}} - 1.$$

Sweetened condensed milk of the character of the "Milkmaid" brand has a specific gravity of about 1·28. If this figure be accepted, and the milk-solids of the original milk be taken at 12·5 per cent., then the above equation becomes:

$$W = \frac{C \times 1·28}{12·5} - 1; \text{ or } W = 0·1024C - 1.$$

Taking as an example the "Milkmaid" brand with 37·6 per cent. of milk-solids, somewhat less than three measures of water will reduce it to the primary concentration:

$$W = (0·1024 \times 37·6) - 1 = 2·85.$$

Similarly, the percentage of milk-solids which will be contained in a diluted condensed milk may be found by the equation :

$$\text{Milk-solids in diluted milk (D)} = \frac{1.28C}{W + 1}.$$

Thus, taking the "Milkmaid" brand, if the milk be diluted with the maximum quantity of water directed on the label, namely, 14 parts, the diluted milk will contain 3.21 per cent. of milk-solids :

$$\frac{1.28 \times 37.6}{14 + 1} = 3.21.$$

If for the value of C in the above equation the percentage of fat (F) in the condensed milk be substituted, the proportion of fat in the diluted milk will be found. In the case of the "Milkmaid" brand, diluted to the maximum as before, this will be :

$$\frac{1.28 \times 11.0}{14 + 1} = \frac{14.08}{15} = 0.94 \text{ per cent. of fat in the diluted milk.}$$

The foregoing equations give the dilution necessary to bring the parts of milk-solids per 100 measures of the diluted condensed milk to that contained in the original milk before concentration. If unity, when it appears in the above equations, be multiplied in each case by the specific gravity of the condensed milk (= 1.28), the equations will give the dilution necessary to yield a product containing 12.5 per cent. by weight of milk-solids.

The following table shows the proportion of fat which would be contained in representative brands of sweetened condensed milk if the contents of the tin were diluted with the amount of water directed on the labels. The calculations have been based on the assumption that the condensed milk before dilution had in each case a specific gravity of 1.28. This is the result of experiment on typical preparations of the kind.

	Brand.	Number of parts of Water recommended to be added to one part of Condensed Milk for cooking and ordinary use.	Percentage by weight of Fat in Milk thus diluted.	Number of parts of Water recommended to be added to one part of Condensed Milk for infants' use.	Percentage by weight of Fat in Milk thus diluted.
A	Alderney ...	5 to 6	2.32 to 1.94	6 to 8	1.94 to 1.52
B	Arcadia ...	4 to 5	1.95 to 1.63	7 to 14	1.24 to 0.68
C	Cowslip ...	4 to 5	0.34 to 0.28	Not stated	Not stated
D	Devon ...	4 to 5	2.06 to 1.72	6 to 14	1.50 to 0.71
E	Farm ...	4 to 5	0.03 to 0.02	Not stated	Not stated
F	Fourpenny ...	4 to 5	2.52 to 2.10	7 to 14	1.60 to 0.87
G	Full weight ...	4 to 5	2.81 to 2.34	7 to 14	1.79 to 0.97
H	Goat ...	5	0.87	Not stated	Not stated
I	Milkmaid ...	4 to 5	2.66 to 2.22	7 to 14	1.69 to 0.92
J	Nestle's Swiss	4 to 5	3.30 to 2.77	Not stated	Not stated
K	Rose ...	4 to 5	3.00 to 2.50	7 to 14	1.91 to 1.04
L	Threepenny ...	4 to 5	0.07 to 0.06	Not stated	Not stated