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STANDARD MILK AND CREAM

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Summary.

Half of the milk produced in Illinois is sold by weight or measure without regard to its composition or food value.

Milk containing a high per cent. of fat is not only worth more for food but it costs more to produce than milk containg a low per cent. of fat and its price should be governed by its food values and not by its bulk.

By standard milk and cream is meant that which has been brought to a certain known composition, thus establishing a true basis for valuation.

Nearly all milk used for direct consumption is sold by measure alone regardless of its food value.

Frequently one quart of milk contains twice the food value of another yet both sell for the same price.

No other commodity is bought and sold with such disregard of its food value. All milk should be sold according to its composition, and milk intended for direct consumption should be standardized, not only that its exact composition may be know but also that definite commercial grades of milk may be established with corresponding values.

Since fat in milk is the most variable constitutent, the other solids remaining fairly constant, standardizing is a comparatively simple matter. All that is necessary is to add or remove a certain amount of butter-fat.

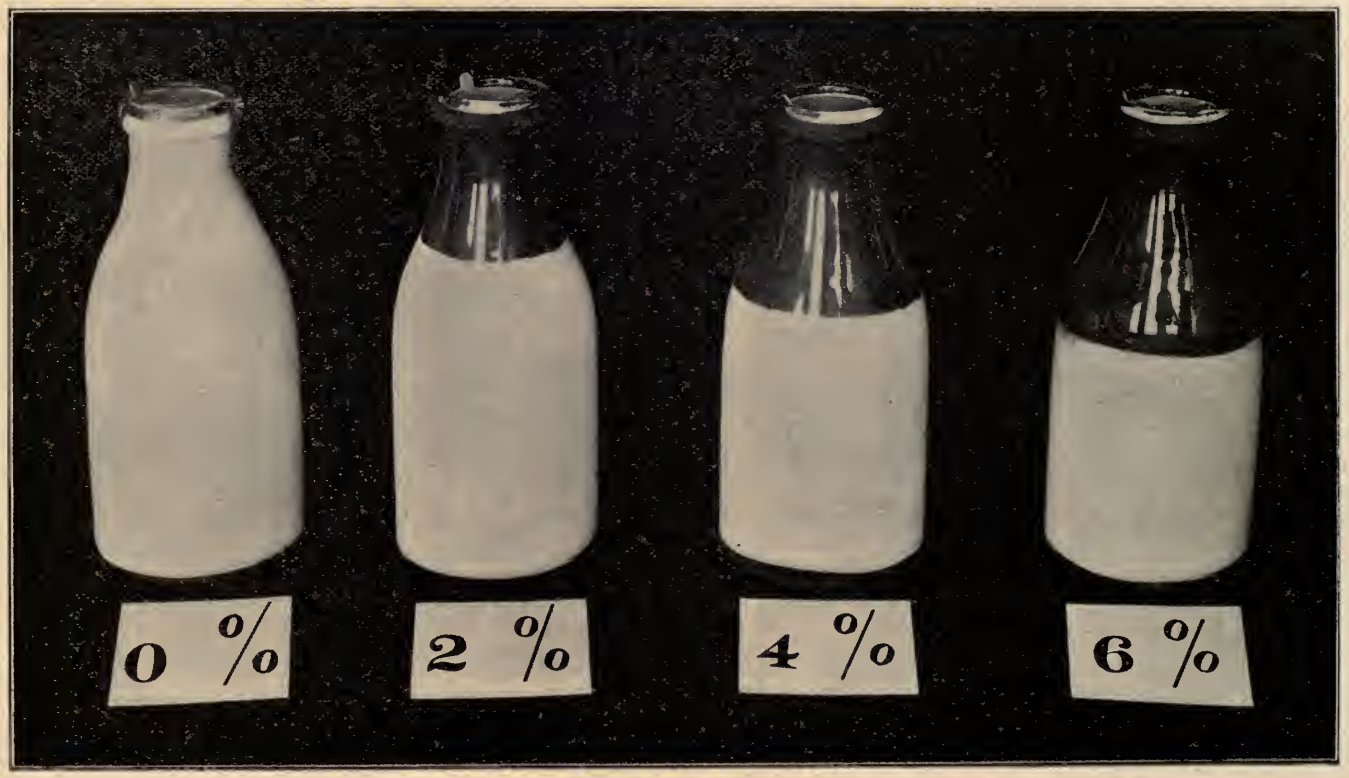
A law requiring the standardization of milk and cream sold for direct consumption would result in justice to both seller and buyer.

Such a system would be no more difficult to control than the present one of minimum limits.

Milk for direct consumption should not only have a standard of values but of cleanliness as well and should be produced under rigid inspection.

No subject is of more consequence to the people from the standpoint of both economy and health, than that milk should be produced under rigid inspection laws. Such a system would be of as much advantage to the better class of dairymen as to the consumer.

The Department of Dairy Husbandry, of the University of Illinois Agricultural Experiment Station, in an investigation of the dairy conditions of the state, finds that in nearly all cities, at the condensing factories and many creameries, milk is sold by measure or weight and almost entirely without reference to its composition or food value. It is safe to say that half of the milk produced in the state is sold in this way. Only five cities besides Chicago have any system of milk inspection whatever, or pay any official attention to the composition of the milk sold, and the only requirement in these cities is that milk must contain at least three per cent. fat and twelve per cent. total solids. The result is that milk varying greatly in composition is sold for the same price.



STANDARDIZED MILK, SHOWING THE AMOUNT OF CREAM ON MILK CONTAINING THE DESIGNATED PER CENT. OF BUTTER-FAT.

The Composition of Milk

The average composition of milk may be fairly represented by the following:

	PER CENT.
Water	87.50
Total solids	12.50
Casein and albumen	3.30
Butter-fat	3.50
Milk sugar	5.00
Ash	.70

The solids not fat are fairly constant but the fat is exceedingly variable. The fat in milk from different cows frequently varies from three per cent. to seven per cent. and greater differences than these are occasionally found. The chief causes are breed, individuality and length of time from freshening. The variations in the composition of milk are clearly shown in Bulletin 51 of this Station, published in May, 1898, and it is upon these variations in composition that the food value of milk entirely depends.

The Food Value of Milk.

Milk furnishes all the constituents necessary to nourish the body, keep it in repair, and furnish warmth and energy for work. A quart of average milk will furnish about the same amount of nutrition as three-fourths of a pound of meat; and if its true food value were fully appreciated, milk would be used much more freely than it now is, to the advantage of both the health and economical sustenance of the people, Each person consumes an average of twenty-five and a half gallons of milk in a year, or an ordinary tumblerful each day. Although this is one of the great dairy countries of the world we do not consume more than one-third the amount of milk per capita that is used in some European countries. This is doubtless due to the failure of Americans to appreciate its food value. In this country it is generally used as a condiment in tea or coffee, on berries and fruit, or for a beverage when drunk at all and not as a regular article of food as are bread, meat, and potatoes.

Many who understand that milk varies in composition think that its food value is based entirely upon the amount of butter-fat which it contains. While it is true that the fat in milk is a very important factor, it is also true that skim milk containing little or no fat has yet a high food value. Skim milk has practically the same composition as whole milk, with the exception of the butter-fat which has been removed in the cream, and for supplying the body with albuminoids alone is worth exactly the same, quart

for quart, as whole milk. Since the albuminoids are lacking in the diet of many people, especially those who do not eat meat freely, skim milk would be a valuable and economical adjunct to their food. For the purpose of furnishing the body with energy skim milk is worth one-half as much as whole milk containing 4 per cent. butter-fat. The objection may be raised that skim milk is not palatable, and while this is true to a certain extent, yet milk containing a small amount of fat makes an excellent drink and can be freely used to advantage, especially in cooking. The following table shows the food value of milk compared with beef :

TABLE I. AMOUNT OF THE DIFFERENT INGREDIENTS AND FUEL VALUE IN 25 CENTS WORTH OF WHOLE MILK, SKIM MILK, AND ROUND BEEF STEAK.

(Estimated prices whole milk, containing 3 per cent. fat, 5 cents a quart; skim milk, 2.8 cents a quart; round steak 12½ cents a pound.)

	Amount.	Protein, lb.	Fat, lb.	Carbohydrates, lb.	En'gy value, calories.
Whole milk.....	5 qt.	.369	.325	.542	3066
Skim milk.....	8.9 qt.	.657	.019	.966	3099
Beef steak.....	2 lb.	.360	.240		1682

From the above table it is seen that equal values of whole milk and beef steak contain practically the same amount of protein and that skim milk contains nearly twice as much, while the energy value of 25 cents worth of either whole or skim milk is nearly twice that of beef steak. In other words the energy value of 13⅓ cents worth of milk is equal to 25 cents worth of round beef steak. Yet people invariably consider milk as something of a luxury and think they are economizing by restricting its use as much as possible, although they buy meat freely considering it one of the necessities of life. They fail entirely to realize that the elements needed to nourish the body may be obtained from milk more cheaply than from meat, and that milk takes the place of other foods, thus diminishing the quantity of other nutrients needed. It is for this reason the quantity of milk consumed in this country is not so great as economy would warrant, considering its food value.

NEED OF STANDARDS IN THE SALE OF MILK.

In the aggregate an enormous amount of milk is consumed for it is used daily by nearly all classes of people regardless of their station in life; and, since it forms an economical factor in their

sustenance, a correct basis of sale is important. To show the injustice of the present system of selling milk even in a city where a standard is required the following extract and tables are taken from circular No. 13 of this Station, upon "The Milk Supply of Chicago," by Miss Jane Adams of Hull House, Chicago, and Dr. H. S. Grindley of the Chemical Department of the University of Illinois.

The purpose of this investigation was to obtain definite information concerning the costs and the varations in the chemical composition or quality of the milk furnished to consumers in the city of Chicago. So far the milk supply of two districts of the city has been studied. Hull House is situated in one of the most densely populated of the "West Side" districts. The district is inhabited largely by immigrants representing nearly every nation in Europe, who do not readily see the point of difference between "amount of food" and the mere bulk or weight of the purchased article, and whose economic condition is such that apparent cheapness is nearly always a determing factor in their choice of food.

The Lewis Institute, on the other hand, is situated in a district of Chicago which contains for the most part the homes of people in fairly comfortable circumstances. The residents are chiefly business and professional men and employes of the better paid callings. This being the case it was expected that the intelligence and standard of material comfort of the community would, in the main lead to a choice of milk of a fairly good quality.

COLLECTING SAMPLES OF MILK FOR ANALYSIS.

The samples represent as nearly as possible the milk actually supplied to the consumers. Samples were not taken from every dealer, but it is believed that the number taken represents the milk supply of the districts studied. In every case the samples were purchased either directly from the delivery wagons on their routes or from the shops of retailers. They were bought as if intended for personal consumption. They represent, therefore, milk as delivered to consumers. The analyses of the samples were made immediately upon their receipt in the laboratory. In the analyses made in the winter of 1896-97 only the fat and total solids were determined. In the samples analyzed during the spring of 1898, the total solids, fat and casein were determined in all but a few cases where the content of fat was three and one-half per cent or more.

The composition of the various samples of milk is shown in the following tables.

TABLE 2.

Composition of samples of milk collected by Hull House during the winter 1896–97.*

Sample number.	Price per quart.	Total solids.	Fat.	Solids not fat.	Sample number.	Price per quart.	Total solids.	Fat.	Solids not fat.
	Cents.	Per Cent.	Per Ct	Per Cent.		Cents.	Per Cent.	Per Ct	Per Cent.
1	5	9.06	1.30	7.76	51	4	11.98	2.80	9.18
2	5	13.42	5.00	8.42	52	5	12.56	3.30	9.26
†3	3	10.25	1.00	9.25	53	4	12.85	3 80	9.05
†4	3	10.75	2.00	8.75	54	5	11.15	3.60	7.55
5	4	12.55	3.50	9.05	55	5	15.16	7.50	7.66
6	5	12.90	4.00	8.90	56	4	11.36	2.60	8.76
7	5	14.26	6.00	8.26	57	4	12.19	3.20	8.99
8	5	9.19	2.00	7.19	58	4	11.24	2.90	8.34
†9	2	8.40	0.05	8.35	59	3	11.84	3.10	8.74
†10		6.70	1.00	5.70	60	4	13.14	4.50	8.64
11	4	12.30	3.40	8.90	61	4	9.46	1.30	8.16
†12	3	7.80	0.60	7.20	62	2	11.02	2.10	8.92
13	4	8.75	2.20	6.55	63	5	8.80	1.50	7.30
14	5	6.24	2.00	4.24	64	3	10.88	2.30	8.58
‡15	4	11.39	2.10	9.29	65	4	9.42	1.60	7.82
†16	3	10.25	1.00	9.25	66	3	9.53	0.50	9.03
†17	3	9.35	0.50	8.85	†67	3	10.12	1.00	9.12
†18	3	9.55	1.20	8.35	68	6	13.70	6.00	7.70
19	6	11.98	2.90	9.08	69	5	11.25	2.50	8.75
20	3	12.75	3.50	9.25	70	5	11.60	3.00	8.60
21	6	14.02	6.20	7.82	71	2	11.95	3.50	8.45
22	4	13.64	4.00	9.64	72	5	11.50	2.00	9.50
23	5	9.76	1.70	8.06	73	3	9.62	2.20	7.42
24	5	12.36	2.90	9.46	74	5	14.20	6.00	8.20
25	5	12.30	3.00	9.30	75	5	11.21	1.90	9.31
26	5	11.85	2.70	9.15	76	5	14.80	6.50	8.30
27	5	14.68	6.40	8.28	77	5	14.20	6.00	8.20
28	4	8.70	1.00	7.70	78	5	12.05	4.00	8.05
29	5	11.02	2.20	8.82	79	6	13.50	5.00	8.50
30	5	11.84	2.90	8.94	80	4	13.15	4.50	8.65
31	5	13.88	4.20	9.68	81	5	12.67	4.00	8.67
32	5	11.50	2.60	8.90	82	6	14.10	5.70	8.40
33	5	13.82	5.00	8.82	83	5	11.00	2.50	8.50
34	5	13.15	4.10	9.05	84	5	10.54	1.70	8.84
35	5	12.50	3 00	9.50	85	5	10.87	2.50	8.37
36	3	11.47	2.10	9.37	86	5	11.25	2.50	8.75
37	5	11.78	2.80	8.98	87	5	11.73	3.40	8.33
38	5	16.28	8.20	8.08	88	3	14.20	6.00	8.20
†39	2	9.89	0.80	9.09	89	4	11.31	3.70	7.61
40	4	11.93	3.40	8.53	90	4	10.05	1.00	9.05
41	5	10.51	1.00	9.51	91	4	12.80	4.00	8.80
§42		17.85	9.50	8.35	92	4	11.68	2.80	8.88
43	4	13.98	4.20	9.78	93	5	11.00	2.50	8.50
44	5	13.17	3.90	9.27	94	5	11.81	2.80	9.01
45	4	12.27	2.80	9.47	95	4	10.26	2.30	7.96
46	4	12.25	3.20	9.05	96	4	11.45	3.90	8.45
47	4	11.04	1.80	9.24	97	4	11.48	2.90	8.58
48	4	12.44	3.40	9.04	98	6	13.50	5.20	8.30
49	5	12.58	3.70	8.88	99	4	11.83	3.40	8.43
50	3	12.01	3.20	8.81	100	4	13.04	4.20	8.84
Average.....							11.74	3.18	8.54

* The samples for the analyses given in this table were collected by a resident of Hull House and analyzed by Dr. Elizabeth Cooke, of the Lewis Institute.

† Sold as skim milk.

‡ Mixed—meaning mixed whole and skim milk.

§ Sold as cream.

TABLE 3.

Composition of samples of milk collected by Hull House during the spring of 1898.*

Sample number.	Total solids.	Fat.	Solids not fat.	Casein and albumen.	Sample number.	Total solids.	Fat.	Solids not fat.	Casein and albumen.
	Per Cent.	Per Cent.	Per Ct.	Per Ct.		Per Cent.	Per Ct.	Per Ct.	Per Ct.
101	11.81	3.25	8.56	3.00	151	11.85	2.70	9.15	3.30
102	11.52	2.35	9.17	3.50	152	11.70	3.05	8.65	3.17
103	11.14	2.60	8.54	3.00	153	10.94	2.20	8.74	3.29
104	12.15	3.40	8.75	3.19	154	10.13	1.10	9.03	3.46
105	12.15	3.25	8.90	3.28	155	11.03	2.60	8.43	3.41
106	.....	5.02	....	....	156	11.56	2.85	8.71	3.08
107	11.10	2.00	9.10	3.44	157	11.69	2.75	8.94	3.75
108	11.62	2.80	8.82	3.37	158	15.41	7.00	8.41	3.24
109	.....	5.00	....	....	159	11.33	2.55	8.78	3.29
110	.....	4.45	....	....	160	11.53	2.90	8.63	3.16
111	11.45	2.75	8.70	3.34	161	12.05	3.40	8.65	3.19
112	11.41	3.20	8.21	3.16	162	11.84	4.10	7.74	2.86
113	11.68	3.30	8.38	3.21	163	12.26	3.25	9.01	3.31
114	.....	3.65	....	....	164	11.70	2.85	8.85	3.13
115	.....	3.65	....	....	165	10.91	2.50	8.41	3.07
116	12.08	3.35	8.73	3.22	166	12.18	3.35	8.83	3.32
117	.....	10.40	....	....	167	12.04	3.60	8.44	3.19
118	11.73	3.28	8.45	3.44	168	11.46	2.95	8.51	3.31
119	12.02	3.25	8.77	3.34	169	9.88	0.90	8.98	3.42
120	11.56	3.00	8.56	3.22	170	12.76	4.05	8.61	3.34
121	11.54	2.75	8.79	3.23	171	12.47	4.00	8.47	3.25
122	10.85	2.20	8.65	3.25	172	12.57	3.70	8.87	3.44
123	13.18	3.35	8.83	3.29	173	17.13	9.20	7.93	3.17
124	9.75	0.50	9.25	3.35	174	11.01	1.90	9.11	3.50
125	11.65	3.00	8.65	3.16	175	18.44	9.95	8.49	3.13
126	11.96	3.25	8.71	3.27	176	12.06	2.90	9.16	3.50
127	11.08	3.35	8.73	3.34	177	12.70	4.25	8.45	3.31
128	10.70	1.40	9.30	3.49	178	12.68	3.85	8.83	3.25
129	9.52	0.60	8.92	3.07	179	12.01	3.10	8.91	3.53
130	11.07	2.55	8.52	3.19	180	11.91	3.15	8.76	3.30
131	9.62	1.00	8.62	3.20	181	9.22	0.75	8.47	3.02
132	.....	4.80	....	....	182	12.18	3.25	8.93	3.52
133	.....	3.50	....	....	183	9.53	0.90	8.63	3.22
134	.....	3.80	....	....	184	10.58	2.25	8.33	3.26
135	11.15	2.30	8.85	3.35	185	11.57	2.60	8.97	3.44
136	11.57	2.30	9.27	3.29	186	11.11	2.20	8.91	3.31
137	11.68	2.70	8.98	3.29	187	11.83	3.00	8.83	3.47
138	11.01	1.70	9.31	3.30	188	10.75	2.45	8.30	2.92
139	11.65	2.75	8.90	3.30	189	12.79	3.60	9.19	3.38
140	10.88	1.65	9.23	3.33	190	9.83	2.13	7.70	2.62
141	10.95	2.25	8.70	2.99	191	10.86	2.85	8.01	2.81
142	11.18	1.85	9.33	3.40	192	11.11	2.60	8.51	3.02
143	10.38	0.80	9.58	3.56	193	12.86	3.95	8.91	2.95
144	11.75	2.35	9.40	....	194	11.17	2.18	8.99	3.07
145	11.11	2.30	8.80	3.21	195	10.33	1.45	8.88	3.12
146	9.87	1.45	8.42	3.52	196	11.13	2.60	8.53	3.14
147	12.10	3.20	8.90	3.34	197	13.06	4.10	8.96	3.21
148	12.66	3.95	8.71	....	198	11.63	2.83	8.80	3.36
149	11.77	2.45	9.32	3.63	199	13.85	4.48	9.37	3.58
150	9.79	0.70	9.09	3.54	200	11.43	2.45	8.98	3.32
Average.....						11.61	3.04	8.77	3.27

† The analysis of these samples of milk was made by H. S. Grindley and J. L. Sammis of the Department of Chemistry of the University of Illinois.

Table 4.

Composition of samples of milk collected by Lewis Institute during the winter of 1896-7.*

Sample number.	Price per quart.	Total solids.	Fat.	Solids not fat.	Sample number.	Price per quart.	Total solids	Fat.	Solids not fat.
	Cents.	PerCent	Pr. Ct.	PerCent		Cents.	PerCent	Pr. Ct.	PerCent
†201	6	11.8	3.2	8.6	244	6	10.8	2.3	8.5
202	6	11.6	2.9	8.7	245	6	9.5	2.5	7.0
203	5	11.4	2.8	8.6	246	6	10.6	2.4	8.2
204	6	13.3	4.8	8.5	247	5	11.2	3.1	8.1
205	6	11.7	3.4	8.3	248	5	12.0	3.5	8.5
206	6	11.7	3.4	8.3	249	6	11.0	2.5	8.5
207	6	11.5	3.0	8.5	250	5	10.4	2.0	8.4
208	6	14.9	6.4	8.5	251	6	10.5	2.2	8.3
209	6	11.8	3.6	8.2	‡252	5	11.8	2.8	9.0
210	6	14.8	6.4	8.4	253	6	9.8	1.6	8.2
211	6	11.2	3.0	8.2	254	5	11.6	3.0	8.6
212	6	11.5	3.4	8.1	255	5	10.4	2.4	8.0
213	6	14.3	6.2	8.1	256	5	11.7	2.5	9.2
214	6	12.9	4.4	8.5	257	5	10.9	2.0	8.9
215	6	11.7	3.2	8.5	258	5	11.9	3.5	8.4
216	6	11.3	3.2	8.1	259	5	11.6	2.8	8.8
217	6	11.8	3.1	8.7	260	5	11.5	3.0	8.5
218	6	11.5	3.0	8.5	261	5	11.2	2.9	8.3
219	7	13.0	3.4	9.6	262	5	10.4	1.8	8.6
220	6	11.7	3.0	8.7	263	5	11.5	2.7	8.8
221	6	12.0	3.3	8.7	264	5	11.3	3.0	8.3
222	6	11.6	2.8	8.8	265	5	11.4	2.9	8.5
223	6	13.1	4.2	8.9	266	5	11.3	3.2	8.1
224	6	11.2	2.6	8.6	267	5	11.5	3.8	7.7
225	6	10.8	2.2	8.6	268	5	11.2	2.9	8.3
226	7	12.9	4.4	8.5	269	5	11.2	3.0	8.2
227	7	11.8	3.4	8.4	270	6	10.5	2.1	8.4
228	5	10.8	2.2	8.6	271	5	12.4	4.6	7.8
229	6	11.1	2.7	8.4	272	6	11.5	3.4	8.1
230	5	11.2	3.0	8.2	273	6	11.9	3.7	8.2
231	6	11.5	3.2	8.3	274	6	12.1	3.5	8.6
232	7	12.8	4.6	8.2	275	5	11.0	2.2	8.8
233	6	11.2	2.8	8.4	276	5	11.7	3.0	8.7
234	6	11.0	2.4	8.6	277	5	11.3	2.7	8.6
235	6	11.0	2.7	8.3	278	5	10.6	2.2	8.4
236	6	10.5	2.9	7.6	279	5	11.5	2.9	8.6
237	6	11.1	3.0	8.1	280	5	11.3	2.6	8.7
238	6	11.5	3.3	8.2	281	5	10.9	2.0	8.9
239	5	11.5	3.1	8.4	282	5	11.6	2.8	8.8
240	6	10.6	2.6	8.0	283	5	12.2	2.8	9.4
241	6	11.6	3.2	8.4	284	5	11.2	1.8	9.4
242	6	11.3	3.2	8.1	285	5	12.0	3.3	8.7
243	6	10.4	2.2	8.2					
Average							11.53	3.08	8.30

*The milk for the analysis given in this table was collected and analyzed by Dr. Elizabeth Cooke, of the Lewis Institute.

†In samples 201 to 251 the price of the milk when delivered is given.

‡In samples 252 to 285 the price of the milk when not delivered is given.

Taking, as a basis of comparison, milk containing 3 per cent. fat and 9 per cent. solids not fat, the required standard for milk sold in Chicago, as worth 5 cents a quart, sample No. 14 is worth 2.8 cents and sample No. 38 is worth 8.4 cents, therefore, 1 quart

STANDARDIZING MILK.

of No. 38 is worth 3 quarts of No. 14 on the basis of total energy value. Again, on the same basis, the average value of Nos. 1, 14, and 63, is 3.2 cents, while the average value of Nos. 38, 55 and 76 is 7.9 cents, therefore the better samples are worth 2½ times as much as the poorer, yet this milk all sold for the same price, 5 cents a quart.

Selling milk by measure alone is unjust to the producer as well as to the consumer. It would be as reasonable to expect to purchase three pounds of round steak for the price of one as to buy milk of the composition of No. 38 and No. 14 at the same price a quart. While the fallacy of this system is apparent to a few, the majority of people seem to think that milk is milk and that one quart is worth as much as another, so long as it is still sweet. The reason for this is partly a lack of knowledge as to what constitutes good milk and partly because milk is an opaque liquid and it is difficult to judge of its composition or food value simply by appearance. For this reason many unscrupulous milk dealers dilute their milk with water or remove a portion of the cream.

State legislatures and city councils have attempted to overcome this difficulty by passing laws and ordinances making it unlawful to change the composition of milk. Where these laws were enforced they stopped the dilution of milk to a great extent but did not tend to compel milk dealers to sell milk of any known composition or on the basis of its food value.

The next attempt to remedy the difficulty was to have a certain standard below which it was unlawful to sell milk. Most of the states and some cities passed laws to this effect. These standards seldom require more than 3 per cent. fat and 12 per cent. total solids. The city or state standards, even where they exist, have not reached the difficulty as it makes the sale of milk coming direct from some individual cows, that give milk low in fat, unlawful while it is good wholesome milk and a perfectly legitimate product when sold at its proper price. But what is even worse, this system prevents the man who produces rich milk from getting the price he should according to its food value and cost of production. Milk containing a high per cent. of fat is not only worth more for food but it costs more to produce than milk containing a low per cent. of fat and the price should be governed by its composition and food value and not by its bulk.

Before there was a ready means of determining the composition of milk these difficulties could not well be overcome and providing city standards of composition was about all that could be done at that time; but since the invention of the Babcock test, by

Dr. Babcock of the Wisconsin Agricultural Experiment Station, the conditions are changed, for by the Babcock test and lactometer and at but slight trouble or expense it is now a simple matter to determine accurately the amount of fat and solids not fat in any milk.

Standardizing Milk and Cream.

Since fat in milk is the most variable constituent, the other solids remaining fairly constant, standardizing milk is a comparatively simple matter. All that is necessary is to add or remove a certain amount of butter-fat, which is easily done by means of the centrifugal separator or by letting the cream rise by gravity. While it is true that milk from individual cows varies somewhat from day to pay, the mixed milk of a herd that is milked at regular times each day will be practically constant for that herd, because all of the cows will not test high or low on the same day. By testing the milk of a herd occasionally the per cent. of fat in the milk may be known at all times with reasonable accuracy together with the amount of skim milk that should be added or removed to bring it to the proper standard. If the separator does good work and the amount of milk handled is small so that it does not warrant testing every day it may be run very close to the desired per cent. of fat by testing once a week, so as to be sure that it is up to the required standard. Where the quantity of milk handled is large it is more economical to run tests frequently and keep the fat at exactly the desired per cent. Even if the per cent. of fat varies but slightly it makes a great difference in profit in the course of the year in a large business. If 1,000 gallons of milk are sold daily at the price given in Table 5 and the per cent. of fat in the milk is 4.5 when only 4 per cent. milk is required, the loss to the one selling the milk would be 1½ cents a gallon or $15 a day, this in a year would amount to $5,475.

The only apparatus necessary to standardize milk is a cream separator and a Babcock milk test. Surely no dairyman who has a business of any consequence can afford to be without these machines. For dairymen handling but a small amount of milk the same results may be accomplished by setting the milk for a time and skimming off the cream. In this case all that is necessary is a Babcock test which may be obtained from any milk supply house for four dollars. In this work skim milk containing practically no fat must be added or removed. If the skim milk used contains fat, proper allowance must be made according to the amount of fat contained or the results will obviously be different. Water cannot

be used to dilute the milk or the per cent. of solids not fat will be reduced.

As the per cent. of casein, milk sugar, and mineral matter are practically the same in milk containing different amounts of butter-fat these are not considered in the following table. From this table it will be seen that a law compelling a man to standardize the milk and cream he sells would result in justice to both producer and consumer. All dairymen would then receive the legitimate price for their product according to its food value and cost of production and would not be selling 6 per cent milk in competition with 3 per cent. milk and for the same price per quart.

TABLE 5. RELATIVE VALUE PER QUART AND NUMBER OF QUARTS IN A DOLLAR'S WORTH OF MILK OR CREAM OF THE FOLLOWING COMPOSITION AS TO FAT, COMPUTED ACCORDING TO THE FOOD VALUE OF 3 PER CENT MILK AT 5 CENTS A QUART.

Per cent. of fat.	Price per quart, cents.	No. of quarts a dollar.		Per cent. of fat.	Price per quart, cents.	No. of quarts a dollar.
0.1	2.8	35.7		17	15.5	6.4
1	3.5	28.6		18	16.3	6.1
2	4.2	23.8		19	17.	5.9
3	5.	20.		20	17.7	5.6
4	5.7	17.5		21	18.4	5.4
5	6.5	15.4		22	19.2	5.2
6	7.2	13.9		23	20.	5.
7	8.	12.5		24	20.7	4.8
8	8.7	11.5		25	21.5	4.6
9	9.5	10.5		26	22.2	4.5
10	10.2	9.8		27	23.	4.3
11	11.	9.		28	23.7	4.2
12	11.7	8.5		29	24.5	4.1
13	12.5	8.		30	25.2	4.
14	13.2	7.6		31	26.	3.8
15	14.	7.1		32	26.7	3.7
16	14.7	6.8				

The objection may be raised that this system would be more difficult to control and would require more inspection than a single minimum standard but upon careful consideration it will be seen to be no more complicated. Every milkman should be compelled to have brass figures soldered on the outside of his can, if delivering milk in bulk, showing the per cent. of fat contained in the milk in that can. This system would prevent the man who was selling milk low in fat from evading the law by simply putting a "skim tag" on his can when the inspector appeared. In selling bottled

milk the per cent. of fat in the milk should either be blown into the bottle or stamped upon the pulp cap. This system would be of great advantage to the consumer as he would know the richness of the milk he was purchasing and not be paying for 6 per cent. milk when he was receiving only 3 per cent. It would also allow him to obtain milk of whatever richness he desired and could afford. If this system were in practice it would not compel the shipper who produces the milk to standardize it but he would sell it by test to the city dealer or milk depot where it would be standardized. The shipper again would not be pooling his milk but would receive a price according to its food value and the cost of production.

Milk for direct consumption should not only be standard in composition, which is of economic importance, but it should be standard in cleanliness as well as this affects the health of the community. Much milk is produced under such unsanitary conditions that it is unfit for food. Any milk that shows a sediment on the bottom of a transparent vessel upon standing one hour, is not fit for human food. All milk for direct consumption should be produced under rigid inspection, requiring that the udders be washed before milking and that the cows be kept clean and the barn in a sanitary condition; also that the cans and utensils be thoroughly washed and sterilized after each using. Any system which insures milk of standard value and free from contamination will, of course, add somewhat to its cost but it will also add to its value for use by healthy people and it is of the utmost importance that invalids and infants have such milk.

Such a system is of advantage not only to the consumer but to the better class of dairymen as well for it puts a value upon their painstaking care; indeed they need it as a protection from unscrupulous and careless competitors. It is of disadvantage only to the slovenly dairymen who are always a menace to the public health.

A bulletin giving definite information in regard to the details of standardizing milk and cream is issued in connection with this, and one on sanitary milk will be published in the near future.