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I N F A N T F E E D I N G

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I N F A N T F E E D I N G .

INTRODUCTORY.

In the following paper evidence has been brought forward to show how necessary it is that an infant should receive not only sufficient, but also proper, nourishment during the first year of its life. For not only is this necessity shown when we consider the results of improper feeding revealed by a study of the tables of infantile mortality, but also when we remember that a high infantile mortality rate means a high damaged life percentage, a circumstance of most serious import when affecting girls, who must be the mothers of the children of the future.

The study of the composition of human milk must be the foundation of all our knowledge regarding the normal food of an infant.

The variations to which human milk may be liable must be studied, the constituents of the milk investigated, and the effect on the infant of either an excess or diminution of the proteid, fat, and sugar, contained in that milk, determined. We shall then be in a position to consider the attributes of a

perfect food, the influence which such a food exercises on the human economy, and to lay down some standard by which we can judge the various milk substitutes and foods, and compare our conclusions with the results obtained by actual clinical experience.

Cow's milk and its modifications will also be discussed in regard to its suitability for infant feeding, also the various patent and proprietary foods.

The necessity for breast feeding having been established, the various rules to be observed during that period, and the signs of successful feeding, will be indicated. The indications for weaning will be briefly stated, and the best methods of artificial feeding considered.

Finally, the general conclusions of our investigations will be stated.

P A R T I.

SYNOPSIS:

The importance of the subject.

The study of the composition of human milk.

1. The variations to which it is subject.
2. The fat constituent.
 - (a) Its variations.
 - (b) Its influence on metabolism.
 - (c) Its relation to the development of rickets.
3. The carbohydrate constituent.
4. The proteid constituent.
5. The nitrogenous extractives.
6. The mineral salts.

General conclusions.

The definition of a perfect food for infants.

THE IMPORTANCE OF THE SUBJECT.

A study of infantile mortality returns reveals the fact that a considerable percentage of deaths of children, under the age of one year, are due to preventable diseases. If we trace the cause of these preventable deaths, it will be found that, in a large proportion of cases, there has been some fault with regard to the feeding of the child.

The injury done by faulty feeding, however, does not only affect the child during the first year of its life. For example, it is now a well established fact that rickets is chiefly due to improper feeding during infancy.

Dr William Hall⁽¹⁾ gives some figures which throw light on this point. He states that he has examined 4,000 children in a slum district of Leeds, that the majority of these children were rickety, and also tainted with scurvy. During the same period he examined 1,000 Jewish children, born and bred in the same slum district, and these were free from scurvy, and superior in development to the other children, due to the fact that most Jewish mothers suckle their children for twelve months.

(1) British Medical Journal, April 9, 1904, page 867.

In an article in the British Medical Journal ⁽¹⁾, reference is made to a paper read at the January meeting of the Société d'obstretique de Gynecologie et de Pediatric de Paris by Madame Darcanne Mouroux, M.D., on the frequency of difficult labours at Fougères and in its neighbourhood. Dr Darcanne Mouroux insists that the rickety pelves of the women of the district referred to, and the consequent frequency of dystocia, are to be attributed to a very definite cause - that is, that the infants of the workmen's and peasants' wives are invariably artificially fed. The infant is fed on milk, rarely diluted with water, and within a few months of its birth, cider and pieces of bacon commonly form part of its dietary.

The suitable feeding of infants, therefore, is a subject which demands consideration. Our aim and endeavour should be to find a food which will enable a child not only to avoid the immediate dangers resulting from unsuitable food, but also to grow up into as healthy a being as it is possible for that particular child to become.

(1) British Medical Journal, March 14, 1908, page 641.

HUMAN MILK.

The natural food of an infant is that which it should obtain from its own mother.

In order to arrive at a proper understanding as to what elements should be contained in a diet suitable for infants, it is necessary to study the composition of human milk.

It has been found that the average composition of human milk during the first few months of lactation is as follows⁽¹⁾:

Proteid	2 per cent.	{ caseinogen 0.6 per cent.
		{ lactalbumen 1.4 " "
Fat	3.5 to 4 per cent.	
Lactose	7.0 per cent.	
Mineral Matters	0.3 " "	
Water	87.0 " "	

The above figures may be considered to represent the average percentage composition. It should however be stated that the percentages are subject to variations.

(1) Still: "Common disorders of Childhood", page 32.

VARIATIONS IN THE PERCENTAGE COMPOSITION OF HUMAN MILK.

It has been found that, in the same woman, breast milk varies in composition from day to day. Even during the same breast feed the milk at the beginning differs from that at the close. Weak women, however, seem to furnish as good a milk as strong women, and age would appear to make no difference.

Effect of the mother's diet on the composition of her milk.

Baumm and Illner have made observations on the influence of the food, taken by the mother, on her milk. They found that the fat was the only ingredient of the milk on which the diet produced any appreciable effect. The diets influencing the milk were⁽¹⁾:

1. An ordinary mixed diet taken in great abundance.
2. A highly nitrogenous diet, one containing much cheese, eggs, and meat.

Both these diets increased the fat percentage in the milk. They further found that the addition of two or three pints of lager beer to the ordinary daily

(1) Quoted from Vincent: "Nutrition of the Infant" page 36.

diet had no effect on the fat percentage of the mother's milk, an observation substantiated by others who have found that as much as five glasses of port or champagne are similarly devoid of influence⁽¹⁾.

Influence of the period of lactation on the mother's milk.

The milk secreted during the first two or three days after the child is born - the colostrum - differs from the milk secreted subsequently; it is more watery-looking than ordinary milk, and contains a greater percentage of proteid.

Soldner⁽²⁾ has made a series of careful analyses of breast milk, and from his report it is evident that there is an excess of proteid in the mother's milk during the first few days of the infant's life. He finds that the percentage of the albuminoids falls from 1.81 per cent. on the fifth day to .88 per cent. on the seventy-fourth day.

In a paper entitled "Some observations on the Composition of Human Milk", by A. H. Carter⁽³⁾, this reduction in the proteid constituent is also noted,

(1) Quoted from Hutchison: "Food and Dietetics", page 435.

(2) Quoted from Vincent: "Nutrition of the Infant", page 17.

(3) British Medical Journal, January 22, 1898, page 201.

the proportion on the fifth day being found to be 2.25 per cent., and on the thirtieth day 1.43 per cent.

THE FAT CONSTITUENT OF HUMAN MILK.

1. Its variations:

Reference has previously been made with regard to the influence of diet on the fat in human milk, page 4.

Dr Olive M. Elgood⁽¹⁾ has recently made a series of observations with regard to the composition of human milk. The method of observation was as follows. Mothers registered as recently confined were visited about fourteen days after confinement, and the time taken in each case, by the infant, to empty the breast was noted. At subsequently appointed times the mothers were directed to leave one breast untouched for four hours before the time appointed for the health visitor's visit. The baby was then put to the breast for half the time already noted, afterwards 10 c.cm. of milk was drawn from that breast by digital expression. Thus the sample was supposed to represent the middle milk of the breast content, and should consequently present an average

(1) British Medical Journal, Oct. 15, 1910, page 1139.

composition for the whole.

The observations were undertaken to determine the fat percentage during different months of lactation. In four cases inquired into, the fat composition was found to be 4.4 per cent.

Other points brought forward in the report were:

1. Very considerable variations in the percentage of fat exist in the same, and in different cases, at the same period of lactation.
2. The variations in fat do not depend upon the period of lactation. That is, the fat does not increase in quantity necessarily as lactation proceeds.

Dr Elgood considers that fat is a definite secretion determined in quantity by variations in tissue metabolism, and is not entirely dependent on the total quantity of milk secreted. That is, a high percentage of fat does not necessarily mean a concentrated milk, and a low percentage a diluted milk.

This variation in the fat percentage in human milk is shown in the following analyses made by Harrington for Rotch. In seven different cases the figures given are: (1)

	<u>1.</u>	<u>2.</u>	<u>3.</u>	<u>4.</u>	<u>5.</u>	<u>6.</u>	<u>7.</u>
Fat per-centage } 5.16 4.88 4.37 4.84 4.11 3.82 3.80							

(1) Quoted from Vincent: "The Nutrition of the Infant", page 24.

2. Its influence on the metabolism:

As the percentage of fat varies, not only in the same case but in different cases, it is important to ascertain what influence fat exercises on nutrition, also if any maximum or minimum to these variations can be fixed, beyond which they should not oscillate.

Fat and carbohydrate are the sources from which the body draws its supply of energy and heat. It is necessary in order to avoid gastric and intestinal trouble, either from too large a bulk of carbohydrate overloading the stomach, or too large an amount of fat overstepping the limits of fat absorption, that these two energy producers be given in their right proportions.

Fat produces energy and heat. Now the surface of a child is relatively three times as great as that of an adult⁽¹⁾. A child therefore requires much more heat proportionately. Without a sufficient supply of fat, the child has a difficulty in maintaining the proper body temperature.

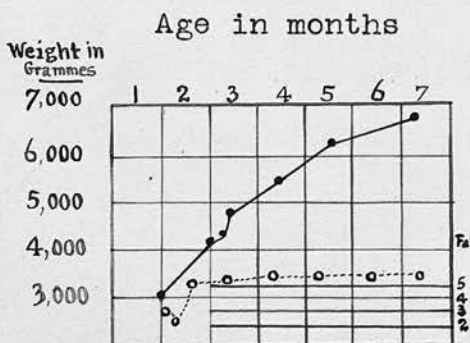
Although carbohydrates also produce energy and heat, it would appear that, in the diet of infants, a deficiency of fat cannot be replaced by an excess of carbohydrate. Fat, indeed, seems to play some

(1) Quoted from Hutchison: "Food and Dietetics", page 440.

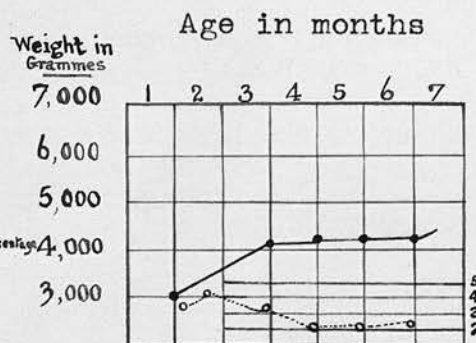
part in the formation of young tissue, which cannot be undertaken by any other nutritive constituent of food.

It would seem that the effect, on the nutrition of a child, of a sufficiency of fat in the diet, is shown by a gain in weight. In the series of observations by Dr Elgood previously referred to, this point has been clearly brought out. In one of the cases mentioned the average fat percentage of the milk was five. In this case the weight of the infant showed a steady and regular advance, so that at the end of seven months the child weighed 7,000 grammes. That this steady gain in weight was mainly due to the high percentage of fat was shown by another case quoted. In this case the fat average fell from 5 per cent. when the child was two months old, to just over 2 per cent. with the child four-and-a-half months old. The fall in fat percentage began at the age of three months. The effect on the weight curve is shown in the following chart:

Case No.1



Case No.2



Taken from Dr Elgood's Paper.

The following case recently came under my notice. The child at birth weighed nine pounds. It was entirely breast fed, and gained weight steadily. At the age of five months the child weighed twenty-seven pounds, and was healthy looking, with firm flesh. The milk when analysed was found to contain 5.8 per cent. of fat.

In the paper by Dr Carter, referred to on page 5, it is stated that, in a certain series of cases, it was found that the average composition of milk that disagreed with infants was

Proteid	2.36	per cent.
Fat	2.95	" "
Lactose	6.28	" "

After eliminating all milks disagreeing with the infants, the average composition of the milks which agreed was found to be

Proteid	1.83	per cent.
Fat	3.11	" "
Lactose	6.70	" "

It would appear therefore :-

1. That fat plays an important part in the healthy growth of a child.
2. That although subject to variations, the higher and the steadier the fat percentage can be kept, the better for the nutrition of the child, as evidenced by a gain in weight.

3. That, while a healthy child can digest and absorb a human milk containing as high a percentage of fat as 5 or even 5.8 per cent., it does not appear advisable that the fat percentage should fall below 3 per cent.

3. Development of Rickets, due to the deficiency of fat in the food.

For the immediate nutrition of the infant a certain proportion of fat in the food is necessary. Various experiments have been undertaken, and cases produced, to show that, in cases where sufficient fat has not been absorbed from the food in infancy, rickets have developed.

From time to time various theories have been advanced with regard to the causation of rickets. More recently the disease has been considered to be due to incorrect feeding, together with bad hygiene and want of fresh air and sunlight. A deficiency of proteid and fat, an excess of carbohydrate in the food, a fault in the proportion of proteid to fat and fat to sugar, all these have been held to be the causes of this disease. It is certainly the case that rickets hardly ever affects a child who has been breast fed for the usual length of time.

Cheadle⁽¹⁾ writes that the only instance within

(1) Allbutt's System of Medicine, Vol.III., pages 129 and 131.

his experience of rickets arising in a child while at the breast during the first ten months of life, was one in which the mother became pregnant during lactation. The suckled infant became rickety, the foetus unborn escaped.

Holt and Cheadle⁽¹⁾ consider that rickets is due to a low percentage of both fat and proteid. Bland Sutton⁽²⁾, in consideration of his experiments in the London Zoological Gardens, teaches that it is entirely due to a deficiency of fat.

Ashby⁽³⁾ considers that fermentation of the carbohydrates may produce toxins, which are responsible for some of the phenomena of the disease.

Still⁽⁴⁾ holds that the disease is due to a deficiency of fat, and that an apparent sufficiency of fat in any particular food will not prevent fat starvation, if at the same time the child's power of assimilation be diminished by the unsuitability of that food in other respects.

The general consensus of opinion is, therefore, that rickets is induced by a deficient assimilation of fat, which may be due to too small a percentage

(1) and (2) Allbutt's System of Medicine, Vol.III., pages 129 and 131.

(3) Gibson's Textbook of Medicine, page 491.

(4) Still: "Common Disorders of Childhood", page 84.

of fat, or to an excess of carbohydrate in the food. Lack of exercise⁽¹⁾ (Findlay) and a deficiency of fresh air⁽²⁾ (Logan) may also be contributory factors.

As fat plays such an important role in the nutrition of the child, it is important to be able to estimate the percentage of fat which may be present in any particular sample of milk. A simple method of estimating the percentage of cream in milk is as follows :-

A cylindrical five cubic centimetre measure, having a diameter of three-eighths of an inch, and graduated in cubic centimetres and millimetres, is filled with greast milk exactly up to the five c.c. mark. It is then corked and allowed to stand for twenty-four hours. Empirically the cream readings are found to correspond with fat percentage, thus⁽³⁾:

<u>Cream.</u>			<u>Fat.</u>	
2	Cubic Millimetres	=	2.8 per cent.	
3	" "	=	3.5	" "
4	" "	=	4.4	" "
5	" "	=	5.6	" "

(1) British Medical Journal, July 4, 1908, page 13.

(2) British Medical Journal, Aug. 22, 1908, page 533.

(3) Still: "Common Disorders of Childhood", page 21.

THE PROTEID CONSTITUENT OF HUMAN MILK.

Proteid is the chief tissue former found in food: it is also a source of energy. There is reason to believe that proteid, besides acting as a repairer of tissues and a source of energy, exerts upon the cells a stimulating influence which increases vitality and energy⁽¹⁾.

A deficiency of proteid seems to impair the condition of the blood, and lower the tone of the muscles and of the heart, besides enfeebling the digestive powers by restricting the supply of the material from which the digestive ferments are elaborated.

Human milk has a proteid strength of from 1.5 to 2 per cent. This is composed of caseinogen 0.6 per cent. and lactalbumen 1.4 per cent. The chief feature of the proteid constituent in human milk is the relatively small amount of caseinogen compared to the lactalbumen.

THE CARBOHYDRATE CONSTITUENT OF HUMAN MILK.

The carbohydrates like the fats are work and heat producers. The carbohydrate constituent of milk is in the form of lactose, a sugar which is the least liable of all the sugars to undergo butyric

(1) Hutchison: "Diet and Dietetics", page 23.

or alcoholic fermentation: on the other hand, it readily undergoes lactic fermentation.

Sugar is a muscle food, and probably the chief source of muscular energy.

THE NITROGENOUS EXTRACTIVES IN HUMAN MILK.

These have been demonstrated by Soldner⁽¹⁾, who estimates that they amount to 1 per cent during the first week of lactation, and diminish to 0.02 per cent on the seventy-fourth day.

It may be that these nitrogenous extractives play an important part in the nutrition of the infant. It seems probable that the degree of energy and vigour of the infant is largely determined by the amount of these extractives present in the milk⁽²⁾.

Oliver⁽³⁾ has shown that while proteids, such as myosin and egg albumin, do not alter the blood pressure, or the flow of tissue lymph, muscle extractives, such as creatin and xanthin, markedly increase arterial pressure and the exudation of tissue lymph. He concludes :

1. That the food constituents themselves do not possess the power of starting the mechanism by which lymph is dispensed to the tissues throughout the body.

(1) Vincent: "The Nutrition of the Infant", page 21.

(2) Vincent: "The Nutrition of the Infant", page 23.

(3) Lancet, January 30, 1904.

2. That nature, however, associates with our food stuffs small quantities of certain very active substances which bring into play that mechanism, though the substances themselves are practically devoid of food value.

THE MINERAL SALTS IN HUMAN MILK.

These are important; they are, together with the proteids, the tissue formers.

Investigation with regard to them has been carried out under Rotch in Harrington's laboratory, with the following result⁽¹⁾:

Uncombined carbon	0.71			
Chlorine	20.11	Calcium phosphate	25.35	} 30.53
Sulphur	2.19	Calcium silicate	1.35	
Phosphoric acid	10.73	Calcium sulphite	2.11	
Silica	0.70	Calcium oxide	1.72	
Carbonic acid	7.97	Magnesium oxide		1.91
Iron oxide and Alumina	0.40	Potassium carbonate	24.93	} 45.77
Lime	15.69	Potassium sulphite	8.04	
Magnesia	1.92	Potassium chloride	12.80	
Potassium	24.77	Sodium Chloride		23.13
Sodium	9.19	Iron oxide and alumina		.40
Oxygen (calculated)	6.16			

(1) Quoted from Vincent: "The Nutrition of the Infant" page 19.

The chief point to notice is the predominance of the potassium group of salts over the calcium group.

It is also a matter of importance to note the proportion of the different ingredients of human milk to each other. Thus

the ratio of fat to carbohydrate is as	1 to 2.
that of fat to proteid is as	1 to 0.6
that of proteid to carbohydrate is as	1 to 3.5.

These ratios correspond, almost exactly, to those observed as the result of investigations, conducted at Munich⁽¹⁾, as to the smallest amounts of food compatible with health under the age of one-and-a-half years.

TO SUM UP THEREFORE -

Human milk is composed of proteid of the most digestible variety. It contains a certain proportion of fat, which, for the healthy nutrition of the infant, must not fall below 3 per cent. Its salts are chiefly those of potassium; the nitrogenous extractives also seem to fill an important part in the rôle played by human milk; and all these various ingredients, fat, proteid, carbohydrate, are present in certain ratios the one to the other.

(1) Carter, British Medical Journal, Jan. 22, 1898, as quoted from Landois and Stirling, Human Physiology Vol. page 481.

Human milk, however, is not simply a mixture of certain definite proportions of fat, proteid, carbohydrate, mineral matter, and water. No food, however accurately prepared, seems to quite take its place, and babies fed on milk substitutes, especially on the proprietary foods, never seem to thrive as well as babies fed on breast milk.

Breast milk indeed would appear to possess some inherent vital quality. It has recently been suggested that milk contains an enzyme⁽¹⁾ which is ultimately derived from the thyroid, and that this enzyme may play an important part in the nutrition of the child.

Human milk must always be the ideal infants' food. It must be our standard by which all milk substitutes and foods must be judged when it becomes necessary to have recourse to any other food for the infant.

Before entering therefore upon a discussion of the various foods which are used as substitutes for human milk, it would be well to define what a perfect infant food should be, and to state the tests to which it should answer.

(1) British Medical Journal. December 24, 1910, page 100.

DEFINITION OF A PERFECT FOOD FOR INFANTS.

A complete food for infants

1. Should contain the various elements which are found in human milk, and in the proportions found in that milk.
 2. It must not contain elements which are not found in human milk.
 3. It must consist of fresh food, and must not have lost its freshness through keeping, or prolonged heating.
 4. It must be free from extraneous organisms, or contain them only in such numbers as not to affect injuriously the food, or the gastro-intestinal mucous membrane.
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P A R T I I.

SYNOPSIS:

Substitutes for human milk.

1. Cow's milk.

Cow's milk and human milk compared.

Modification of cow's milk :-

Laboratory modified milk.

Expedients to render caseinogen more digestible :-

Dilution of milk.

Boiling of milk.

The addition of citrate of soda.

Peptonization of milk.

Practical methods of milk modification:-

Milk and water.

Milk, cream, and water.

Whey and cream.

Milk and water with citrate of sodium.

Sterilized undiluted milk.

The Pasteurisation and Sterilization of Milk.

Humanized Milk.

2. Consideration of the milk of other animals.

SUBSTITUTES FOR HUMAN MILK.

1. COW'S MILK.

Cow's milk, or some modification of cow's milk, would appear to be the most natural substitute for human milk. In certain particulars however, the two milks differ. They may be compared thus :

	<u>Cow's milk.</u>	<u>Human milk.</u>
Proteid	3.40 per cent	1.5 to 2 per cent
Fat	3.90 " "	4 per cent.
Carbohydrate	4.75 " "	7 " "
Mineral Matter	0.7 " "	0.3 "

If we compare the above analysis, the chief differences between the two milks may be summed up as follows: Cow's milk contains more proteid, less sugar, and about the same amount of fat as human milk.

But there are qualitative as well as quantitative differences. If the various constituents of the two milks are closely examined, it will be found that sugar is the only ingredient which is identical in kind in the two milks.

QUALITATIVE DIFFERENCES BETWEEN COW'S MILK AND HUMAN MILK.

1. The Fat Constituent:

The fat emulsion in human milk is more perfect than that in cow's milk, the fat being in a much finer state of division. The fat in human milk contains more oleic acid and is thus more easily digested.

2. The Proteid Constituent:

Cow's milk consists chiefly of caseinogen, human milk of lactalbumen. Lactalbumen is a much more easily digested form of proteid than caseinogen. Cow's casein leaves behind, after digestion, an indigestible residue, which human casein does not⁽¹⁾.

3. The Nitrogenous Extractives:

One-eleventh of the total nitrogen in human milk is present in the form of extractives, as compared with one-sixteenth in cow's milk.

4. The Mineral Salts:

The calcium group of salts predominates in cow's milk, the potassium group in human milk.

(1) Hutchison: "Food and Dietetics", page 445.

Variations in Cow's Milk.

Human milk, we have found, varies considerably, at different times, in the same individual. Cow's milk is also subject to variations, not only in different breeds, but also in the same breed. It has been found that the composition of cow's milk is greatly affected by various factors, as for instance

1. The season of the year - during November, December and January the milk is richer in fat.
2. The time of day - the evening milk being richer in fat.
3. The character of the food given to the cows.
4. The period which has elapsed since calving.

This variability in the composition of cow's milk renders it difficult to determine the exact amount of fat and proteid which may be present in any milk mixture which may be ordered. It is also a reason why it is better to give the mixed milk from a herd, where these variations must to some extent neutralize one another, rather than to give the milk from one cow.

The specific gravity of milk is of no use as a guide to its composition, for it is increased by the

solids and diminished by the fat.

The amount of fat is the only trustworthy gauge of its quality; a milk rich in cream is rich in proteid and fat.

MODIFICATION OF COW'S MILK.

The relative composition of cow's milk and human milk being determined, we are now able to consider how cow's milk can best be utilized for supplying the needs of an infant.

Fat and sugar can easily be added to any diet.

The proteid constituent therefore must be the one which determines our dilution of milk. Here we are met with a difficulty, for not only is the percentage of proteid higher in cow's milk than in human milk, but also the bulk of the proteid in the former case consists of caseinogen, not lactalbumen, the proportions being as follows⁽¹⁾:

	<u>Human Milk</u>	<u>Cow's Milk</u>
Whey proteid (lactalbumen)	1.23	0.53
Caseinogen	0.59	2.88

This difficulty may be overcome by using
Laboratory modified milk.

(1) Vincent: "Nutrition of the Infant", page 12.

The great advantage to be derived from the use of this method is that the proteid constituents of the milk can be given in whatever proportion it may be desired.

Thus whey, containing lactalbumen, cream, containing fat, fat-free milk, containing caseinogen, and a solution of sugar of milk, are used. These solutions contain certain definite known proportions of lactalbumen, caseinogen, fat, and lactose. A milk prescription can thus be written to suit the needs of any particular case.

Valuable as such a method is, its use must necessarily be limited. It may either be impossible to obtain a reliable laboratory milk, or if obtainable it may, because of expense, not be suitable for many cases with which we have to deal. Some other method must therefore be used for modifying cow's milk. Cow's milk when introduced into the stomach of an infant forms curds of larger bulk and firmer consistence than is the case when human milk is given.

The problem which therefore confronts us is this:
What expedients can be used to render the casein coagula smaller and more flocculent?

1. Dilution of the milk with barley water,

lime water, or water.

Careful experiments upon this point have been made by Dr Barrett of Melbourne, in conjunction with Dr Wood. The results of these experiments are thus summed up by Dr Barrett:

"The net result of our work is that none of the diluents attenuated clot more efficiently than pure water. In Savory and Moore's food, and Mellin's food, when made up with milk and water, casein was precipitated rather more finely divided than in milk and water alone."⁽¹⁾

2. Boiling of the milk:

Rotch's experiments showed no difference in the coagulability of boiled and unboiled cow's milk⁽²⁾. He obtained finer curd with milk diluted with boiled water.

3. The addition of citrate of soda:

Wright⁽³⁾ has drawn attention to the advantages to be gained by the use of citrate of sodium. It had previously been noted that rennett coagulation is delayed, and curdling becomes less and less firm, as an increasing proportion of the lime salts of the

(1) Cheadle: "Artificial Feeding of Infants", Ed.VI. page 61.

(2) Keating's "Cyclopedia of Diseases of Children", Vol.I., page 308.

(3) Lancet, July 22, 1893, Page 194-

milk become precipitated as insoluble salts (Arthus and Pages).

Now cow's milk contains more lime salts than human milk. If the action of the lime salts can be neutralized, the difficulty of digestion, which is due to the firmness of the clot, will be much diminished.

Citrate of sodium when added to cow's milk has been found to prevent rennet coagulation. How this takes place is uncertain, but it seems probable that the following may be the explanation.

The caseinogen of the milk is acid, and in the process of clotting combines with the calcium salts in the milk to produce a thick casein clot (calcium casein). Citrate of sodium when added to the milk combines with the caseinogen, and a sodium compound, of less density than the calcium casein, is formed. The calcium salts of the milk combine with the citric acid to form calcium citrate.

4. Peptonisation of the milk:

Milk may be completely or only partially peptonised. In feeding healthy infants it is advisable, if peptonised milk is to be used, to only partially peptonise the milk. This can be done by means of Fairchild's peptogenic milk powder. Each

powder contains the ferment required to digest a certain quantity of milk, together with some bicarbonate of soda, and milk sugar. The process of digestion is carried sufficiently far enough to partially change the casein of the milk in order to prevent its clotting.

It is believed by some authorities that one of the essential differences between the casein of human milk and that of the milk of the cow, is that the former is really a stage nearer the digested condition than the latter. If this be so, this method of rendering the caseinogen of cow's milk more digestible, has much to recommend it. The analysis of this preparation, as given by Professor Chittenden⁽¹⁾, shows that it compares favourably with the analysis of human milk.

	<u>Human milk.</u>	<u>Milk prepared with Peptogenic milk powders.</u>
Proteid	2.0 per cent.	2.09
Fat	4.1 " "	4.38
Sugar	6.9 " "	7.26
Mineral matter	0.2 " "	0.26

Such then are the various methods which may be used to render the proteid of cow's milk more digestible.

(1) New York Medical Journal, July 18, 1896. Quoted by Hutchison: "Food and Dietetics" page 456.

Whatever method may be employed, it is essential that the other ingredients of the milk, the fat, sugar, and mineral salts, should be present in the same proportion as in human milk.

The Modification of Cow's Milk for use in Infant Feeding.

1. Milk and water mixture.

Some infants do well on a simple mixture of milk and water, with the addition of a little sugar.

This mixture is generally given thus :

During the first month - Milk 1 part, water 2 parts
 During the second month - Milk 1 part, water 1 part
 During the following months - Milk 2 parts, water 1 part.

The analyses here would read :

	Human Milk	Cow's Milk			
		Pure	Milk 1 Water 2	Milk 1 Water 1	Milk 2 Water 1
Proteid	1.5-2%	3-4%	1.13	1.7	2.3
Fat	4.	4.	1.33	2.0	2.7
Carbohydrate	7.	4.75	1.58	2.37	3.17
Mineral Matter	0.2	0.7	0.2	0.35	0.5

In these cases a teaspoonful of sugar of milk, or a lump of sugar, is added to each feed.

By the use of cow's milk in this way, the stomach gradually gets accustomed to digesting the caseinogen of cow's milk.

The objection to this simple milk and water mixture is, that even when the child is taking a mixture of two parts of milk to one of water, the proportion of fat is much below the standard of human milk. Notwithstanding this drawback, however, some infants seem to thrive on this milk and water mixture, and escape the dangers of rickets. These would appear to be infants who do not suffer from gastric trouble, and are therefore able to absorb all the fat contained in the milk. It may also be that, in certain cases, a milk richer in fat than that usually supplied may be obtained.

Unfortunately, all infants do not thrive on such a milk dilution, and in these cases it may be necessary to use a

2. Milk and cream mixture.

In order to bring a milk and water dilution up to the requisite strength of fat and sugar, cream and sugar of milk are added.

Cream is not a standardized preparation. It

may be obtained, in large towns, in the form of centrifugal cream. On an average centrifugal cream may be considered to contain 48 per cent. of fat. In smaller towns, ordinary cream, obtained by skimming, may be the usual cream sold; this cream may contain 20 per cent. of fat. Roughly speaking, then, centrifugal cream is twice the strength of ordinary cream, which may be termed gravity cream.

One teaspoonful of centrifugal cream, or two teaspoonfuls of gravity cream, added to two and a half ounces of any mixture, that is one in twenty, means the addition of 2.4 per cent. of fat. Sugar may be added in the form of sugar of milk. One teaspoonful in two and a half ounces of any mixture means the addition of 5 per cent. of sugar. If cane sugar be used, one lump half an inch square, weighing forty grains, in two and a half ounces of any mixture means the addition of $3\frac{1}{2}$ per cent. of sugar.

A mixture such as the following may be ordered:

Mixture		Resulting compared Percentage to		Human Milk
Milk	3vii.	Proteid	1.13	1.5-2%
Water	3xiv.	Fat	3.77	4.
Cream	{ Centrifugal 3i.	Carbohydrate	6.58	7.
	{ or Gravity 3ii.			
Milk Sugar	one tea- spoonful	Mineral matter	0.2	0.2

It is necessary, when cream is ordered, to specify the kind of cream required, and also to make sure of its freedom from sourness or decomposition and also from boracic acid. It has been found that decomposition and boracic acid may be present in the same sample of cream.

In a case which recently came under my notice, a child, aged four weeks, had been fed on milk and water, and was making no progress. One teaspoonful of gravity cream was added to each feed, with the result that after each feed containing the added cream the child was sick. The probable explanation of this is: The caseinogen of the cow's milk is precipitated in the form of large lumps; the interference with normal digestion is then increased by the presence of an extra amount of fat, which, instead of being suspended as an emulsion, becomes entangled in the casein masses, so that these masses consist not merely of casein, but of an extremely indigestible combination of casein plus fat. In these cases citrate of sodium is an agent of great value in that it renders the curd finer.

3. Whey and cream mixture:

The great advantage of using whey in milk dilutions instead of water has been upheld by various

authorities.

In the methods previously considered, the proteid strength of cow's milk has been reduced by means of dilution to the proteid strength of human milk. Caseinogen still, however, remains the chief proteid in such a mixture, and therefore taxes the infant's digestive powers far more than human milk does. By the use of whey, this difficulty can, to a great extent, be overcome; for whey contains the albumen of the milk and not the casein. Again, inasmuch as nitrogenous extractives may play an important part in the nutrition of the infant, and as dilution of cow's milk with water would reduce the amount of extractives, it would seem to be the better plan to use whey as the diluting fluid.

Ashby⁽¹⁾ recommends the use of whey. He prepares it by placing thirty ounces of fresh milk in a Hawksley's Sterilizer and heating to 104° F., two teaspoonfuls of Benger's essence of rennet are added and the bottle set aside for a few minutes. When curdling has taken place, the curd is thoroughly broken up by stirring and shaking, and the whey is then strained off through fine muslin. In this way twenty-three ounces of whey are obtained. This

(1) Edinburgh Medical Journal, April, 1899. Quoted by Hutchison: "Food and Dietetics", page 451.

is heated to 180° F. for twenty minutes to destroy the rennin, and is then strained again.

The composition of whey so obtained is ⁽¹⁾:

Proteid	0.97	Chiefly lactalbumen.
Fat	2.0	
Sugar	4.7	
Mineral Salts	0.61	

To this centrifugal or gravity cream is to be added, thus -

Mixture		Resulting Composition	Human Milk
Whey	2½ ounces	Proteid 1%	1.5-2%
Cream {	(Centrifugal 1 drachm	Fat 4.4	4.0%
or	Gravity 2 drachms		
Milk Sugar	½ tea-spoonful	Sugar 7.2	7.0%

This mixture contains the right kind of proteid, though somewhat deficient in strength, the due amount of fat, and the proper quantity of sugar. Above all, there is the further advantage that the nitrogenous extractives of the milk are not diluted, as would be the case in a milk, cream and water mixture.

(1) Hutchison: "Food and Dietetics", page 452.

Still⁽¹⁾ recommends a mixture of milk, whey, and cream, thus -

Mixture		Resulting Composition	
Milk	6 drachms	Caseinogen	0.81%
Whey	18 drachms	Lactalbumen	0.75 *
Cream, Centrifugal	1 $\frac{1}{4}$ drachms	Fat	3.3
Milk Sugar	$\frac{1}{8}$ teaspoonful	Sugar	6.50

The objections with regard to whey and cream mixtures are that of expense and the amount of time and care necessary in their preparation. It is not a process which is suitable for poor mothers, and unless cream mixtures can be sold at a reasonable price, some other method must be found which will eliminate the ill effects of caseinogen digestion.

4. Milk and water with citrate of sodium.

The advantages to be gained by the use of citrate of sodium have been pointed out (page 26).

From a clinical standpoint, there can be no doubt that the use of citrate of sodium enables an infant to digest a milk mixture which would be vomited in masses of curd should the citrate of sodium be

(1) Still: "Common Disorders of Childhood", page 42.

withheld.

Citrate of sodium should not be used in larger doses than are actually necessary - from two to four grains may be given with each feed. Still⁽¹⁾ quotes the case of an infant who was given ten grains of citrate of sodium with each feed, the result being that general oedema appeared, within a few hours, after these doses were begun. It was suspected that this might be due to the citrate of sodium; it was therefore stopped. The oedema subsided, only to reappear when the use of the citrate of sodium, in the same doses, was recommenced.

The following case was treated with a citrated milk.

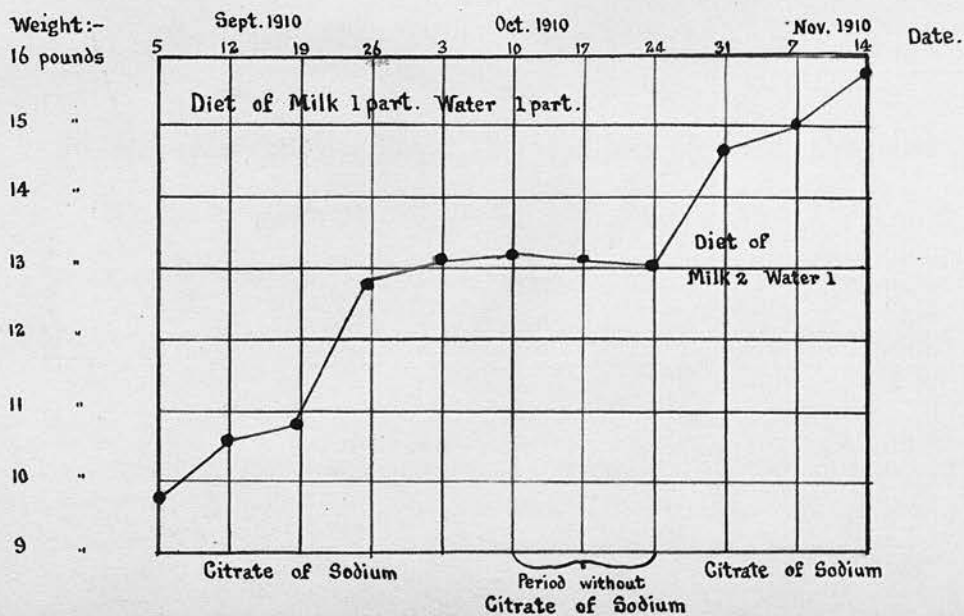
G.S., age 6 months. The child was brought to the Exmouth Dispensary, suffering from vomiting, with loss of weight. The history given was as follows. The child had been entirely breast fed up to the age of three months. At that age she seemed to come to a standstill with regard to growth, so the mother gave Bath biscuit in addition to the breast milk. At the time of coming under observation, the mother was not in good health, and the breast milk appeared to be poor. The child was therefore weaned.

(1) Still: "Common disorders of Childhood", page 51.

A mixture of equal parts of milk and water was ordered, a pint and a half of the fluid to be given to the child during the twenty-four hours - the milk not to be boiled. To each feed three grains of citrate of sodium were added. The child immediately began to improve: in three weeks she had gained nearly three pounds in weight, and that notwithstanding the fact that the food only contained 2 per cent of fat.

After a time, the use of the citrate of sodium was discontinued. The child immediately began to vomit curdled milk, and to lose weight. At the end of two weeks, the citrate of sodium was again ordered. The vomiting ceased, and the child began to gain ground.

The following chart represents the various points, namely, the gain in weight when citrate of sodium was used, and the food given.



To such a citrated milk it would, however, be well to add a teaspoonful of centrifugal cream to every two and a half ounces of milk and water.

5. Sterilized undiluted milk:

Closely allied to the citrate of sodium method of affecting the digestibility of the caseinogen of cow's milk, by substituting a sodium casein for a calcium casein, is the method of increasing the digestibility of the milk by sterilization⁽¹⁾. It appears to be absolutely necessary, if this method is to be a success, that the milk should be exposed to a temperature of 212° F. for forty minutes. This precipitates the calcium salts, and thus interferes with curd formation.

The advantages claimed for this method are⁽²⁾:

1. The bulk of food required to be given at each feed is smaller.
2. The assurance that the milk is sterile.

Care must be taken that the infant is not overfed.

This method is open to the objection that the prolonged heating of the milk destroys the anti-scorbutic element, and as the same result, namely

(1) British Medical Journal, Feb. 20, 1904, page 440.

(2) Byrom Bramwell: "Clinical Studies", Vol. 8, part 2, page 150.

that of increasing the digestibility of the milk, can be obtained by the use of citrate of sodium, it would seem that the use of citrated milk is preferable.

The mention of sterilized milk raises the question of the boiling of milk. Should milk be sterilized or pasteurized?

THE PASTEURIZATION AND STERILIZATION OF MILK.

Cow's milk, as delivered by a milkman, may contain pathogenic as well as non-pathogenic organisms. The chief dangers to be anticipated are those arising from the presence of tubercle bacilli, the organisms of typhoid fever, scarlet fever, and diphtheria.

The chief non-pathogenic organism present is that of lactic acid, producing the souring of the milk.

That tuberculosis may be conveyed by milk seems to be a well established fact. Cheadle⁽¹⁾ mentions a case where six girls fell victims to tuberculosis: the milk taken by these girls was drawn from a cow whose udder was the seat of extreme tuberculous lesions.

(1) Cheadle: "Artificial Feeding of Infants", Ed.VI., page 71.

Still⁽¹⁾ states that he has met with cases of tuberculosis which were directly due to the giving of raw milk.

Another danger is that in summer an acute diarrhoea may be produced by some milk-borne bacteria. To avoid these dangers, milk may be pasteurised, that is, heated to a temperature of 158° F. and kept at that temperature for thirty minutes. This destroys the bacilli of diphtheria⁽²⁾ and typhoid fever⁽³⁾. In order to destroy tubercle bacilli, it is necessary that the fluid in which they may be present be exposed to a temperature of 212° F.⁽⁴⁾ This can be done by the use of a double saucepan. The water in the outer vessel is brought to the boil and kept thus until the milk has reached the same temperature as the boiling water.

Or milk can be sterilized, that is, the temperature of the milk must be raised above the boiling point - that is, up to 230° F. - and kept there for some time.

The advantages of boiling milk which is to be used as an infant's food are therefore great, also these advantages do not seem to be purchased at the

(1) Still: "Common Disorders of Childhood", page 48.

(2) (3) (4) Muir & Ritchie: "Manual of Bacteriology",

(2) page 345, (3) page 309, (4) page 225.

cost of any noteworthy diminution of digestibility and absorption.

To counter-balance these advantages, however, it would seem that, by sterilizing food, especially milk, some change of a character not quite known is wrought. There seems to be no doubt that the antiscorbutic principle of milk is in some way destroyed. May it not be also that milk contains some inherent vital quality, other than the antiscorbutic, which is necessary for healthy growth, and that sterilization destroys this? It may be that this vital quality is associated with the nitrogenous extractions, and that these are injured by heat.

Cheadle⁽¹⁾ says: "My own experience is that, although sterilized milk answers admirably for a time, children kept on it eventually lose firmness of flesh and vigour, and do not thrive into robustness."

Referring to the use of milk in such conditions as dropsy and malnutrition, Hutchison⁽²⁾ quotes Donkin as follows: "A temperature of 212° F., I feel assured, either seriously impairs or altogether destroys its therapeutic energy, possibly by altering the molecular constitution of the casein, or by destroying some vital property with which it is endowed.

(1) Cheadle: "Artificial Feeding of Infants", Ed.vi., page 75.

(2) Hutchison: "Food and Dietetics", page 130.

Vaglio⁽¹⁾ holds that the reason why rickets is more common in artificially fed infants is because when milk is boiled the enzyme which it contains, and which is ultimately derived from the thyroid, is destroyed by the boiling.

Carstens and Von Starch⁽²⁾ have both found that the use of sterilized milk leads to grave disturbance of nutrition, resulting in the development of severe anaemia, rickets, and scurvy. On the other hand, Still⁽³⁾ denies that rickets can be produced by the use of boiled milk.

There can be no doubt however with regard to the production of scurvy by the use of sterilized foods.

Ashby⁽⁴⁾ reports the case of an infant fed on the breast till six weeks old, and then brought up on sterilized humanized milk. When seen by Ashby, at the age of ten months, the child was found to be suffering from scurvy.

So far the milk modifications which may be prepared at home have been considered.

(1) Quoted from British Medical Journal, Dec. 24, 1910, page 100 of epitome.

(2) Vincent: "Nutrition of the Infant", page 152.

(3) Still: "Common disorders of Childhood", page 48.

(4) British Medical Journal, Feb. 27, 1904, page 479.

HUMANIZED MILK, -

As prepared by various Dairy Companies, is sometimes useful. In two of my cases, where nothing seemed to suit the infant, humanized milk was ordered, with the result that both cases began to improve.

The mode of manufacture is as follows: Milk is diluted with an equal quantity of water. It is then subjected to the action of a centrifuge, and divided into two equal parts. One part contains practically all the fat of the original milk, but only half of the other ingredients. The addition of milk sugar makes good the deficiency in that constituent.

Table to show composition of various
Humanized Milks.

	Human Milk	Aylesbury Dairy Co.		Pager's Perfected Milk Food	Goertner's Feltmilch
		No.1	No.2		
Proteid	1.5-2%	1.3	2.2	1.08	1.5
Fat	4.	4.0	3.6	3.83	3.2
Carbohydrate	7.	4.7	5.2	6.82	6.0
Mineral Matter }	0.2	0.49	0.57	0.23	0.35

Analyses taken from Hutchison's
"Diet and Dietetics", page 450.

Our thoughts naturally turn to the consideration of cow's milk when it is necessary to consider the question of bringing up an infant by artificial means.

The milk of other animals is sometimes used, especially that of the ass.

The following table presents the chief characters of these various milks, and compares them with human milk.

	Human Milk	Mare's Milk	Ass's Milk	Cow's Milk	Goat's Milk
Proteid	1 to 2%	2.	1.8	3.40	4.3
Fat	4.0	1.0	1.	4.	3.4
Carbohydrate	7.0	6.33	5.5	4.75	3.8
Mineral Matter	0.2	0.45	0.4	0.7	0.9
Time by which weight is doubled - in days.	180	60		47	19

It has been pointed out that the percentage of proteid and mineral constituents of any milk bears some relation to the rate of growth of the animal that particular milk is intended to nourish. The foal takes more time to double its weight than the calf. Thus mare's milk contains a percentage of

proteid and mineral matter, which, being less than that of cow's milk, more closely approximates that of human milk.

Ass's milk contains the same amount of proteid as human milk, but is very poor in fat. The curd formed by ass's milk is finer and more like the curd formed by human milk, than the curd formed by cow's milk when diluted down to the same proteid strength.

The cost, however, of ass's milk is prohibitive to its general use. Cow's milk is therefore the only milk which is used instead of human milk, save in some exceptional cases.

P A R T I I. (Continued).

The Proprietary Foods :

Considered from an Analytical and Clinical
standpoint.

1. Starch containing foods.
2. Foods not containing unaltered starch.
 - (a) Those intended as substitutes
for cow's milk.
 - (b) Those intended to be used as
additions to cow's milk.

Summary of views formed.

*

THE PATENT OR PROPRIETARY FOODS.

There are many milk substitutes or patent foods, which, by reason of their large and daily use, demand inquiry into. These foods may roughly be divided into two main classes :

1. Patent or proprietary foods which contain unaltered starch.
2. Those which contain no unaltered starch.

1. PATENT FOODS WHICH CONTAIN UNALTERED STARCH.

Amylopsin⁽¹⁾ is not present in the human pancreatic secretion until the sixth month of life. The absence of this ferment in the pancreatic juice of infants is an indication that starch is not their natural diet.

Unfortunately it is very difficult to make some parents, or grandparents, understand that a child can thrive on milk and milk only: they consider that a child requires some food which has more substance in it than milk.

In one case of which I had personal experience, the child had been given cornflour as an addition to

1. Halliburton: "Handbook on Physiology", 1903, page 488.

the milk. On remonstrating with the grandmother, who was in charge, I was informed that 'all her children had been brought up on cornflour from the tenth day, and the grandchild was to be brought up on the same food'.

Among the poor it is frequently found that boiled bread is given with the milk. Fortunately, for some of these children, the starch digesting power of infants seems to vary. Hutchison⁽¹⁾ mentions the case of a child who was making no progress on a diet of peptonised milk. The mother, on her own initiative, added cornflour to the diet, with the result that the child began to put on weight.

Still⁽²⁾ goes so far as to say, that his experience leads him to consider, that even such a small amount of starch (1-2%) as is present in barley water is often hurtful.

It is better therefore to exclude all foods containing unaltered starch from the dietary of an infant, till at least the sixth month of life, and even then starch containing foods should only be gradually introduced.

The analyses of the commonly used starch containing foods is shown in the following table, and

(1) Hutchison: "Lectures on Diseases of Children", page 52.

(2) Still: "Common Disorders of Childhood", page 62.

comparison made with the analysis of dried human milk⁽¹⁾.

	Dried Human Milk	Ridge's Food	Neave's Food	Frame Food	Cornflour
Proteid	12.2%	9.2	10.5	13.69	Proteid and Fat are washed away in process of manufacture, thus nearly Pure Starch
Fat	26.4	1.0	1.0	0.44	
Soluble Carbohydrate	52.4	5.19	4.71	22.33	
Starch		77.96	74.27	54.96	
Mineral Matter	2.1	0.70	1.60	0.96	

Not only do the above foods consist largely of Starch, but they are also greatly deficient in fat; a combination of errors which render them unsuitable as foods for an infant under the age of six months. Even if given after that age, they require the addition of some fat.

2. PROPRIETARY FOODS WHICH DO NOT CONTAIN UNALTERED STARCH.

(a) Those intended as substitutes for cow's milk.

1. Dessicated milk, as Glaxo and Lacvitum.

(1) Analyses quoted from Sutherland: "System of Diet and Dietetics", page 217.

2. Condensed Milk.

3. Dried milk with additions as :

Allen and Hanbury's Food No.1 and 2.
Horlick's Malted Milk
Carnrick's Soluble Food.

(b) Those intended to be used as additions to cow's milk.

Cereal starch completely converted, as
Mellin's Food.

Cereal starch partially converted, as
Benger's Food.

(a) Foods intended as substitutes for cow's milk :

1. Dessicated Milk:

Dried milk is the residue left after the natural moisture in milk has been evaporated.

The process of manufacture is as follows.

Fresh milk is fed in a continuous stream on to revolving heated cylinders, on which it forms a thin film. These cylinders are heated by steam at about forty pounds pressure, and the surface attains a temperature of about 250° F. The dried film is automatically detached from the cylinders by knife edges, and falls into receptacles below. The small amount of moisture not evaporated is taken up by the milk sugar as water of crystallisation. The dried milk is then passed through a sieve, and afterwards packed in air-

tight packages. It is practically sterile, and will keep indefinitely.

In the British Medical Journal⁽¹⁾ there is to be found a report relating to the feeding of infants on dried milk in Sheffield. The brands used were Glaxo, Cow and Gates, and Universal. This form of milk was used in the following cases :-

1. For infants who had been breast fed entirely, but who had not thriven, owing to the scarcity or quality of the milk.
2. For infants who had been fed on cow's milk, or on some patent food, and had suffered from considerable digestive disturbances.
3. For infants who, without marked symptoms of indigestion, appeared to be congenitally incapable of assimilating nourishment.

The result, in most cases to which this form of nourishment was given, appears to have been most favourable; one case is reported to have developed a minor degree of rickets, and in two or three cases the initial gain in weight was followed by a stationary period.

Dr C. Kellick Millard⁽²⁾, Medical Officer of Health for Leicester, has published the results obtained from the use of dried milk at the Leicester

(1) British Medical Journal, Aug.29, 1908, page 571.

(2) British Medical Journal, Jan.29, 1910, page 253.

Corporation Infants' Milk Depot. In this town the use of dried milk seems to have been attended with good results. Careful watch was kept to note any ill effects, such as rickets, but, although some of the infants had been fed in this way for ten months or longer, no ill effects had been noted.

Dr Millard claims for dried milk -

1. That it is pleasant to take.
2. That it seems to be more easily digested than fresh milk, the curds produced not tending to form the hard cheesy masses as with fresh cow's milk.
3. The third advantage claimed being its cheapness, ease of use, and freedom from contamination and bacteria.

In thus administering dried milk, the precaution has been taken to advise the routine administration of fresh fruit juice every other day as an antiscorbutic.

No cases of scurvy have occurred, either at Sheffield or Leicester.



Table giving analyses of Dried Milk Preparations.

	Dried Human Milk	Glaxo (1)	Lacvitum (2)	Glaxo mixed for use	Milk 2 Water 1
Proteid	12.2	22.2	28.04	2.2	2.3
Fat	26.4	27.4	29.40	2.7	2.7
Carbohy- drate }	52.4	41.0	31.26	4.1	3.17
Mineral Matter }	2.1	5.90	5.96	0.5	0.5

Glaxo when diluted according to directions contains one tenth of the above proportions: the resulting fluid has therefore a composition which closely approximates that of a mixture of two parts of milk with one of water.

2. Condensed Milk:

Condensed milk has a large sale among the poor population. About 500,000 cwt. of this product is imported into this country yearly. It is a cow's milk from which a large proportion of water has been

(1) Analysis from Hutchison: "Lectures on Diseases of Children", page 46.

(2) Analysis from Sutherland: "System of Diet and Dietetics", page 223.

removed. The removal is effected by evaporation under reduced pressure, and with the aid of a greater or less degree of heat. As a rule the milk is reduced to one third of its original volume.

There are two principal varieties of condensed milk:

a. Condensed Milk without added sugar.

This may be prepared from skimmed milk, whole milk, or milk with added cream: there must therefore be a considerable difference in the food value of the various brands.

The following table gives the analyses of the best brands⁽¹⁾.

	Ideal	Viking	Hollanded
Proteid	8.3 p.cent	8.9 p.cent	11.3 p.cent
Fat	12.4 "	9.9 "	9.8 "
Lactose	16.0 "	13.3 "	18.5 "
Ash	1.3 "		3.4 "

The 'Ideal' brand is stated to be enriched by the addition of 20 per cent. of cream. On one part

(1) Quoted from Sutherland: "System of Diet and Dietetics", page 218.

of such a milk being diluted with two parts of water, the resulting fluid corresponds to a sample of good cow's milk. The disadvantage of the unsweetened condensed milk is that it is apt to go bad soon after the tin has been opened.

b. Condensed Milk with added sugar.

Here again the goods of various manufactures differ. The original milk may be either skimmed, whole, or with added cream. To all, a considerable amount of cane sugar is added. This acts as a preservative, so that the milk will keep good for several days after the tin has been opened.

The best brands of sweetened condensed milk have the following composition⁽¹⁾:

	Nestle's	Milkmaid Swiss	Milkmaid English	Anglo-Swiss
Proteid	9.7%	9.7%	9.6%	8.8%
Fat	11.5%	11.5%	10.1%	10.8%
Lactose	13.0%	13.0%	12.5%	16.0%
Sucrose	37.5%	37.5%	41.5%	37.1%

When considered from an analytical point of view, it

(1) Quoted from Sutherland: "System of Diet and Dietetics", page 220.

is evident that no dilution can possibly render such a fluid fit to be used as an infant's food. The sugar (50%) is the dominant factor: reduce the sugar to the percentage found in human milk, and the fat is reduced to 1.7 per cent., a percentage which is much below that which we have laid down as the minimum.

From a Clinical point of view. - Condensed milk would seem, in so far as the proteid constituent of the milk is concerned, to be more easily digested than fresh cow's milk. The process of manufacture in some way seems to affect the caseinogen, so that the milk, when diluted with water in such a proportion as to restore it to the percentage proteid composition of ordinary cow's milk, either does not clot with rennet, or, should it clot, the clot is much looser.

The cane sugar, however, is apt to cause digestive disturbance should the condensed milk not be sufficiently diluted.

Condensed milk may be of use in an emergency. Yet, notwithstanding the legend to be found on the tins to the effect that "Condensed milk is more suitable for infant feeding than cow's milk", we must be careful that its use is not continued for any length of time, for not only does the deficiency of fat

favour the production of rickets, but also, condensed milk, not being a fresh food, is liable to lead to the development of scurvy. Still⁽¹⁾ states that he has notes of fifteen cases of infantile scurvy following the use of condensed milk, where it had been used either by itself, or with some other patent food.

Another preparation of condensed milk is made by the Aylesbury Dairy Co. called Humanoid. This has to be diluted with two parts of water before use.

The only kind of condensed milk which can be recommended, for use as an infant's food, is that made from whole milk, and to which no sugar has been added. It can be used when fresh milk is unobtainable: or in cases where infants cannot digest fresh cow's milk, it may be found useful as a temporary food.

It would appear, however, that in dried milk we have a preparation which will ultimately supply the place now filled by condensed milk.

(1) Still: "Common disorders of Childhood", page 68.

TABLE showing the relative proportions of fat, proteid, carbohydrate, in Human Milk, and in the dilutions of Cow's Milk, and Condensed Milk.

	Human Milk	Cow's Milk				Condensed Cow's Milk						
		Pure	1 part 2 parts	1 part 1 part	2 parts 1 part	Un-sweetened		Sweetened			Human Milk	
			Milk Water	Milk Water	Milk Water	Pure	1 in 3	Pure	1 in 7	1 in 3½	Pure	1
Proteid	1.5-2%	3.4	1.13	1.7	2.3	8.3	2.8	9.7	1.4	2.8	4.2	
Fat	4.0	4.	1.33	2.0	2.7	12.4	4.1	11.5	1.7	3.4	10.2	
Carbohy- drate }	7.0	4.75	1.58	2.37	3.17	16.0	5.3	50.0	7.1	14.0	17.8	
Mineral Matter }	0.3	0.7	0.2	0.35	0.5	1.3	0.4					

The directions given for the use of sweetened condensed milk are, one part is to be mixed with fourteen parts of water, the strength of the mixture to be gradually increased until a dilution of one in seven is reached.

One full teaspoon of condensed milk, I find, is

(1) Analysis quoted from Still: "Common disorders of Childhood", page 71.

equal to two drams. . So that, if the directions are followed accurately, the first dilution is that of one in seven; this would, in proteid and sugar strength, correspond with human milk, but be lacking in fat.

The stronger dilution would be one of one in three and a half, a fluid in which the sugar is in excessive amount.

3. Dried Milk with additions:

Examples of these foods are to be found among the present day largely advertised infant foods. One is advertised as forming on the addition of water 'An accurately estimated humanized milk'.

Allen and Hanbury's Food No.1 may be taken as an example of this class. It is a dessicated cow's milk from which the excess of casein has been removed, and a certain proportion of soluble vegetable albumin, milk sugar, and cream added: no starch is present. The directions given are that half an ounce is to be mixed with six ounces of water.

Other examples of this class are Horlick's Malted Milk and Carnrick's Soluble Food.

TABLE to show composition of Foods of this class
compared with Human Milk and Cow's Milk⁽¹⁾.

	Human Milk		Allen & Hanbury's Food No.1		Horlick's Milk		Carnrick's Food		Cow's Milk & Water Equal Parts
	Dried	Liquid	Dried	Liquid	Dried	Liquid	Dried	Liquid	
Proteid	12.2	1.5	9.7	1.6	13.8	1.38	13.6	1.36	1.7
Fat	26.4	4.0	14.0	2.3	9.0	0.9	2.5	0.25	2.0
Carbohydrate }	52.4	7.0	66.85	10.0	70.8	7.08	76.2	7.6	2.37
Mineral Matter }	2.1	0.3	3.75	0.6	2.70	0.27	2.20	0.22	0.35

On comparing the analyses of these foods with that of dried human milk, the most striking feature is the high percentage of carbohydrate, contrasted with the low percentage of fat.

From a clinical standpoint this is disastrous, more disastrous indeed in that the ill effects of these foods may not manifest themselves until several months have passed.

I have experienced a case such as the following:

(1) Analyses quoted from Hutchison: "Food and Dietetics", page 461.

The mother for some reason or other was unable to nurse the child, and the usual milk modifications seemed to disagree. Allen and Hanbury's Food was used, and for a time all went well. The child thrived. The flatulence from which the child suffered was relieved, the bowels, which were constipated, acted regularly. Under these circumstances it was difficult to make the mother understand that the food was only intended to be a temporary one, and that a return had to be made to cow's milk, or to some modification of cow's milk, as soon as possible. This necessity of considering the use of such a food as a temporary expedient, was forced upon me by two cases. In each case, as for some reason breast milk was unavailable, I had ordered Allen and Hanbury's Food to be given. The food agreed so well with the infants that the mothers continued to use it until the ill health of the children led to my being consulted. Both children had been well looked after, and had been given plenty of fresh air, yet both showed signs of rickets.

It is interesting to note that one of the mothers has subsequently had a second child which she has been able to nurse, and this child at the age of one year is in good health.

Scurvy may also arise from the use of these

foods.

A case has been reported in the British Medical Journal⁽¹⁾ where a child was brought up from the age of three weeks on Allen and Hanbury's Food. At the age of nine months the child was found to be suffering from scurvy.

The other two foods mentioned, Horlick's Malted Milk and Carnrick's Soluble Food, contain such a small percentage of fat that they do not form adequate foods for an infant. In those cases where it may be deemed necessary to order these foods, it is advisable to impress upon the mother the necessity of administering some fresh fruit juice daily.

(b) Foods intended to be used as additions to Cow's Milk :

These are farinaceous foods prepared from cereal, usually wheat, of which the starch has been partly, or wholly, transformed into soluble substances, dextrine and malt sugar. They require the addition of milk to fit them for use as an infant's food.

They may be divided into two groups :

1. Those in which all the starch has been transformed before reaching

(1) British Medical Journal, Feb.1, 1908, page 258.

the consumer - Mellin's Food.

2. Those which contain malt, or pancreatic ferment, which converts the starch when the food is mixed. Examples are - Savory and Moore's Food, Benger's Food.

The following Table gives the analyses of these Foods, in a dry state, and compares them with Human Milk and Cow's Milk when mixed ready for use.

	Human Milk		Mellin's Food		Cow's Milk & Water, Equal Parts	Benger's Food	Savory & Moore's Food	Moseley's Food
	Dried	Liquid	Dry ¹	Liquid ²		Dry ¹	Dry	Dry ¹
Proteid	12.2	1.5	7.9	2.62	1.7	10.2	10.3	11.0
Fat	26.4	4.0	0.9	2.89	2.0	1.2	1.4	0.92
Carbohydrate }	52.4	7.0	82.0	5.98	2.37	79.5	83.2	76.4
Mineral Matter }	2.1	0.3	3.80	0.47	0.35	0.8	0.6	0.94

The directions given for making Mellin's Food are as follows:

For a child one month old, one teaspoonful of food to be added to four ounces of fluid.

(1) Hutchison: "Food and Dietetics", pages 462 & 463.

(2) Quoted by Hutchison: "Food and Dietetics", page 467.

For a child three months old, one teaspoonful of food to be added to three ounces of fluid.

For a child six months old, two teaspoonfuls of food to be added to three ounces of fluid.

The fluid to be a mixture of milk and water, the strength of which has gradually to be increased, from a mixture of one part of milk to two parts of water, to a mixture of three parts of milk and one of water.

One heaped teaspoonful of Mellin's Food weighs 85 grains, of which 70 grains are sugar; thus the addition of one heaped teaspoonful of Mellin's Food to three ounces of any fluid is equal to the addition of 5 per cent. of sugar.

An infant of three months would therefore be taking a food containing 7 per cent. of sugar, and an infant six months old, a food containing 12 per cent. of sugar.

Such an excess of sugar is not to be found in an ideal food, and as it seems likely that an excess of carbohydrate when continued for several months has some slowly produced effect favouring the ultimate onset of rickets, probably by interfering in some way with the assimilation of fat⁽¹⁾, the continued use of Mellin's Food is not to be approved of.

(1) Still: "Common disorders of Childhood", page 65.

The same objection applies to the other foods of this class which have been mentioned.

The analyses of all these particular foods, when compared with the analysis of dried human milk, are characterised by the large amount of carbohydrate compared to the small percentage of fat.

If the extent to which these proprietary foods are advertised be any criterion, then their sales must be enormous. Are they thus largely used because they satisfy a genuine want, or is it because the reiteration of advertisement gives them a fictitious value? They are, as a rule, readily procured, easily prepared, and unfortunately when first used seem to suit the infant. The indigestion from which the child may have suffered vanishes, the bowels become more regular in their action, and the child puts on weight. Thus far, then, they may be of service. Should they, however, be continued for any length of time, this initial advantage is apt to be more than counter-balanced by a period of ill-health, an ill-health which may take the form of rickets or scurvy.

To summarize our views on proprietary foods, therefore, - While they may be of temporary use,

they do not answer satisfactorily to the test of analysis. They do not correspond with our description of a perfect food. The various proportions of proteid to fat, fat to carbohydrate, are not those found in human milk, and above all they are not fresh foods, and do not seem to contain any anti-scorbutic element. Of all the preparations mentioned, the only one, the use of which, for any length of time, seems to be warranted by the results obtained by actual clinical experience, is that of dried milk.

P A R T I I I.

SYNOPSIS:

The Mother in relation to the Child.

1. Methods of improving the mother's milk.
2. The times for feeding the infant.
3. The diet of the mother during lactation.
4. The indications for weaning.

In cases where the Mother's Milk is not available for feeding.

1. Wet nursing.
2. Bottle-fed babies.
 - (a) The simpler the food the better.
 - (b) Fresh food to be preferred to boiled or sterilized.

Premature Infants.

We have thus considered the question of infant feeding in relation to the normal standard of breast milk. The conclusion forced upon us is. - If deprived of the mother's milk, it is difficult for the infant to be provided with a substitute which will be quite as good.

We would therefore consider

THE MOTHER IN RELATION TO THE CHILD.

The various points to be considered are :

1. The best methods of attempting to increase the quantity if necessary, or improve the quality of the milk.
2. The times of feeding, and the amount taken at each feed.
3. The diet of the mother during the nursing period.
4. The indications for weaning.

1. The best methods of improving the supply of milk.

Should breast milk appear to disagree with the child, it would be well to draw off a specimen of the milk and have it examined. The method of doing this is as follows. The time taken to empty the

breast is noted: the infant is put to the breast, from which we are to obtain our specimen of milk, for one third of the time noted; immediately afterwards about one ounce of milk is extracted by a breast pump. The sample obtained will show approximately the average quality of the milk.

(a) The milk may be deficient in quantity :

One of the best methods of improving the flow of milk is to order rest for the mother. Extract of malt administered with meals is also said to increase the flow of milk.

(b) The milk may be deficient in quality:

The influence of diet on the mother's milk has already been investigated (page 4), from which it is evident that a highly nitrogenous diet is helpful.

2. The times of feeding and the amount taken at each meal.

Experiments have been undertaken to ascertain the gastric capacity: the method adopted being to carefully weigh the child before and after each meal.

It has been found that the average size of the stomach is as follows:

At the age of one week - $1\frac{1}{2}$ ounces.
 At the age of two weeks - 2 ounces.
 At the age of three months - 3 ounces.

From the age of three months till the age of eight months, the stomach capacity increases at the average rate of one ounce for every month.

Figures published by Rotch show⁽¹⁾

1. The necessity for frequent increase in the amount of food given in the early months of life.
2. The very slow increase of gastric capacity during the months six to eight.
3. The gradual increase of stomach capacity at the end of that period.

The amount of food to be given during the twenty-four hours, with the number of meals, and the period of time which should separate the meals is shown in the following table⁽²⁾:

Age	Interval	Meals	Amount of each	Total in 24 hours
1st week	2 hours	10	1 ounce	10 ounces
2-6 week	2 hours	8	$1\frac{1}{2}$ -2 ounces	12-16 ounces
6 weeks to 4 months)	$2\frac{1}{2}$ -3 hours	6	3-4 ounces	18-24 ounces
6 months	3 hours	6	6 ounces	36 ounces
10 months	3 hours	5	8 ounces	40 ounces

(1) Vincent: "Nutrition of the Infant", page 179.

(2) Table from 'Diseases of Children' (Goodhart & Still) page 64.

3. The diet of the Mother during the nursing period.

This should be abundant - ordinary diet. In my opinion certain articles of food should not be eaten during this period. Acid fruits, such as apples; vegetables, such as spinach, cabbages, turnips, seem to be agents producing pain in the infant.

Various drugs also, such as saline aperients, potassium iodide, salicylate of soda, seem either to be excreted in the milk or affect the milk indirectly. Opium is excreted in the milk, and therefore should not be given to nursing mothers⁽¹⁾.

The effect of an insufficient diet taken by the mother seems to be to lower the percentage of fat in the milk, and thus injuriously to affect the child (see page 8).

4. The indications for weaning.

The immediate signs of successful feeding are:

1. Steady increase in weight, with firmness and active movements of the limbs.
2. Regular and good appetite, with satisfaction after a meal.
3. Absence of vomiting and flatulence, with regular action of the bowels, and healthy stools.

(1) *Materia Medica* (Hale White) 2nd Edition, page 108.

4. Comfort and happiness when awake,
and regular periods of unbroken
sleep.

In certain cases the breast milk does not seem to agree with the child. In these cases we should be very careful how we advise that breast feeding be discontinued. The immediate, as well as the ultimate, gain to the child by breast feeding is so great that it is only after careful consideration that we should determine to discontinue it. It may be that the mother has not been sufficiently careful with regard to her own diet. In other cases, the fault may lie in the too frequent feeding of the child, or the child may be taking the milk down too quickly.

With regard to the child, the indication for weaning would be an insufficiency of the mother's milk, resulting in either a loss of weight, or a not sufficient increase in weight. In these cases, the question of mixed feeding should be considered, the child to be fed from the breast at certain times during the day, and at the other times during the twenty-four hours on some suitable milk modification.

The chief conditions affecting the mother which would contra-indicate breast feeding are: Extreme weakness, tuberculosis, various acute illnesses, such as puerperal fever, and pregnancy during lactation.

The child should naturally be weaned about the ninth month.

THE TREATMENT OF PREMATURE INFANTS.

It is extremely important in these cases that every effort be made to maintain the normal heat of the body. Paquet has described a simple method of doing this.

"An incubator not being procurable, Paquet enveloped the child in a half-pound packet of absorbent cotton wool, leaving only a small opening for air and feeding, covering the wool with jaconet to prevent evaporation. The infant was then surrounded with hot water bottles in a warm cradle in a room kept at a temperature of about 80° F." (1)

If the mother is not able to suckle the child, and it be necessary to artificially feed the child, it must be remembered that the child's digestive powers are weak. The feedings require to be frequent, and the amount of each feed should not exceed two drachms. Whey may be given as the food.

(1) Quoted from British Medical Journal, Jan. 14, 1911, page 7.

Seeing how difficult it is to get a substitute for human milk, which will be fresh, pure, and contain the necessary amount of fat, proteid, and carbohydrate, in their proper proportions, mothers should be taught how necessary it is for them to nurse their children, and every influence should be used, so that this, one of the most pleasant and natural duties of motherhood, may be properly carried out.

If for any reason the child has to be weaned, the method of artificial feeding to be used will be influenced by the circumstances which surround the particular child with which we have to deal.

Should the infant be very feeble, and if it seem probable that the only chance of living the child has lies in our ability to provide it with breast milk, then, if possible, a wet nurse should be obtained. In such circumstances it would be necessary not only to examine the woman, but also her infant for any sign of syphilis, or other specific disease. It has been proposed, in such cases, that the milk of the woman, instead of the blood, should be examined by Wasserman's test⁽¹⁾. The quality and quantity of the milk should also be

(1) The Medical Review, Dec. 1910, page 664.

ascertained. In stronger children, where a wet nurse is not absolutely necessary, when dealing with either rich or poor, the points to remember are these :-

The child must be supplied with a food containing sufficient fat, and the right proportion of digestible proteid and carbohydrate. The food should also be fresh, if possible.

In dealing with the better classes, if it has been decided that the mother is not to nurse the child, then, during the first three days it would be well to feed the child on whey; cream can then be added, gradually, to the whey, until the child is taking a cream and whey mixture containing the right proportion of fat. This can be replaced later by a whey, milk and cream mixture. In these cases, if the milk supply is above suspicion, the food may be given unboiled. If there be any doubt, then let the milk be brought to a temperature of 212° F. in a double saucepan.

In the case of infants belonging to the poorer classes, the aim should be to give as simple a food as possible. In those districts where a satisfactory milk can be obtained, the use of fresh cow's milk is much to be preferred.

After the preliminary use of whey during the first few days of life, milk and water, gradually, but at the same time as rapidly as possible, rising from a dilution of one part of milk with two parts of water, to a dilution of two parts of milk with one part of water, can be given. To this the necessary amount of sugar and cream can be added. Should any difficulty be experienced in digesting this mixture, citrate of sodium, one grain to each ounce of milk, should be added.

Here again the question of giving boiled or un-boiled milk must be answered according to the circumstances of each case.

Unfortunately, every now and again, we are brought in contact with cases where even the simplest of milk mixtures disagree. In these cases if a reliable Laboratory milk can be obtained it should be given. The percentages of lactalbumen and caseinogen can thus be regulated to suit the individual case. This milk has neither to be pasteurized or sterilized before use.

If this cannot be obtained, one of the humanized milks, such as 'Paget's Perfected Milk Food' may be of service, or it may be found necessary to peptonize the milk. If either of these two latter foods are used, it must be remembered that the

ultimate aim should be to gradually return to some milk modification at the earliest possible opportunity.

THE HYGIENE OF THE NURSERY.

The day nursery should be one of the best rooms in the house. It should be large and airy, with such an aspect that it may be exposed to as much sun as is possible.

The feeding bottles, boat shaped, and teats should be cleaned immediately after use, and boiled in water at least once during the day.

All food used must be absolutely fresh, and care must be taken to ensure that the milk be free from all preservatives such as boracic acid.

The weight of the child is so important a guide with regard to diet, that if possible a systematic weight record should be kept - once a week, or once every two weeks as may seem advisable, having regard to the condition of the child and the feelings of the mother.

P A R T I V.

SYNOPSIS:

The feeding of Children during the second year
of life.

1. The necessity for a sufficient
amount of fat in the food.
 2. The various foods which may be
used.
 3. The need of giving food at regular
times.
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We have thus considered the feeding of infants until the natural time of weaning, which should take place when the child is about nine months old.

As it is important that the child should have a dietary suited to its age during the second year of its life, and as the term infant may be taken to apply to a child up to the second birthday, it would be well to indicate the lines on which rules for the diet during this period may be laid down.

It has been found that the amount of nutrition required during this period is as follows⁽¹⁾:

	Proteid	Fat	Carbohydrate
At $1\frac{1}{2}$ years } of age	42.5 grammes	35 grammes	100 grammes
At 2 years } of age	45 "	36 "	110 "
For an adult	125 "	50 "	500 "

The striking feature is, that as in the case of an infant up to the age of one year, fat plays an important part in the diet during the second year of life; considerably more fat, in proportion to the

(1) Hutchison: "Diet and Dietetics", page 469.

other constituents of the food, being required by the child. Still⁽¹⁾ lays stress on the importance of a sufficient amount of fat being given during the second year of life, to guard against the development of rickets.

The various constituents of the food may be obtained thus:

1. The proteid constituent of the food:

This plays an important part. Lack of sufficient proteid leads to feebleness, flabbiness, and palor of the child.

The principal supply of proteid should be obtained from cow's milk, supplemented by yolk of egg, chicken, fish, and underdone meat.

It has been estimated that one-third of the proteid supply should be obtained from animal food, the remaining two-thirds from vegetable sources - especially from preparations of oats, which contain a comparatively high percentage of fat.

The following table shows the analysis of suitable preparations⁽²⁾:

(1) Still: "Common disorders of Childhood", page 86.

(2) Quoted from Hutchison: "Diet and Dietetics", page 221.

		Nitrogenous Substances	Fat	Carbo- hydrate	Cellulose	Mineral Matter
Wheat	Scottish Oatmeal	14.6%	10.1%	65.1%	3.2%	2.1%
	Quaker Oats	14.7	6.2	68.4	1.7	2.0
	Robinson's Groats	11.3	6.5	70.4		1.7
	Rice	5.0	0.1	41.9		0.3
				Carbohydrate		
				Soluble	Insoluble	
	(Grape Nuts	11.97	0.61	42.7	36.52	2.01
	Force	9.42	1.35	11.36	65.69	2.9

The yolk of egg contains ⁽¹⁾:

Proteid	16.2 per cent.
Fat	31.75 " "
Mineral Matter	1.09 " "

2. The fat constituent of the food:

This is to be obtained from milk, butter, bacon fat, yolk of egg. Butter contains 82 per cent. of fat. Butter fat consists of 40 per cent. of olein; as this fat has a low melting point, it implies that

(1) Quoted from Hutchison: "Diet and Dietetics", page 152.

butter is easily digested and absorbed. Butter, indeed, is the most easily digested of fatty foods. In close relation to butter stands margarine; this contains 82.7 per cent. of fat and consists largely of olein. Margarine is absorbed almost as completely as butter, the difference being about 2 per cent. It is much cheaper than butter, and thus makes a valuable food for the children of the poor.

The fat of bacon is also easy of digestion.

3. The carbohydrate constituent of the food:

Up to the end of the first year of life it is well to avoid giving starchy foods. After that period starch foods can be gradually introduced - such as rice, potato, oat flour, biscuits. The soluble carbohydrates, as represented by such articles of food as jam, sweets, chocolate, are also useful when given in moderation.

4. The mineral constituents of the food:

These are obtained from milk and eggs. The vegetable salts of potash found in fruits and green vegetables are of use.

Milk is to be the foundation of the diet during the second year of life. One and a half pints may

be taken during the twenty-four hours.

Bread and milk, biscuits, milk puddings, potato, bread soaked in bacon fat, yolk of egg, beef tea, and, towards the end of the second year, some under-done meat and a little vegetable. All these may be given at suitable times.

It is necessary that food be given at stated times, that care be taken to render the food pleasing to the palate, so that sufficient nourishment being taken at meal times, it becomes unnecessary to give intermediate meals.

BEEF TEA.

Raw beef-juice is better than ordinary beef-tea. The former is best made as follows :-

Four ounces of minced steak is soaked for an hour in four ounces of water. The juice is then forcibly expressed through fine muslin. The composition of such a beef-juice has been found to be⁽¹⁾

Proteid (albumen)	5.1	per cent.
Extractives	3.1	" "
Mineral Matter	0.7	" "

Good beef tea properly made only contains $1\frac{1}{2}$ per cent. of proteid, and the same quantity of extractives⁽²⁾.

(1) Quoted from Hutchison: "Diet and Dietetics", page 99.

(2) Hutchison: "Diet and Dietetics", page 105.

P A R T V.

SYNOPSIS:

The Public Health aspect of Infant Feeding.

1. Necessity for teaching midwives and nurses the essentials of infant feeding.
 2. The useful purpose to be served by having crèches close to factories in manufacturing towns.
 3. The importance of having a clean, pure, and good milk supply.
 4. All milk which has been subjected to any process of pasteurization, or sterilization, should bear a label with the particular process indicated on it.
 5. The duty of Public bodies to place an adequate infant's food within the reach of the necessitous poor.
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The necessity of giving to infants a suitable food has been shown, and the points by which such a food may be judged have been indicated.

It is incumbent upon doctors to make up their minds fully as to what an infant requires in the form of food, also to understand the composition of all these foods which are so prevalent, so that they may be able to advise both mother and nurse.

It is also necessary that those who have the looking after of poor mothers at the time of childbirth should be taught the elements of infant feeding, and the fact that infants can be brought up on fresh cow's milk, or some modification of that milk.

It would also be well for all nurses, who are likely at any time to be in attendance after a confinement, to understand that their knowledge is of necessity a limited one, and that it is a serious step to take to advise a mother to wean her child. Too often do we hear, "Oh, Nurse said I had better wean him."

In our manufacturing towns, where the mother, belonging to the poorer classes, finds it necessary to go to work as soon as possible after the child is born, in order to earn her own living, the method advocated by Prof. Budin might be of service.

He urged, as a practical means of fighting infantile mortality, that ^Acrèches should be established close to all factories, the mothers to be allowed to nurse their infants at regular times⁽¹⁾.

Stress should also be laid upon the great importance of having a clean and pure milk supply. Our schools are inspected, our school children are examined, and advice given with regard to their health: and surely the inspection of dairies and of dairy farms, the instruction of milkmen in the best methods of handling milk, from the time it leaves the cow, to the time it is in the hands of the consumers, are matters of equal importance. The present, as well as the future, health of the children depends largely upon the ability of the parents to obtain a milk which shall be good, pure and fresh.

It would be well that the standard of fat in milk should be at least 4 per cent. Also that all milk sold should be clearly stated to be either fresh, pasteurized, or sterilized. This would avoid the pernicious effect of sterilizing milk which has already been subjected to that process.

(1) British Medical Journal, June 4, 1904, page 1339.

The steps taken by the Public Bodies of various towns to supply the poor with a pure infants' food, are to be commended. The success of these efforts at Leicester and Sheffield have been referred to. At Leith⁽¹⁾ a modified pasteurized milk has been supplied with evidently good results.

Of such vital importance is this question of Infant Feeding, so far reaching the results of injudicious diet during the first two years of life, that no effort should be spared, either by the Profession to teach those who have the bringing up of infants committed to their charge, as to what constitutes a proper infant's food; or by the Public Bodies in providing that food in necessitous cases.

(1) British Medical Journal, March 31, 1906, page 76.

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