MILK : A EUROPEAN CHILD HEALTH PROBLEM*

BY

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It is indeed a great honour to have been invited to give the first Windermere Lecture, and it is a strange coincidence that I should have selected a topic that is so closely related to the generous donor of the Windermere Lectureship. My reason for selection of 'Milk: A European Child Health Problem' for presentation to your Association is that I think the paediatricians of Europe can play a much more important rôle in obtaining a safe pure milk supply for the children of Europe than they have in the past. Before the World War 1939-45, the milk supply of Europe was qualitatively inadequate, and the war has rendered it also quantitatively inadequate. If the present milk production can be properly developed it should result in a much improved supply, possibly an ideal supply of cows' milk for infants and children in Europe.

* The First Windermere Lecture, delivered to the British Paediatric Association at Windermere, April 16, 1948.

The Ideal Milk Supply

Leaving out of account for the moment the fact that the ideal milk for the infant is breast milk, we can define the ideal milk supply as one that is hygienically produced, that can be delivered to the home of the consumer in a sterile condition, that will keep for a protracted period of time, in containers of a size that approximates to the immediate needs of the user, that can be converted into the appropriate feeding mixture with a minimum of effort and utensils, and that can be produced at a cost that does not preclude its use.

European Milk Production

In table 1 is given the total milk production of European countries in 1937* and in 1946, the consumption of milk for the feeding of calves, the human consumption of liquid milk, and the amount of milk used in the manufacture of butter and cheese. There are a number of figures to which I want to call particular attention: the reduction

TABLE 1
PRODUCTION AND CONSUMPTION OF MILK IN 1,000 QUINTALS HECTOLITRE

	Total production		Consumption for feeding calves		Liquid milk for human consumption		Milk for butter, cheese, and other products	
	1937	1946	1937	1946	1937	1946	1937	1946
Austria	23,690	13,540	3,845	2,770	11,785	6,100*	8,060	4,700*
Belgium	28,369	11,576	3,404	1,962	5,957	3,934	19,006	—
Czechoslovakia ..	46,818	25,546	3,448	3,032	25,969	14,893	17,401	7,621
Denmark	53,000	45,610	4,000†	4,000†	5,000	6,280‡	44,000	35,330
Finland	26,630	—	—	—	—	—	—	—
France	147,012	96,911	35,425	23,461	35,421	28,911	76,166	43,607
Greece	5,879	2,900	—	40	2,800	1,395	3,078	1,465
Hungary	15,260	7,428	2,988	1,407	10,350	—	1,922	—
Ireland	22,234	21,026	2,730	2,670	4,187	4,395	15,774	13,960
Italy	62,794	48,000	17,255	13,210	15,615	11,990	29,924	22,800
Luxembourg	1,454	1,250	200	180	410	380	790	690
Netherlands	53,396	35,814	1,532	2,200	14,050	18,665	37,813	15,593
Norway	14,050	12,850	1,000	1,001	6,090	7,200	6,960	4,650
Poland	100,619	33,782	8,000	2,800	52,270	18,700	40,349	17,325
Sweden	27,783	—	—	—	—	—	—	—
Switzerland	26,130	21,500	4,700	3,200	10,122	9,980	11,308	8,420
United Kingdom ..	80,960	83,145	9,590	6,046	45,550	66,098	25,502	10,865

* Estimated figure. † Including other use on farms. ‡ Including milk for cream production. || Whole milk entered in dairies.

of the milk supply of Poland to one-third, from 100,619,000 hectolitres in 1937 to 33,782,000 in 1946, and the reduction to half the pre-war supply in Austria, Belgium, France, and Hungary. There is a considerable reduction in all the other countries except the United Kingdom, in which there was an increase from 80,960,000 to 83,145,000 hectolitres. Of even greater interest is the increase of

TABLE 2
PERCENTAGE OF TOTAL MILK PRODUCTION
FED TO LIVESTOCK

Countries	1937	1946
France	24.1	31.0
Italy	22.2	27.5
Belgium	12.0	17.0
Austria	11.8	20.0
United Kingdom	11.0	7.0
Poland	8.0	9.2
Denmark	7.5	9.0
Canada	5.2	4.5
U.S.A.	2.6	4.0

20,548,000 hectolitres in the human consumption of liquid milk in the United Kingdom, accounted for by a 2,000,000-hectolitre increase in production, a saving of 3,500,000 in the feeding of calves, and a reduction of 14,500,000 hectolitres in the amount that went into the production of butter and cheese. Another interesting figure is the 4,500,000-hectolitre increase in the liquid milk for human consumption in the Netherlands, with a 17,500,000-hectolitre reduction in the total milk production and a 22,000,000 reduction in the milk used for butter and cheese production. A comparison of the

TABLE 3
MILK TRADE FOR THE AVERAGE YEAR
BETWEEN 1934 AND 1938, IN 1,000 QUINTALS

Country	Fresh milk		Condensed milk	
	Imports	Exports	Imports	Exports
Austria	1	57	—	2
Belgium	6	3	44	10
Czechoslovakia	1	1	—	—
Denmark	—	—	—	186
Finland	—	5	—	—
France	—	153	23	51
Ireland	—	26	—	61*
Italy	3	17	—	15
Netherlands	—	26	—	1,784
Norway	—	11	—	21
Poland	—	2	—	—
Switzerland	94	2	94	59
United Kingdom	54	—	1,049	171*

* Re-exports included.

percentages of milk fed to livestock in 1937 and 1946 shows (table 2) that in all the countries of Europe studied, except the United Kingdom, there was an increase in the percentage of milk fed to livestock. In 1937 the range was from 24.1 per cent. of milk fed to livestock in France to 7.5 per cent. fed in Denmark. The United Kingdom showed a decrease from 11 per cent. to 7 per cent. from 1937 to 1946. This increase, in a measure, can be explained by the increased number of female calves raised, and the resulting fact that with the reduced daily production per cow a greater percentage is needed to feed the calf. In France and Italy it is in greater measure the result of a fixed price in liquid milk and no fixed price in meat that makes it more profitable for farmers to feed the whole milk to his livestock and sell his animals as meat. In the report of the French Commission on Modernization (September, 1946) the importance of reducing the amount of milk fed to livestock is particularly stressed.

Milk Exports and Imports

Table 3 shows the average exports and imports of the various European countries in the period from 1934 to 1938. Switzerland and the United Kingdom were the only importers of large amounts of both fresh and condensed milk, with smaller amounts imported by Belgium. France was the

TABLE 4
ANNUAL MILK CONSUMPTION IN EUROPE
PER PERSON, IN KILOGRAMMES, BEFORE 1939

Switzerland	290	Germany	125
Sweden	275	France	90
Denmark	260	Hungary	90
U.S.A.	251	Greece	42
Holland	150	Italy	30
United Kingdom	140		

largest exporter of fresh milk, with Austria next and Ireland, the Netherlands, and Italy in smaller amounts. The Netherlands were by far the greatest exporters of condensed milk, followed by Denmark, England, Ireland, and Switzerland. The flow of milk was into Switzerland, the United Kingdom, and Belgium, from Denmark, Netherlands, France, and Ireland.

European Milk Consumption

Table 4, giving the consumption of milk in the various countries of Europe, shows that Greece and Italy stand at the bottom of the list with 42 and 30 kg. per person per year. The consumption of milk in France and Hungary is only 90 kg. per person per year, and from that level it ranges upward to Germany with 125 kg. and Switzerland with 290 kg. per person per year. The United Kingdom rates are 140 kg. per person per year and the United States 251 kg.

Skimmed Milk

As is to be expected, the production of skimmed milk (table 5) is highest in the two butter-producing countries, Denmark and Australia, 60 and 57 per cent. respectively, dropping down to almost one half for the Netherlands at 33 per cent. From there the range is gradually downward to the United Kingdom with only a 3 per cent. production of skimmed milk. The percentage range of the utilization of skimmed milk for human consumption is even greater. In Czechoslovakia 71 per cent. is so used, 64 per cent. in Hungary, 59 per cent. in Switzerland and Rumania, 53 per cent. in Poland, and only 4 per cent. in France and 1 per cent. in Australia. Forty-six per cent. of the 3 per cent. skimmed milk produced is used in the United Kingdom for human consumption.

I have inserted this table because it shows very well the use that is made of a very excellent supply of a cheap protein food in the various countries; and the great loss to human nutrition that there is when only 4 per cent. of it is used for human consumption, as in France. There is great need for the education of the public in the value of skimmed milk. Milk has been evaluated by the public solely on its fat content, a good milk is one that is yellow with cream and a poor milk one that is blue and thin from lack of fat. Another reason for this feeling on the part of the public no doubt is that the value of milk is determined by the Babcock test, by its fat content.

Prices of Milk

To have available a large amount of milk for human use it is necessary that the farmer deliver his milk to the processing plants as whole milk, and not as cream, using his skimmed milk to feed to cattle, pigs, and chickens. In order that he may do this it is necessary for him to receive a better price for his whole milk than he would for the

cream plus what he can make by feeding skimmed milk to his livestock and selling the stock as meat. The price that the manufacturer can pay the farmer depends on the price that he receives for the butter and the condensed or powdered skimmed milk. It is necessary that the milk be of good grade to make a fit skimmed milk powder. It is therefore necessary that a steady market be available for skimmed milk powder. As a result of the 1939-45 war the price of skimmed milk has advanced to 13 cents per lb. wholesale, but even at this price it is less than a quarter that of the whole milk powder, thus again showing that it is the fat and not the protein that is the costly part of the milk. In figuring out what a hundred dollars will buy to supply food for the greatest number of children, the W.H.O. I.C./F.A.O. Committee on Child Nutrition to advise U.N.I.C.E.F. last summer determined that skimmed milk and lard would provide protein and calcium to 30.7 persons for six months, and that skimmed milk and margarine fortified with vitamin A would give these ingredients to 20.5 people for the same time, but that dry whole milk as supplement would feed only 11.4 persons for six months. The caloric value of the mixture was practically the same. This shows the great relative value of skimmed milk as a cheap source of excellent protein for children.

Methods of European Milk Production and Delivery

Even before the 1939-45 war the milk supply of Europe as a whole could be considered nowhere near a standard necessary for safe artificial feeding of infants. With the hygiene of milk production very poor, except on exceptional farms, with pre-cooling, rapid transportation of milk, and pasteurization plants lacking, and with most of the milk delivered in bulk rather than in bottles, there was much that could be criticized in European milk production and delivery. With the end of

TABLE 5

ESTIMATED PRODUCT OF SKIMMED MILK IN VARIOUS COUNTRIES IN 1,000 METRIC TONS

Country	Total whole	Production skimmed	%	Utilization for food	%
U.S.A.	56,500	21,000	37	5,900	28
Canada	7,995	3,225	40	217	7
Australia	4,990	2,850	57	14	1
Denmark 1946-47 ..	4,650	2,800	60	485	17
Netherlands	3,700	1,240	33	500	40
Czechoslovakia ..	2,730	860	31	590	71
France	10,880	3,100	28	124	4
Poland	2,790	750	27	400	53
Norway	1,140	250	22	60	24
Hungary	7,000	1,160	14	710	64
Switzerland	2,164	293	14	172	59
Rumania	2,050	240	12	140	59
United Kingdom ..	7,830	235	3	100	46

the war, conditions reached a low point in most countries of war-torn Europe as regards milk production. Poland was hit harder than any other country. Dr. Brockman of Gdansk told me that only 5 per cent. of milch cows remained in the province of Gdynia, and that the year before U.N.R.R.A. brought milk into Poland the infant mortality was 62 per cent. in the city of Gdynia. In Salonika it was reported that in 1941 and 1942 there was no milk, and that nutritional oedema was rampant but disappeared promptly when Swiss and Swedish shipments of milk became available. In Italy to-day nutritional oedema is still present in central and southern Italy. Dr. Fontale said he still saw a certain number of cases in his clinic, but not as frequently as formerly. The oedema in Italy he thinks is due to insufficient nutrition of the mothers who are nursing their babies and giving them only a pap of bread and water in addition to the insufficient breast milk. (I saw an eight-year-old boy giving his brother of eight months dry powdered chestnut flour in addition to mother's milk and pap of bread and water. On superficial examination the baby seemed in excellent condition.)

U.N.R.R.A.'s Powdered Milk

It is probably safe to say that as a result of the war, the milk production in Europe was reduced roughly 50 per cent. This would have been calamitous had not U.N.R.R.A. stepped in and with its supply of powdered milk brought in an ideal food for infants and children. The powdered milk was an innovation in most homes but one that the population took to quite readily, although there was considerable opposition at first, particularly in Italy and Greece.

Adverse Factors in Restoring the Milk Supply

The reduced milk supply of Europe is in large measure due to the destruction of from a third to one half of the milch cows of the various countries as the result of the war. There are many other factors, however, that have acted adversely in the restoration of an adequate milk production. Some of these are:

1. In the 20 per cent. to 60 per cent. of tuberculous cows the milk production is reduced as much as 50 per cent.; Bang's disease is present in from 15 to 40 per cent. among cows, and this high incidence of Bang's disease retards the growth of the herds, as the result of abortion and infertility. Trichomoniasis and persistent corpus luteum are two other causes of infertility. Mastitis, frequently of a recurring nature, reduces milk secretion progressively. Foot-and-mouth disease is endemic in many parts of Europe.

2. The relatively higher loss of milch cows of high production, and the low production per cow, as for example in Hungary from 6.1 litres per day in 1938 to 3.75 in 1946, reduced the milk available.

3. The lack of scientific care and feeding, and

the lack of proper fodder, particularly of concentrated foods, such as oil cake, are responsible for the lowered amount.

4. The use of milch cows for draught purposes because of lack of horses and oxen reduced the milk supply.

5. The drought of 1947 reduced the milk production as much as 35 per cent. in some areas, and necessitated the killing (table 6) of milch cows in Czechoslovakia, Switzerland, Denmark, Holland, France, and Poland; 40,721 cows and heifers were slaughtered in September, 1946, and 59,878 cows and heifers were slaughtered in September, 1947, in Czechoslovakia.

6. The high percentage of milk fed to livestock resulted in its loss for infants and children.

7. The inadequate price paid for milk in the controlled market, only half to two-thirds that paid in the open market, or the governmental fixing of the price of milk and not of other related products, butter, cheese, and meat, had an adverse effect.

TABLE 6
EFFECT OF DROUGHT ON MILK PRODUCTION
DURING THE SUMMER OF 1947: FIGURES IN
THOUSAND HECTOLITRES

Country	January		September	
	1946	1947	1946	1947
Czechoslovakia ..	1,867	1,921	2,258	1,985
Denmark ..	2,823	3,075	3,880	2,978
Netherlands ..	1,028	1,368	2,629	2,347
Norway ..	351	436	467	509
Sweden ..	2,600	2,656	2,984	2,681
United Kingdom	4,978	5,205	5,078	4,992
American Zone of Germany ..	2,823	3,075	3,880	2,978

Meeting the Situation

The situation should be met by increasing the quantity and secondly by improving the quality of the milk. Many of the factors concerned improve both. The quantity of the milk can be increased by:

1. Importation of high-grade cattle.
2. Raising more female calves, sired by high-grade bulls by use of artificial insemination.
3. Teaching modern methods of care and feeding and procurement of concentrated food for milk production.
4. Vaccination of the herds to control Bang's and foot-and-mouth disease.
5. Artificial insemination with sperm of known healthy bulls to prevent trichomoniasis.
6. Dislodging manually a persistent corpus luteum.
7. Penicillin to control mastitis.
8. Testing of cows and isolating and slaughtering of known tuberculous cattle.

9. Proper sanitation, feeding, and vaccination to prevent loss of calves.

10. Reduction of milk feeding to livestock.

11. Governmental price adjustments of milk in relation to other food products, and payment of premiums to ensure milk delivery.

12. Reducing the use of milch cows for draught purposes.

The quality of the milk can be improved by:

1. Education of farm personnel, processors, and handlers in farm sanitations and hygienic milk production.

2. Pre-cooling of milk on the farm, and motor transport to processing plants in jacketed cans when needed.

TABLE 7
VARIOUS FACTORS RELATED TO MILK
DISTRIBUTION IN ITALY

Area	Popula- tion %	No. cows per sq. km.	Milk produc- tion %	Live- stock feeding %	Pro- cessing facilities %
North	46	488	80.0	18.2	73
Centre	18	132	10.6	43.2	20
South	24	55	5.6	30.7	7
Islands	11	50	3.4	34.0	1

3. Pasteurization of milk, packaging in bottles or other sterile containers, and constant refrigeration.

4. Production of unsweetened condensed or powdered milk.

5. Offering premiums to farmers for the production of milk with a low bacterial count.

6. Supervision of farms and milk plants by governmental milk inspectors.

When it has been determined how to increase the quantity as well as the quality of milk in Europe, what other factors are there that must concern us before making our decision as to what to recommend as the ultimate and best solution of the problem of supplying milk to infants and children?

The following factors must be considered according to our definition of an ideal milk supply. To start with we must take a very definite stand against the use of raw milk as a food for infants and children. Even so-called certified milk has been known to contain tuberculosis bacilli and to give rise to milk-borne epidemics. Infants should not be fed bulk milk, even when pasteurized, because it is subject to frequent gross contamination and, summer or winter, is a source of danger to the infant.

We have, then, to consider on the one hand pasteurized bottled milk that is not a sterile product, that must be used within a twenty-four hour period, that can be shipped no great distance unless properly cooled; and on the other hand powdered or

TABLE 8
FRENCH DAIRY EQUIPMENT NEEDED (FRENCH
COMMISSION, SEPT., 1946)

Milk production	..	..	..	13,500,000
Pasteurization	..	..	..	5,810,000
Butter	..	..	..	2,900,000
Cheese	..	..	..	1,000,000
Renewal equipment	..	..	..	5,000,000
Total	..	..	..	28,210,000

unsweetened condensed milk, both of which are products with excellent keeping qualities, both of which can readily be placed in the home of the user in the required weekly or monthly amounts, both of which are more difficult to use, and both of which may or may not be more expensive than pasteurized bottled milk.

The following points are to be considered in arriving at a conclusion as to the relative value of the pasteurized and processed milks:

1. The complete lack of refrigeration in most European homes and in retail distribution centres.

2. The necessity of refrigerated transportation because of the unequal distribution of the milk-producing areas in the different countries. Eighty per cent. of the milk is produced in northern Italy, whereas only 46 per cent. of the population lives there (table 7).

3. The production of 75 per cent. of the milk in the so-called six-months flush period, and 25 per cent. in the slack period.

4. The cost of the equipment to produce it.

5. Disease outbreaks conveyed by milk.

6. The cost of the final milk products.

If we consider pasteurized milk versus processed milk under point one, which is the complete lack of refrigeration, there can be no question that the processed milk is a much safer product. It can be used to make up the feeding just before it is given to the infant.

Under point two, the processed milk can be shipped and stored for months without danger, as compared with a forty-eight hour limit for very good

TABLE 9
ESTIMATED COST OF EQUIPMENT FOR
ADEQUATE MILK PRODUCTION IN
CZECHOSLOVAKIA

75 Pasteurization plants	..	..	\$ 9,000,000
8 Powdered milk plants	..	..	3,500,000
750 Collecting centres	..	..	12,000,000
100,000 Farm coolers	..	..	400,000
Miscellaneous cans, bottles, etc.	..	..	2,000,000
<i>Government Programme 1947-1951</i>			
50 Pasteurization plants	..	..	6,000,000
4 Powdered milk plants	..	..	1,750,000

TABLE 10

ESTIMATE OF EQUIPMENT REQUIRED TO PROCESS MILK FOR 0-1 GROUP

Country	No. of infants in thousands	Daily requirements (thousand litres)	Yearly requirements (fluid thousand Hl.)	Yearly requirements powder (tons)	Approximate no. plants required	Approximate cost* \$
Czechoslovakia ..	240	240	876	10,950	8	3,400,000
France	850	850	3,102	37,595	30	12,750,000
Italy	1,004	1,004	3,665	44,807	36	15,250,000
Poland	480	480	1,752	21,900	18	7,650,000

* A milk powder plant with the daily capacity of 500 hectolitres of milk will produce 6.25 tons, assuming that the plant would operate on a schedule of 200 days per year (flush period). It would produce 1,250 tons of powdered milk. The estimated cost of such a plant would be from \$400,000 to \$450,000.

pasteurized milk even with good refrigeration in the summer.

Under point three, the use of processed milks is the only possible way of keeping the excess milk production of the flush period for use in the slack period.

Under point four, as to the cost of plants, there is a decided advantage in the relative costs in favour of pasteurization as seen by tables 9 and 10.

Under point five, there were thirty milk-borne

1. Spray-dried powdered milk can be used in making up any sized feeding without waste. When a can of evaporated unsweetened milk is opened, it becomes readily contaminated if not immediately used. Powdered milk can be put up in small packages to make single feedings.

2. Europe is becoming educated to the use of powdered milk.

3. Tin is not available in adequate quantities in Europe to-day. A plastic container might solve this problem.

TABLE 11

COMPARATIVE PRICES OF A QUART OR A LITRE OF MILK IN FRANCE AND U.S.A.

	Pasteurized bottled	Unsweetened condensed	Powdered
France ..	31*	54*	48*
U.S.A. ..	22† (43*)	15† (32*)	13† (29*)

* In francs.

† In cents—official rate 214 francs to 100 cents.

epidemics in the U.S.A. in 1943, twelve from pasteurized milk.

Under point six, we have the figures for the three types of milk in the U.S.A. and in France, and the price here is definitely in favour of the processed milk as opposed to the bottled pasteurized product. The reverse is true in France, with the price of fluid milk fixed by the government (table 11). When we have determined that processed milk can compete with bottled pasteurized milk on the basis of cost, it becomes evident that processed milk becomes the milk of choice.

The comparative prices of a quart of pasteurized bottled, unsweetened condensed, and powdered milk (spray) in the U.S.A. and France are shown in table 12.

It remains now only to determine which of the two processed milks is the preferable one. The following considerations are of importance in making a decision:

TABLE 12

COMPARATIVE PRICES OF VARIOUS MILKS IN U.S.A. AND IN FRANCE

		Pasteurized bottled	Unsweetened condensed	Powdered spray dried
U.S.A. ..	1939	13*	7	5
	1944	17	10	11
	1945	22	13	12
France ..	1947	26†	54	48

* Cents.

† Francs.

4. The cost of shipping of powdered milk is lower.

5. It is easier to use unsweetened condensed milk than to reconstitute powdered milk.

Of the five points considered, four are favourable to powdered milk and only the fifth is favourable to unsweetened condensed milk. Both products are valuable, but on the basis of the above consideration powdered milk seems to be the preferable one of the two processed forms.

Summary

If by large-scale production the price differential between powdered milk and pasteurized bottled milk can be wiped out in Europe or powdered milk rendered even cheaper, as in the U.S.A. at the

present time, powdered milk should prove to be the ideal cows' milk supply for the infants and children of Europe.

The milk used locally in production areas or in communities without pasteurization facilities should be boiled before using.

All commercial fluid milk should be pasteurized, bottled, and refrigerated until used.

The use of dried skimmed milk deserves greater

attention from the pediatrician for its value as a cheap protein food for children.

I want to thank the European Office of F.A.O. in Rome, and in particular Mr. M. E. Hays, Consultant on Milk to U.N.I.C.E.F., for their assistance and the use of their charts, as well as Dr. Carl Schlott-hauer of the Mayo Foundation for his help in giving information on milk production as affected by disease in cattle.