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

The subject of infant feeding, in this country at least, does not seem to have received all the attention that the importance of the matter deserves. The figures on Infantile Death and Disease, and the extreme frequency with which gastro-intestinal disorders occur amongst infants, which on enquiry are found in the majority of cases to be brought on by improper food, are sufficient to justify some enquiry into the methods at present in vogue in feeding infants.

I propose to consider the subject in the following manner:-

The natural food is of course taken first with general conditions as to the times of nursing and the quantities taken.

Failing the Mother's milk, the selection and control of a Wet Nurse is considered next, as being the best substitute. This leads to some of the reasons that make nursing impossible, and the method and times for weaning. Which brings us to Artificial feeding.

The substitutes for Mother's milk that have

been considered are:-

Asses Milk. Goats milk. Ewes milk.
Mares milk. Patent foods.
& Cows milk.

Cows milk resolves itself into the food that is used most frequently.

The various methods of preparing cows milk are described; simple dilution and sweetening, Sterilisation, with the objections to its use,"comparatively sterilised" or scalded milk much to be preferred. Under sterilisation, the action of heat upon milk is discussed.

Condensed milk, dried milk preparations, humanised milk, peptonised milk and cream foods are next considered.

The Walker Gordon method of America is described, being the best system that is used.

Having found a suitable food, the number of meals and the quantity of food taken at each is indicated; the child's weight rather than its age being the guide. The various feeding bottles are considered.

After the end of the sixth month the child is in a position to have well-cooked starchy foods

introduced, though it is just as well to keep it on the milk diet till it is 9 or 10 months old; when it can be gradually brought out of its infant ways.

In considering the bearing that food has upon Infantile gastro-intestinal troubles, it is certain that errors in diet are responsible for the majority. Such are:- Dyspepsia, Gastro-enteritis, Diarrhoea and Constipation.

The grave constitutional conditions due also largely to errors in diet are considered:- Anaemia, Atrophy, Rickets and Scurvy.

It has seemed to me that the main lines upon which improvement should take place are:-

1. The greatest possible care in producing a milk supply of constant quality and unquestionable purity.
2. The admixture of dilutants and scalding.
3. The dissemination of more accurate knowledge of the subject, amongst those responsible for the upbringing of children.

I have tried the effect of administering a specially prepared cows milk, whose preparation is described, with very satisfactory results.

On referring to the Registrar General's Report, it will be seen that the disorders affecting the digestive organs of young children are an extremely common cause of death.

Death Rate amongst Infants.

In the report for 1895 for the decennium 1881-1890, the Annual Death rate for England and Wales in the case of children under 5 years per million living was 56,825 for all causes: of these deaths 4,346 were certified as from diarrhoea; (4,449 from Tubercular disease). Of children under 1 year, 155 males and 128 females per 1000, die annually, a considerable proportion being from Alimentary disease.

During the decennium 1881-1890 the mean population of England & Wales, all ages, was 27,488,482 of whom 753,823 were children under 1 year.

Of these children under 1 year:-
119,346 died of diarrhoea and 69,258 of digestive ailments: a very considerable total.

The death rate of children under 1 year is rather higher in towns than in the country, being 142 per 1000 living over All England & Wales and 160 per 1000 for Urban and 128 per 1000 for Rural England.

The death rate from all diarrhoeal diseases exclusive of Cholera in England & Wales is equal to

659 per million living, by far the greater number of these being children.

The decennium 1881-1890 has a rather better result to show than the decennium immediately preceding it, viz., 1871-1880. For the mortality of infants under 1 year in 1871-80 was 149 per 1000 for all causes, and in 1881-90 it was 142 per 1000: diarrhoea and alimentary diseases causing the majority.

Diseases due to Faulty Nutrition.

These figures deal only with the actual deaths of infants due to gastro-intestinal maladies but do not give any idea of the number of Tubercular, Rickety, Anaemic or Scorbutic children, whose unfortunate constitutional condition is in a large proportion of cases directly traceable to improper feeding at the outset of their lives.

Natural Food.

The Natural Food for an Infant is of course its mother's milk,,and this should suffice absolutely for the first 7 or 8 months of its life.

Nursing - Contraindications.

Every mother should always try to nurse her baby herself, but if she is suffering from Phthisis, or any tubercular disease of the mammae, it is better not to do so.

Also with a strong history of insanity, nursing is inadvisable, at all events if it is carried on to such an extent as to undermine her strength.

Whilst waiting for the milk to come into the breast it is sufficient to give the child a little hot water or sugar water by the spoon, it will not suffer from a little starvation; it should be given the breast none the less every two hours for a short time. When the milk is in the breasts, the child should be nursed on alternate sides and fed every 2 hours during the day (between 5 a.m. and 11 p.m.) with longer intervals at night, giving about 10 feeds in the 24 hours.

* A strong newly born infant empties the breast in about 15-20 mins. and in doing so takes in about 1 to 1½ ounces of milk, giving a total of about 10 to 12 ounces a day for the first week of its life. The stomach of the newly born child only holds about 1½ ounces without distension. If the stomach is too rapidly filled, or over filled, vomiting is pretty certain to result; therefore the mother should be careful to see that the child extends its meals over about 15-20 mins. But in strong and vigorous children where a certain amount of absorption is going on during a feed, a rather larger amount than the above may be taken without injury.

* Ashley & Wright. "Diseases of Children" 1892,p.37.

As the infant's stomach increases in size, so does the secretion of milk increase in quantity; so that after the first week or two it will be sufficient to give the child the breast every 2½ hours with a total of 8 feeds in the 24 hours.

From the 3rd month to the end of lactation an interval of 3 hours with from 3 to 6 ounces taken at every feed, with a total of from 20 to 40 ounces in the 24 hours will suffice.

Regularity in nursing is of the highest importance; too frequent nursing is a cause of dyspepsia, for an over full stomach works at a disadvantage. The quality of the milk also will vary, as it is too watery after a very short interval of nursing, and too concentrated after a long interval.

The infant will soon get accustomed to its meal hours, and wake and cry when they are due.

If the infant is too weak to take the breast at the outset, it may be fed with a teaspoon with either its mother's milk or a sterilised mixture of cream and whey or a peptonised humanised milk, or a modification of Dr. Gaertner's humanised milk*, until it is capable of taking its natural food.

* Note. The mode of preparing these and other foods are given later.

Pregnancy during Lactation.

Should the mother become pregnant during lactation, if both she and her child are healthy, the infant need not be weaned until the sixth month of pregnancy; unless it should be found that this is too much of a strain on the mother's strength, which may be shown by gastro-intestinal disturbances in the child, then weaning had better not be delayed, as the child will probably suffer from insufficient nourishment, and the mother might have a miscarriage.

Menstruation during Lactation.

Schlicter considers that menstruation occurring before the sixth week causes gastro-intestinal irritation in the child, because of the change it produces in the milk, casein and fat being increased and albuminoids, sugar and solids being decreased. Changes just as great, however, are found between the periods. He also considers that at a later period menstruation is of but slight importance. Whatever may be the actual cause, although in some cases children are quite unaffected by the milk of their mother when she is menstruating, in others it is observed that they suffer severely from Colic flatulence or diarrhoea.

Should this occur, give the infant a little

boiled water before feeding, and reduce the amount of meat in the mother's diet. Sometimes the gastro-intestinal disturbance is so severe that weaning may have to be contemplated.

When the supply of milk is small it must be supplemented with some form of cow's milk as, either Rotchs cream or Goertners humanised milk. When the supply of milk stops altogether, there is no artificial food yet devised to take its place, that can compare with the milk of a healthy woman, and therefore no substitute so good as a wet nurse.

Wet Nurses.

The chief points to be attended to in selecting a wet nurse are the following:-

She should be between 20 and 30 years old, a very young wet nurse is difficult to manage. If the child to be nursed is strong and vigorous, a primipara may be taken. But if the child is weak and puny, a multipara is better, as her milk will not be so difficult to digest.

If the nurse's own child is healthy, it is a point in her favour.

She should not have been too recently confined, as the colostrum is undesirable. If there is

a difference of 2 or 3 months between the ages of the nursling and the nurse's own child it will not be a disadvantage, as the nurse's child will have had time to show symptoms of Congenital Syphilis if present.

A syphilitic child must not be allowed to have a wet nurse.

Still in spite of most careful selection, the milk may not agree, and either another wet nurse must be obtained, or the child must be weaned.

Diet of Nursing Mothers.

The diet of a nursing mother or a wet nurse should be a plain mixed diet, with a slight increase of fluid and meat above her usual habit.

Alcohol is not necessary, unless she is in the habit of taking it; in small quantities it increases the quantity of fat in the milk. Over-feeding and an excessive meat-diet will make the milk indigestible from too much proteid. It is very important that a wet nurse should take regular daily exercise and be out a good deal in the open air.

Some drugs are eliminated by the milk, e.g. morphia, which may have a deleterious effect upon the child.

No wet nurse should ever be allowed to dose her charge on any pretence whatever.

Still there are many cases where the milk ceases to be secreted at an early date, in which a wet nurse is not obtainable, and again there are many mothers who are unable to nurse, owing to a hard working life which compels them to earn their bread a few weeks after the child is born, and there are also some mothers who have no desire to be burdened with nursing, some children again have harelips and so are unable to suck: so that for some reason or another the nursing cannot be carried out and the infant has to be brought up by hand, and weaning has to be carried out.

Weaning.

No child should be nursed longer than one year, even under the most favourable circumstances, or rickets is likely to be produced. As a rule from eight to ten months is sufficient.

When the supply of milk is deficient, or when from any other cause weaning has to be entered upon earlier, always allow the child to extract as much nourishment from its mother as it can, so long as there is any milk present. This defective supply should be supplemented with an artificial food which will gradually take the place of the natural food.

At first the bottle may be substituted for the breast once or twice in the 24 hours, or when the breast milk yields a reduced quantity for each feed, the bottle may supplement this reduced supply; each step should be watched before going further.

The process of weaning should be extended over a month.

It is better to avoid weaning a child when cutting a tooth or during the hottest part of the year, for fear of summer diarrhoea. Also postpone weaning if the child is just recovering from an illness.

Growth of the Child.

One of the best guides by which to estimate the growth and developement of the child, is its weight.

*It should gain about 5 or 6 ounces a week during the first 3 or 4 months, 3 or 4 ounces a week from the third to the sixth month, from the seventh to the ninth month about 3 to 3½ ounces, and about 1½ to 2 ounces from the tenth to the twelfth month.

Children will sometimes put on a large

* Carpenter Lancet, Vol.II, 1897.

amount of fat without a corresponding growth in other tissues; in such cases it may be that the mother's milk, though ample in quantity is deficient in quality.

In such cases an analysis of the milk is of value. Several analyses should be made so as to strike an average.

The milk for such analysis should be taken from the breast after the child has been nursed for 5 minutes: then the sample should be drawn off.

A high percentage of Albuminoids and a low percentage of fat indicate a poor milk.

Artificial Feeding.

For one of a great number of reasons, children are frequently brought up by hand from the very first.

"The successful rearing of a child by artificial means is not a difficult matter; it requires intelligence, tact, and above all, it requires watchfulness. If we are vigilant to detect the first signs of discomfort and acidity and at once modify the diet accordingly, we may be sure of preserving a healthy tone of the stomach and warding off the accidents to which a child less carefully nurtured might possibly succumb." *

* Eustace Smith. "Diseases of Children.",p.638.

The importance of this subject is illustrated by the fact that three quarters of the deaths that occur amongst infants under one year are of those brought up on artificial food.*

Dr. Niven of Manchester reports ** that of the deaths from diarrhoea amongst children in Manchester, 97 per cent were hand fed. The importance and at the same time the need of a really reliable method of artificially feeding infants is almost daily brought before our notice by the countless "Foods" that are continually being produced, and the ever-increasing number of advertisements on the subject. The ideal artificial food for an infant should resemble exactly the composition of its mother's milk. This is of course impossible, for the quality, constituents, and quantity vary with the age of the child; it is an ever-changing food exactly suited to that child.

It is not possible to produce an artificial food that will constantly be suitable to the child it is designed to feed; but it is possible to strike an average of the milk of nursing mothers and then produce a food whose properties are as close a copy of these properties as is required for the nourishment of children of any age provided the standard food is altered in such a way as is necessary to properly feed that age and weight of child.

* Ashby & Wright, "Diseases of Children" p.37.
** Brit Med. Journ. Vol.I, 97. p.1160

Human Milk.

The analysis of human milk gives considerable variety in results; but one made by Dr. Luff from 12 different milks may for general purposes be taken as a standard.

The proportions of the different elements are as follows:-

	(a) Human Milk.	(a) Cows Milk
Proteid.	2 6.35 per cent.	3.22
Fat.	2.41	4.20(b)
Carbohydrate.	6.39	5.00
Salts.	0.34	0.10
Water.	88.51	87.01

(Cheadle "Artificial Feeding of Infants" p.19)

Whatever artificial food is used ought therefore to contain all the elements and in these proportions.

Note (a)
A.V.Meig's Analysis(Allbutt's System of Medicine Vol.I, p.413.)

	Human.	Cows.
Proteid.	1.04	2.79
Fat.	4.28	3.31
Carbohydrate.	7.40	4.89
Salts.	.10	.45
Water.	87.16	88.54

Note (b). Pheiffer gives 3.1 per cent; Adriance 3.8; Leeds 4.1; Hoffmann 4.per cent; Carpenter 3.76; All a higher percentage than Luff's of human milk.

Substitutes.

The commonest substitute for mother's milk is cows milk, and it is generally used. Chemically it differs from human milk in that it contains more proteid and fat, and less carbohydrate, as is seen in the accompanying table.

But the chief difference is the way in which the casein of cows milk curdles; it forms large and insoluble curds with acids which are not easily digested; whereas human milk throws down small flocculent masses on the addition of an acid and these are readily digested.

As supplied from the average dairy, cows milk is acid in reaction, and full of bacteria; it is an excellent medium for the growth and development of micro-organisms of various diseases, e.g., typhoid, and scarlet fever. Human milk, on the other hand, is always alkaline and free from bacteria when drawn direct from the breast; any organisms that are present are usually skin organisms.

Children have been brought up entirely upon undiluted cows milk and have thrived, but have done so rather in spite of this treatment than on account of it. Cows milk, to be a suitable infants food requires certain modification which will be considered later.

Other Substitutes for Mothers Milk.

Asses milk is an excellent substitute for mothers milk when obtainable, the chief points in its favour are that its curd is thrown down in small flocculent masses and is easily digested. But the objections to its use are, that compared with human milk it is defective in Albuminates and Fats, and it would require nearly twice the quantity of asses milk to supply the nutriment of human milk. It is also rather laxative and very expensive. Still it may be used in those who cannot tolerate cows milk in any form - for a time, and also in gastro-enteritis.

Comparative Analysis of Human & Asses Milk:-

	Human.	Asses.
Proteid.	2.35 per cent.	1.7 per cent.
Fat.	2.41	1.4
Carbohydrate	6.39	6.4
Salts	0.34	
Water.	88.51	90.5

(Cheadle"Artificial Feeding of Infants" p.19)

Goats Milk.

Goats milk is highly nutritious, contains more fat than cows milk, and may be used where an extra rich food is advisable.

*Another point in its favour is that the

* Carpenter; Lancet, Vol.II, 1897.

goat does not suffer from tubercular disease to the same extent as does the cow. But it has precisely the same defect as cows milk, in that its casein coagulates in the same large masses, and it has therefore to be modified in just the same manner.

Comparative Analysis of Human & Goats Milk:-

	Human.	Goats.
Proteid.	2.35 per cent.	4.5 per cent
Fat.	2.41	4.1
Carbohydrate.	6.39	5.8
Salts.	0.34	
Water.	88.51	85.6

Ewes milk resembles cows milk in the manner in which the casein coagulates.

Mares Milk.

Mares milk resembles asses milk with regard to the curd but it is very deficient in fat and rich in sugar.

Kourmaiss" is the fermented milk of mares in Russia, but it is artificially produced in this country from cows milk.

Note. Eustace Smith "Diseases of Children" 1889,p.632.

	Human.	Cows.	Asses.	Goats
Proteid.	2.7	4.2	1.7	2.89%
Fat.	3.5	3.8	1.3	5.13
Carbohydrate	5.0	3.8	4.5	4.69
Salts.	.2	.7	.5	.87

The strength and composition vary with the time that fermentation has been going on; more alcohol being present the longer fermentation is continued. It is apt to produce diarrhoea but is generally well digested, it should not be used as a food, but is useful in some cases of constipation and in gastro-enteritis.

Comparative Analyses of Human and Mares Milk.

	Human.	Mares.
Proteids.	2.35 per cent.	1.99 per cent.
Fat.	2.41	1.17
Carbohydrate.	6.39	5.70
Ash.	0.34	0.37
Water.	88.51	90.71

(Bauer (after Konig) "Dietary of the Sick).

Patent Foods.

With regard to the innumerable Patent "Foods" in the market, an extract from a pamphlet issued from the Medical Committee of the Hospital for Sick Children, Great Ormand Street, may be quoted: "..... "do not on any account give the child any baked flour, arrowroot, cornflour, biscuits, tops and bottoms, or any so called "infants food" before it is seven months old."

The London Obstetrical Society also in its

"Rules for the General Management of Infants" says:- "When the child is seven months old it may have one or two small meals a day of milk thickened with some variety of malted food, such as can now be easily obtained."

Patent Foods may be roughly divided into those whose starch is wholly, partially, or not at all, converted into - dexterin Maltose or Grape sugar. Some are prepared entirely with water, some with milk and water, and some with milk. They are mainly starchy in substance, and if that starch is entirely unconverted, they are utterly unsuited for young infants.

Koronin (St. Petersburg) found that it was not until the end of the third month after birth that the Pancreatic fluid had any appreciable action on starch.

If made with water they are most deficient in fat and are quite unsuited as the sole diet of an infant, though they may be very well used as adjuncts to milk after the child has completed its third month. When malted, and so partially dextrinised, they are of decided use when mixed with milk, in that they aid in mechanically preventing the formation of such large curds, and so materially increase the digestibility of the milk.

The carbohydrates in such a partially dextrinised food are mainly present in the form of dextrin or maltose, in which shape they are preferable, for sweetening purposes, to the cane sugar ordinarily used, which is more liable to ferment during its conversion in digestion into grape sugar.

The process of dextrinising starch previous to its introduction into the child's stomach is physiologically sound, as it does what should be done outside the child's stomach and is done by its mother, when she converts starch and sugar into lactine before they are supplied as food in her milk.

Such foods are, however, generally deficient in fat, so that cream should be added to bring them up to the standard of human milk.

Unless there is a due proportion of fresh animal food given at the same time in the shape of fresh milk the child runs a great risk of becoming scorbutic. This is considered later under Scurvy.

Cows Milk.

The practical outcome is that the majority of hand fed children are brought up on Cows Milk in some shape or other.

Methods used for preparing Cows Milk.

One of the simplest ways to prepare an infants food from cows milk is to dilute it with water and lime water and add sugar. This reduces the quantity of the casein present, but does not materially alter the quality of the curd, and at the same time produces a food very deficient in fat; a food so prepared is inferior to one of which cream forms the basis.

Yet a great number of children are brought upoon diluted cows milk and appear to thrive on it. Many such children pass a large amount of undigested curd in their stools but seem none the worse for it. The poor cannot get cream and have to use milk. A mixture to agree with a child must be regulated to suit the requirements of that child.

The difficulty of digesting diluted cows milk is greater in newly born infants than in older children.

* If this method is employed, to begin with take 2/3 water and 1/3 milk, one twelfth being lime water; increase after about a month by gradual stages to 1 of water and 1 of milk, always adding a twelfth part of lime water to keep the mixture fairly

* Ashley Wright. Op. Cit. p.43.

alkaline. The first of these dilutions is deficient in fat, but the deficiency can be made up where obtainable, by adding a teaspoonful of cream (20%) to every ounce of the mixture; failing this, one fifth of the quantity of cream in the shape of Cod Liver Oil should be given to the child, i.e. from 10 to 15 drops to each ounce.

A better way of diluting cows milk is to add two parts of sugar water to 1 part milk, boil, or preferably "scald" for half an hour and when cool add the 1/12 lime water. This involves more trouble than some mothers would like to undertake. Sugar water is prepared by dissolving one ounce of milk sugar in a pint of water. Cane sugar may be used, but it is open to the objection mentioned before, of its liability to fermentation during digestion.

Sterilised Milk.

Dr. Geo. Carpenter* recommends a method of sterilising milk for infants amongst the well to do.

He says that on receiving the milk from the dairy it should be placed in a scalded vessel: then filtered through absorbent wool to remove gross impurities: then place enough milk in the bottles of

* Lancet Vol.II, 1897; Article: "Artificial Feeding of Infants."

an Alts Steriliser to feed the child for 24 hours and keep at a temperature of 100° for half an hour.

The teats may be fixed to the bottles as required for use, after the whole has been allowed to cool. The food should be kept in a cool place.

This is a very good method and it effectually sterilises the milk and destroys all pathogenic organisms, the continued heating of the casein appears to render it less easily precipitated.

(Fig 1) Escherich's Milk Steriliser consists of two cylindrical vessels, an outer one (a) which is placed upon the fire and contains the water which surrounds the inner vessel. An inner vessel (b) large enough to hold the food for 24 hours consumption. It has a moveable lid, which is kept in position by a lever (c) and a curved

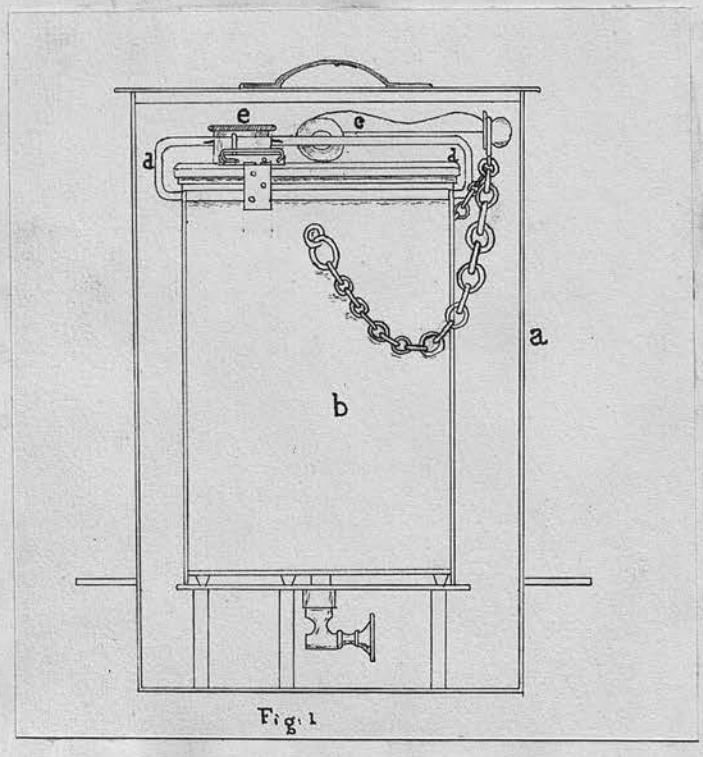

Fig 1

* Ashley & Wright. Op cit. p . 724.

piece of metal (d); it is provided with an air-filter (e) and a stop-cock for drawing off the milk when removed from the outer vessel.

This steriliser is not so convenient as one in which the food is sterilised in separate bottles.

Soxhlet of Munich has devised perhaps the simplest and best. (Fig:4) It consists of a sheet tin vessel resembling a potatoe steamer into which 8 or 10 bottles containing the food are fitted in a moveable frame.

Fig:2

The bottles when filled are placed in the frame, the mouth of each is then covered with an india-rubber disc, and a metal cap is slid over the neck; (Fig:2) the frame is then placed in a saucepan, which is filled with cold water up to a level with the milk in the bottles; the lid is placed tightly on the sauce-pan (it must not be loose) which is then set on the fire or over a gas or petroleum stove, until it boils. It must be allowed to boil freely for three-quarters of an hour, the steam escaping round the edge of the lid; the latter is then taken off, and when the steam has cleared away

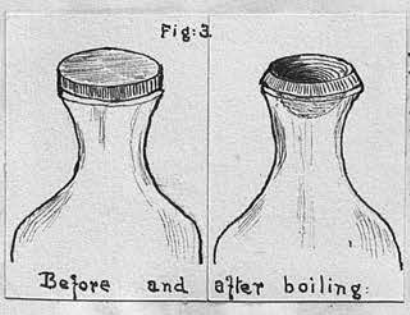

Fig:3

Before and after boiling.

the frame and bottles are removed from the sauce pan. When the lid has been taken off, and the contents of the bottles cool down, and the atmospheric pressure, acting on the discs, ensures the closure of the bottles.(Fig 3) After ten minutes have elapsed, the discs will be found to be somewhat depressed and concave, and the metal caps may then be removed; but it is better to wait until the bottles are quite cool, or to allow the metal caps to remain on the bottles until the latter have to be opened.

To open the bottles, it is sufficient to merely lift up the edge of the disc and air rushes in and allows the bottle to be opened. A teat is fixed and the infant fed. As long as the disc is firmly fixed no germs can possibly enter.

Another form of stopper consists of an indiarubber plug, perforated in the centre by a small hole.

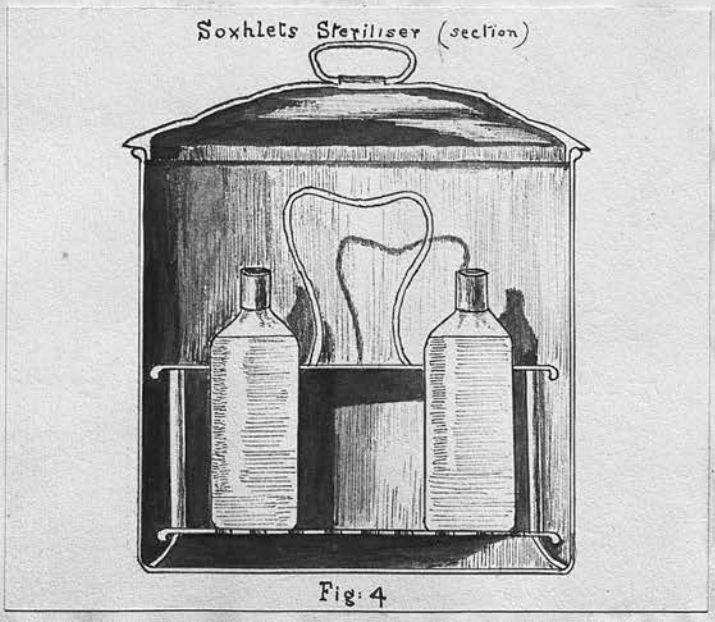

Fig: 4

When the bottles are in the steriliser this hole is left open, but it is stopped by a small glass rod as soon as

the boiling has ceased. So long as the glass rod is in position the bottle is sealed, to open the bottles it is merely necessary to pull out the glass rod when the stopper can be removed and a teat fixed.

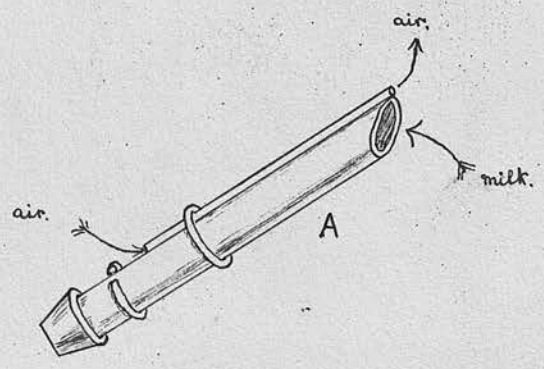

Fig: 5

Instead of fixing on a teat a "Galactophore" (Fig: 5) may be inserted through the hole in the stopper. This consists of: A. Two tubes joined together, one to allow the passage of air and the other of milk. B. India rubber stopper through which the instrument passes. C. A bottle full of milk in which has been inserted a "galactophore" fitted with a rubber teat and a bone mouth-shield. (Fig: 7.)

Fig: 6

* P.Budin. "Femmes en couches & Nouveau Nés". 1897. p.286.

The Galactophore has the advantage that there is a separate opening for air to enter the bottle to take the place of the consumed milk. Sucking is less of an effort and the flow of milk is regulated.

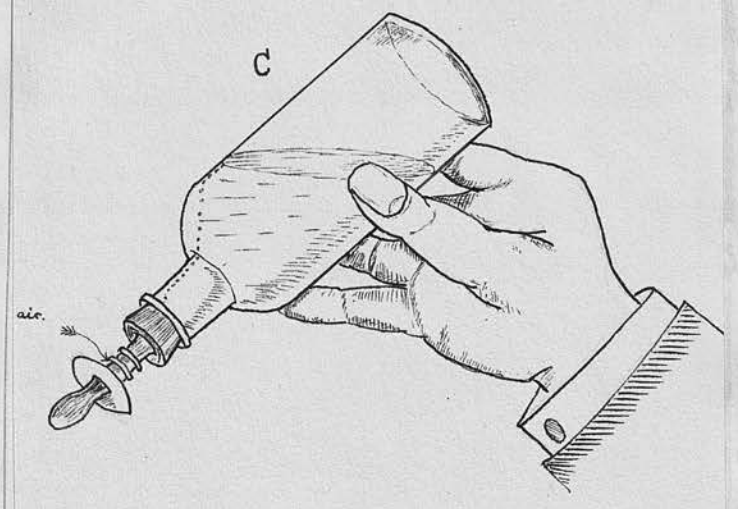

Fig:7.

Dr. Barton* on the other hand holds that sterilised milk if used as the sole article of diet will sooner or later produce scurvy. He agrees that if it is administered at once and not kept for more than 24 hours, it can be relied upon as free from any pathogenic bacteria. He also states, however, that sterilised milk if free from added chemicals can become foul as soon as, if not sooner than ordinary fresh cows milk. To obviate the risk of scurvy he recommends one meal of freshly prepared whey daily.

Dr. Carpenter recommends for the same object the administration of orange juice.

* Brit. Med. Journal. Vol.I, 1897. p.14.

Comparatively Sterilised Milk.

Dr. Barton has made careful investigation into the properties of milk that has been "Comparatively sterilised" which he finds can be administered for any length of time without any risk of Scurvy being produced.

Comparatively Sterilised milk is thus produced:-

Take the milk that is designed for the half days consumption, and raise it to the boiling point, or better still to within 2° of the boiling point and maintain it there from 5 to 15 minutes; such milk is almost quite safe from Pathogenic organisms. The heating of the milk alters very slightly if at all, the nourishing qualities contained in it. It does not lose its antiscorbutic properties for at least 12 hours. The most convenient way of maintaining the milk at 2° below boiling point, is to place it in a china vessel which stands in another vessel containing cold water; this is brought to the boiling point; then the milk will not itself boil within the first fifteen minutes after the water boils.

Milk that is boiled directly over a fire undoubtedly constipates: whereas "Comparatively sterilised" milk does not.

The only chemical permissible is a small quantity of Bicarbonate of Soda to be added to the fresh milk before it is scalded. This is to neutralise the acidity which appears in cows milk soon after it is drawn from the cow, and in the second place, the bicarbonate of soda seems to produce an increase in the flow of bile.

Dr. Barton Kingston sums up his advice by saying - "If you would steer clear of scurvy and pathogenic organisms, then obtain as clean, fresh milk as possible twice a day in winter and three times a day in summer and scald it as soon after its receipt as possible, of course every precaution being taken to prevent contamination of the scalded milk between the time of sterilisation and administration.

Boiling of Milk.

With regard to the action of heat upon milk:

Dr. Andrew McPhail, Montreal*, says that "boiled milk is not milk within the meaning of the term, and that sterilised milk is boiled milk. It is a fact that it requires a higher temperature to boil milk than water - by which one means that the vapour tension of milk overcomes the atmospheric pressure at a higher temperature than water, due to the presence

* Brit Med. Journal, Vol.II, '96. p.1767.

of fat in the milk. To imagine that such milk is not"boiled" is merely to imagine it.

When a temperature above 167°F. is applied to milk then the changes incident to boiling commence. The fat globules are broken up and the fat is liberated, the lactalbumin is coagulated and changes occur in the milk sugar and casein. A substance is created differing materially from the original milk even though it is a sterile substance."

Mr. Droop, Richmond, F.I.C. (Aylesbury Dairy Company) says on the matter that "When milk is raised to such a temperature (certainly below 167°F.) at which evaporation takes place to an appreciable extent from the surface, and at which the cream rises quickly, the larger fat globules have a tendency to coalesce and fat is liberated in visible globules. Lactalbumin, as such, does not exist in milk, the alkaline salts of soluble Lactalbumin are converted into the Alkaline salts of coagulated Lactalbumin, which are still soluble and do not appear to be difficult to digest. The milk sugar is somewhat changed by the action of the alkaline salts in milk, its carbohydrate constitution does not appear to be seriously affected if the change is not too rapid. The casein is unchanged or so slightly changed that the

* Brit. Med. Journal, Vol.I, '97., p.50.

alteration cannot be detected unless the milk be alkaline, when a portion of the sulphur is removed as sulphide. At high temperatures a deposit of calcium citrate occurs causing loss of both lime and citric acid. Owing to the deficiency of lime in boiled milk the action of rennet (which produces from casein in solution as calcium caseinate, the calcium salt of dys-chymo-caseose-curd) is modified."

This is no doubt quite true, but at the same time, whether the milk so scalded is called "boiled" or not, it certainly has not the disadvantages of sterilised milk and does not produce scurvy; and in the majority of cases is perfectly digested and is a satisfactory and complete food.

Condensed Milk.

Condensed milk on the other hand, though in many ways a convenient food especially for travelling, and has the advantages that it does not easily "turn" is well digested when properly diluted, because the casein is more digestible than that of fresh cows milk, is not to be recommended as a sole food, because it is certainly deficient in the antiscorbutic property, and unless of unquestionably good make, deficient also in fat, being made from "skimmed" milk;

though such milks are obliged to state the fact upon their labels: it contains also a great excess of cane sugar added for the purpose of preserving it.

If used it should be given extremely dilute; at first 1 in 24 and then by degrees increased to 1 in 10, or 1 in 7, and 1 drachm of 20 per cent cream should be added to every ounce of food.

Dr. Cheadle* recommends that 1 teaspoonful of the milk should be mixed with half a bottle of very thin barley water, and this mixture used for the first six weeks.

A form of condensed milk is obtainable in which the added sugar is largely absent, such milk is called"unsweetened" but it does not keep so well as the ordinary kind.

**With regard to the condensed milk from Switzerland, it has recently been ascertained that about 85 per cent of Swiss cows are tuberculous, a far greater proportion than the cows of any other country.

* Artificial feeding of Infants, p.72.

** Carpenter Lancet, Vol.11, 1897.

Swiss milk is evaporated in Vacuo and therefore not sterilised, consequently the Tubercle Bacilli are not destroyed.

The Medical Officer of Healths report for Liverpool, 1897, states that tuberculous milk boiled for a few seconds is rendered safe from Tubercle Bacilli.

"Dried Milk" Foods.

There are also some "dried milk" preparations in the market, but those tried by the German Navy were found to decompose, unless kept absolutely dry. The Albuminoids decomposed and the fat went rancid. No preservative had been added. It would seem from this that some chemical preservative is necessary to prevent decomposition of dried milk foods.

Goertner's Humanised Milk.

This is an excellent food and is prepared in a variety of ways.

On a large scale it is produced in the following manner.

Fresh milk mixed with an equal quantity of boiled water is placed in a centrifugal "Victoria Cream separator".

The machine is then revolved at such a speed that the outcoming streams become equal, from one spout pours all the cream and half the milk and water, and from the other the remainder, the dirt remains in the machine. By this method all the fat, half the proteids, half the milk sugar and half the salts are obtained.

To bring the sugar to the required standard 5 7/10 drachms of milk sugar are added to every pint of the mixture before bottling. It is then sterilised in the bottles and kept in them till required for consumption.

Should half the original proteids be still too large a quantity for the digestive capabilities, the mixture before the sugar is added can be once more diluted with boiling water and sent through the centrifugal separator; thus obtaining all the fat and a quarter of the original proteids, milk sugar and salts. In that case a larger quantity of milk sugar will have to be added if the human milk standard is required.

The percentage of fat in the Goertner milk is kept at from 3.2% to 3.5% in the milk supplied commercially. The casein of this milk when it is precipitated by the gastric juice curdles in a flocculent

form in a manner similar to mother's milk.

Humanised milk as supplied by large dairies is apt to vary; but it can be prepared at home by the nurse or mother without very great trouble.

Such a method is the following:-

Allow fresh milk to stand for some time till the cream has risen, skim this off, divide the remaining milk into two equal parts; remove all the casein from one part by acting upon it for 15 mins. with Rennet, mix the whey so obtained with the other part and add the cream.

* As the child grows older the casein from 1/3 of the milk only may be removed; this raises the proportion of proteid to 3.6 per cent, or more than equal to Human milk.

Humanised milk prepared in this way still retains the disadvantage of curdling like cows milk in large masses, though this curdling is much improved by the dilution with water: this disadvantage can be still further remedied by boiling and mixing with an alkaline solution, e.g. bicarbonate of soda, 6 grains to the ounce of water (previously boiled) or an equivalent proportion of the saccharated solution of lime.

Note. Lloyd in "The Dairy" of March 15th 1897 draws attention to some samples of Humanised Milk. In one sample, Fat was 1.1 per cent, in another 5.2 per cent and sugar 3.5 per cent; some were very much worse, in one the sugar was over 10 per cent.

* Cheadle "Artificial Feeding, etc., p.76.

Mucilaginous substances such as barley water or a prepared food act mechanically in preventing the formation of large curds.

The objections to Humanised Milk are, that it will not keep long, and the cream with some curd separates in great clots, whcih does not easily remix if kept for more than 12 hours. In children of 6-7 months the amount of casein is insufficient, and at this age fresh cows milk should be substituted. Moreover it has not the antiscorbutic property of fresh milk in sufficient degree and scurvy may be produced by its prolonged use.

Peptonised Milk.

Whether prepared by peptonising fresh cows milk or condensed milk is a very useful preparation to tide a child over a crisis or in cases where there is troublesome diarrhoea or sickness, where there is absolute intolerance of dilute cows milk, or where the digestive powers are extremely weak.,

If persisted in, the infant's gastro-intestinal glands will not develop and the seeds of dyspeptic troubles in after life may be sown in infancy.

When given, the peptonising process should be gradually reduced, both by lessening the quantity

of the peptonising powder and also shortening the time during which the process is continued. Or unpeptonised milk may be added to the peptonised milk and gradually increased in quantity.

Cream Foods.

Good mixtures of Cream food are those made according to Dr. Meig's and Dr. Rotsch's formulae (which see 4 & 5.)

They are both reliable and satisfactory, Rotsch's especially, as it is made a near approach to Human Milk in composition and the ingredients for its preparation are to be mixed as soon as they are received from the dairy, thus reducing the risks of contamination.

Cream is well digested by infants if the proportion of fat in the food is kept below 4 or 5 per cent and too much food is not given. Food too rich in fat may give rise to vomiting and diarrhoea and possibly a gastric catarrh. Fat, however, is one of the most essential elements for the growth and development of infants.

Fat appears to be an essential part of every cell and enters largely into the structure of the brain, nerve, and bone marrow. It is also probably

vital to the perfect formation of bone, as is shown in the causation of Rickits. Another important function is that of a fuel to be oxidised and so keep up body temperature and supply energy.

The Best Food for Infants.

For all practical purposes the best food for infants is some form of Humanised Milk, and a method that requires no appliances and can be carried out easily at home is this:-

Divide a pint of milk into two glasses, let them stand for one or two hours under cover, skim the cream off one, and curdle the skimmed milk with half a teaspoonful of rennet; then add the whey so produced and the cream to the first portion, add a teaspoonful of sugar of milk and a pinch of salt and pour the milk into four wide necked feeding bottles and place them in a saucepan of water, necks upward, and let the water boil for 20 mins. This quantity is sufficient for a healthy child for half a day, at 2 months old.

The process can be repeated in the afternoon for the evening and night feeds.

So long as milk is liable to contamination so long will it be necessary to take precautions against pathogenic organisms.

The Walker Gordon Laboratories of America have begun a scientific system of feeding infants, and have produced a modified milk that can be regulated to suit any given child and is prepared daily and sent round to the child's house much as ordinary milk is delivered here.

*They have three ends in view:-

I. To produce good milk.

II. To keep it good by consistent cleanliness and Pasteurisation.

III. To modify the constituent elements in accordance with the demands of any given child.

With a view to producing good milk, and realising that the only impurities of cows milk are those that are put into it, and that no amount of treatment will ever make good milk out of bad, their first care is for the source of the milk.

The cows are properly selected and bred for this purpose alone. They are tested individually for tubercle. The herd farm and dairy are under the supervision of a veterinary surgeon and a bacteriologist. The cleanliness observed approaches asepsis in its rigidity.

The cows and their attendants are daily cleansed and groomed; the milk is received into glass

* Macphail: Brit. Med. Journal, Dec.19/96.

pails, aerated and cooled to 44°F. and in two hours is in the Laboratory. The milk is then Pasteurised at 167°F. for 20 mins. This does not render it absolutely sterile, but as we have seen it is for all practical purposes sufficiently so.

Some of the milk is then modified to suit the requirements of individual children, according to age, constitution and health. The milk is rendered alkaline and the cream separated in a centrifugal machine. This yields the following standard of materials as a basis to work upon:-

	Fat.	Sugar.	Albuminoids.
Cream.	16.00	4.00	3.60
Separated Milk.	0.13	4.40	4.00

If it is desired to increase the sugar, Milk Sugar filtered with distilled water is used.

With these materials the prescriptions of those Physicians who are ordering milks of certain constitution are accurately made up. The bottles are filled and pastuerised at 167°F. for 20 mins., but put into zinc baskets and those are sent direct to the children's houses. Where the distance is considerable they rely on ice for its preservation for 24 hours. The following is the form of prescription used:-

	Per cent.	Remarks.
Fat	.....	Number of feeds .....
Milk Sugar	.....	Amount at each .....
Mineral Matter	.....	Infants age .....
		Infants weight .....
Total Solids	.....	per cent.
Water	.....	
	100.00	Alkalinity .....
		Heat at .....°F.

Ordered . . . . . .

Date . . . . 189 Signature . . . . . .

The system is coming into very general use and is said to be viewed with favour by every one considered. It is established on purely commercial lines like a chemist's business, the cost being about three times as much to feed children with this milk as with ordinary cows milk.

The process is so well established that the same methods of exactness are employed as those which prevail in any manufacturing concern.

Contrasted with this system we compare the milk supply from so many diaries which is as often as not very impure.

No selection is made of the cows, no particular trouble is taken in keeping the udders clean, the milkers hands are not cleansed; and dust and dirt are allowed to enter the milk. A greenish deposit is sometimes observed which consists of nothing else than cow dung. To make up for the bad state of the milk preservatives and colouring matters are added to prevent it "turning" at once, in fact to allow it to be sent to the consumer in as stale a condition as possible. Boric Acid is largely used as a preservative and this alone when in sufficient quantity, is enough to set up gastro-intestinal disturbance in infants.

The country dairy farms are perhaps the worst offenders in the matter of uncleanness. But who is to see that cleanliness is duly observed when milk has to be ready to be sent into the town as early as five o'clock?

Quantities to be taken.

Having considered the various foods of the child, the quantities to be taken require to be known

The amount to be taken and the number of feedings in the day depend chiefly upon the weight and digestive powers of the infant.

Dr Carpenter* gives the following as an average dietary.

	Intervals of Feeding.	No.of times in the 24 hours.	Average Amount at each feed.	Average total in 24 hours.	Weight of Average Child. in lbs.	
1st Week.	2 hrs.	10	1 oz.	10 oz.	At birth	6.8
1st Month.	2 "	8	1½-2	12-16	1st Month	7.4
2nd "	2½ "	8	3-4	20-30	2nd month	8.4
3rd & 4th Month.	3 "	7	4-5	30-35	3rd & 4th"	9.6-10.8
5th & 6th "	3 "	6	6-7	34-40	5th & 6th	11.8-12.4

The quantity of milk administered within these special limits will depend upon the constitutional peculiarities of the infant, but the maximum amounts here given should not be exceeded.

Feeding Bottles.

With regard to the subject of feeding bottles, those supplied with Soxhlet's Alts or Escherich's sterilisers can be recommended, their soft rubber teats can be easily turned inside out and thoroughly cleaned.

* Lancet, Vol. II, '97.

Those with thermometers attached are perhaps the best; 95°F. to 98°F. is quite a warm enough temperature for a child's food.

Allen and Hanbury have also a very good bottle which has a valve at one end and a teat at the other, for any food which is not to be warmed in the bottle this is an advantage since a stream of water can be passed straight through the bottle. These cannot be used with a steriliser as the valve at the bottom would probably come out and in any case, the rubber would impart a flavour to the milk.

The holes in the teats of these bottles should not be too small or the child cannot suck, nor should it be too large or the food will be bolted. Those bottles with internal indentations, Makers name, etc., are bad, as they are difficult to clean. Bottles with india-rubber tubes cannot be too strongly condemned; they cannot be kept absolutely clean and they permit of the pernicious habit of leaving the child with the bottle in its cot at all times, and the teat in its mouth. The tube becomes septic, the food cold and the feeding irregular.

* In France where a great deal of care is given to infant life, they are forbidden. The bottles after being used should be thoroughly cleaned

* Brit. Med. Journ., July 11th, '96, p.68.

with a brush kept for the purpose and boiled, then inverted so that they may drain and no dust get into them.

At the commencement of the seventh month if the infant is still thriving, the modified cows milk which has been found to suit the child should still be continued, from 35 to 40 ounces being given in the 24 hours; there need be no change of diet until 9 or 10 months old; the child can, however, quite well digest well cooked starchy foods if not given in too great abundance. Any of the cereals may be given, e.g., oats, rice, wheat, barley or maize. The grains should be washed and then ground into a fine powder and passed through a No.80 seive. Two tablespoonsful of the powder to a pint of milk will make a suitable mixture. It should be thoroughly cooked for 20 mins. Should the starch prove troublesome, at first, it may be partially predigested by using an artificially prepared ferment, such as distol.

By gradual stages the child is accustomed to bread soaked in milk, gravy, beef tea, eggs, etc., until it is able to deal with regular meals.

All through its early years milk should still form the chief article of diet

The diseases arising in Infants from improper feeding may be divided into two classes:-

I. Those produced by irritation of the alimentary canal; by decomposition or indigestibility of food, or absorption of poisonous matters produced by different ferments.

Under which heading come:-
Dyspepsia, Stomatitis, Parasitic Stomatitis, Gastro-enteritis, the more severe forms of Choleraic diarrhoea or diarrhoea infantum and Constipation.

II. Those arising from defective nutrition, due to the want of sufficient food; or rather of certain elements of the food, a defect of quality rather than quantity.

Under which heading come:-
Such constitutional conditions as Anaemia, Atrophy, Rickets and Scurvy, some of which may be sequels of the first class and due to them.

Dyspepsia.

Few, if any, children brought up by hand escape altogether from suffering at some time or other from dyspepsia, some breast fed infants even suffer.

The mother's milk may disagree and cause colic and flatulence, unaccompanied in some cases by either vomiting or diarrhoea; so much so that weaning is necessary. More commonly the wet nurse's milk disagrees.

With bottle fed children, dyspepsia is very common. The explanation of this is of course that there is a very large amount for the alimentary system to do, and it is worked to its utmost capacity in infancy. Any overtaxing is likely to produce a disturbance, the alimentary canal being extremely intolerant of irritants in any form.

The Signs.are usually clear. The child is restless after a meal, is uncomfortable, draws up its legs, brings up wind, eructates some of its food hiccoughs, or actually vomits curdled masses.

"Sometimes there is a blueness round the mouth, twitching of the face, and contraction of the lips. The child breathes with difficulty and respiration is almost stopped, then a quantity of flatus is

brought up and the child seems relieved and is coaxed off to sleep."*

Some children seem to have a certain amount of discomfort after every meal, are always crying and restless and fretful; this may occur without any marked vomiting, diarrhoea or malnutrition. Vomiting may be mere reguritation, called "Posseting" by nurses from active peristalsis of the stomach, due sometimes to teething. Or it may be due to over-distension, wind or coughing.

In true vomiting there is always a certain amount of retching and the gastric contents are expelled, with force; it may be very difficult to distinguish from reflex vomiting, in which the tongue is a very uncertain guide, and in which cerebral symptoms should be looked for. In breast fed children dyspepsia may be due to too rapid gulping down of milk, which can be regulated by pressure with the fingers on the breast, or by reducing the amount of the food which the infant is taking by giving a few teaspoonsful of sweetened lime water, whey, or barley water before the breast is taken, and not allowing the breast to be taken too long or too often.

Or it may be due to anxiety or a fit of anger on the part of the mother, or she may be taking

* Dr West. "Diseases of Infancy & Childhood" p. 41.

some irritating food or medicine which must be corrected.

In treating dyspepsia in breast fed children, if the condition is but slight, it may be sufficient to give an alkaline carminative mixture, such as:-

Sodae Bicarb.	grs.iij
Spt. Ammon. Aromat.	M.j
Spt. Chlor.	M.j
Syrup.	M.x
Aq. Anethi	ad ʒi

(for a child 1 month old) after its meals.

But if very severe it may be advisable to wean the child at once, on to a diluted solution of peptonised milk dextrinised food, to which a small quantity of scalded cows milk has been added, this cows milk may be gradually increased in quantity as the child's digestive power improves. Or milk diluted with whey may be used sweetened with sugar or milk. If cows milk cannot be taken at all, peptonised milk may be added instead; a stomach sedative being given at the same time to soothe the irritation.

*Large enemata of warm water, and hot fomentations to the abdomen will generally relieve the colic due to flatulence, together with 1 grain of Mercury and Chalk powder combined with half a grain of Dovers powder by the mouth. (For child of 1 month)

* Ashley and Wright.

In bottle fed children the causes are usually that the appetite is in excess of the digestive powers when more food is taken than can be absorbed and masses of undigested cows milk curd, or indigestible starch remain in the stomach and undergo lactic fermentation,or sometimes Cane sugar undergoes fermentation, or milk sour from commencing decomposition. In some shape or another food of an improper quality decomposes in the alimentary canal and gives rise to flatulence, vomiting or diarrhoea.

The symptoms to a certain extent point to that partbof the alimentary canal most affected, thus when vomiting is the most prominent symptom, the sto stomach when flatulence and loose stools containing much undigested curd, the small intestine, and when colic tenesmus and excoriated anus and butlocks the large bowel is most affected. If however the cows milk is scalded "Comparatively sterilised" and very thin barley or oatmeal water, which has of course been boiled is used to dilute it, in the proportion of 1 to 3 at first, gradually made stronger; at the first curd is broken up and there is much less likelihood of dyspepsia resulting.

On theoretical grounds the barley water is perhaps inadmissable, since the child has so small

a power of converting starchy foods into glucose, but as previously stated it aids in mechanically breaking up the curd, and children do remarkably well upon it and seem to pass very little indigested curd into their stools.

If younger than 3 months the barley water must be omitted and sugar water substituted. If the child be exceptionally delicate or other children of the same parents have had difficulty in digesting cows milk, it may be placed upon a highly dextrinised malted food in which all the starch has been converted, mixed with water, and one or two teaspoonsful of milk (scalded) added to each half bottle; or dilute peptonised milk or peptonised condensed milk may be used, gradually reducing the peptonisation as the child can tolerate it, or substituting scalded milk and water in increasing quantity.

Whatever is used, if should not be administered in anything but small quantities at a time and should not be taken too quickly.

Cozzolino* recommends washing out the stomach as the best means of rapidly and certainly cutting short an attack of infantile dyspepsia, and preventing the concomitant, diarrhoea and gastro-

* La Pediatria, January 1898.

intestinal catarrh.

Where dyspepsia is allowed to continue unchecked and no effort is made to cope with the fermentation and non-digestion of the food, a catarrhal inflammation may be readily set up. Or perhaps there is deficient secretion of digestive juices or they are impaired in quality, so that the food taken undergoes decomposition, irritates the bowels and leads to its being quickly expelled instead of being absorbed and results in that incessant vomiting and purging that constitutes Acute Inflammatory Diarrhoea.

* Acute Gastro-enteritis forms one third of the total number of infantile disorders. In some mild and chronic cases the cause may be merely indigestibility of food. But the most potent cause is the decomposition of food which may be brought about in a variety of ways, the supply may be bad at the outset, the utensils may be foul, the food may be kept too long before it is administered. A very small remnant of foul food will set up fermentation in a whole bottle, as is shown by the way in which food decomposes in inefficiently cleansed tube and cork fitted bottles. This fermentation is especially favoured by the plan of keeping the bottle warm in a "food warmer" at night. Warmth and moisture especially favour decomposition. The curd decomposes

* Cheadle. p.137.

in some part of the child's alimentary canal and sets up the disturbance. In warm climates diarrhoea is especially prevalent.

Dr. Concetti* gives these figures for Italy. There are 800,000 deaths per annum in the country, of these 370,000 were children under five.

The chief causes of death amongst the latter were diseases of the digestive system, respiratory system, and infectious diseases. Amongst 1000 deaths of children under five years, the deaths of 261 were due to diseases of the digestive system. This heavy mortality is probably due to the warm climate combined with the great prevalence of errors in feeding. Diarrhoea is also very prevalent in the summer in this country.

It may be that under these conditions the growth and development of micro-organisms being more active these are more prevalent in the milk taken and so find a way into the alimentary tract.

** Escherich found that in undigested milk discharged from the bowel, two organisms were invariably present and in large numbers, viz., the Bacillus Coli Communis, and the Bacterium AErogenes; they

* Brit. Med. Journal, Vol.I, 1897, p.34.

**Clifford Allbutt's "System of Medicine" Vol.III, p.747.

attack the milk sugar especially, and the state of catarrh of the bowel seems to be the most favourable condition for their operation.

Diarrhoea is also very common about the time of weaning, the younger the child, the more likely is it to be affected.

*In New York nearly every child taken from the breast between April and October becomes affected with diarrhoea, which, if not inflammatory at the outset, soon becomes so.

* Cheadle. p.137.

The varieties of diarrhoea are numerous. Simple diarrhoea, non-inflammatory diarrhoea, Inflammatory diarrhoea, Entero-colitis, choleraic diarrhoea, Cholera infantum, and dysenteric diarrhoea. With the exception of the dysenteric form which is not properly a food disorder at all, though it may follow on an attack of simple diarrhoea, the general affection, passing away, leaving a local inflammatory condition, in the Colon Sigmoid Flexure or Rectum - the difference is only one of degree.

Catarrhal inflammation of the alimentary canal exists in every variety of intensity from the slight disturbance produced by the irritation of a little indigestible food, to the severe choleraic diarrhoea due to the poisons of decomposition; these severe cases are probably always septic.

Holst found in four epidemics of gastro-intestinal Catarrh, the Streptococcus longus present in cows that were suffering from Mastitis and from which the milk supply was derived.

The Symptoms of Gastro-enteritis are usually mild at first, with from 4 to 6 loose motions in the day; the stools from being yellow become greenish slimy and offensive; the temperature rises, the

child is restless, fretful and in pain; there is usually a little sickness for one or more days, then vomiting begins of sour undigested food.

In severe cases the vomiting and purging set in at once, and all food is ejected, the bowels act two or three times in the hour and the child visibly loses fat and weight, the tissues shrink to an alarming extent; there is great muscular weakness, pallor, pinched face, cold extremities, weak thready pulse, and high temperature falling rapidly to subnormal, coated tongue, congested bases of the lungs, drowsiness deepening into coma, and death takes place in two or three days, the child being convulsed or exhausted.

The treatment should be directed to the following principles

I *Stop all food which favours fermentation or acidity, or causes irritation by indigestibility.

II Neutralise acidity developed by fermentation.

III Sooth the irritability of the Stomach and Intestine and stop excessive peristalsis.

IV Sustain the strength and repair the loss of fluid through the excessive liquid drain by easily digested nutritious food.

V Assist further the depressed circulation and heat production by stimulants and external warmth.

* Cheadle 147.

Details.

Stop therefore the cow's milk or whatever irritant food has caused the attack, and give no cows milk until the symptoms have greatly improved.

In the slighter forms of diarrhoea where there is not much restlessness or distention of the abdomen, and not more than four or five loose motions in the day, it will generally be sufficient to underfeed for a day or two, and give a mild laxative such as castor oil or Hydrarg e Cret. The acidity should be neutralised by a mild alkaline mixture.

Bismuth, opium and Ipecac. to soothe the irritability of the stomach and intestine and reduce the active peristalsis. Pepsine (2 or 3 grains) in powder given before meals is often of use. "Lactopeptine" is also of use , it contains pure pepsine, Pancreatin, Ptyalin, Lactic Acid and Hydrochloric Acid.

If purging is very severe and there are curds in the stools and vomit, all cows milk should be omitted; only peptonised milk should be given in small quantities from one or two teaspoons full every half hour or hour; even this may not always stay down, as a certain amount of the curd may be left unpeptonised

and that causes irritation.

Peptonised milk is of more use in gastric catarrh with much vomiting than in acute diarrhoea.

Failing peptonised milk a mixture of cream and whey may be tried.

Watu* (Cases treated in Grancher's service) recommends treating infantile diarrhoea by a regimen of boiled water, to the exclusion of all other food for from 8 - 12 to 24 hours. The water cooled to a suitable temperature and given in small quantities every half hour. He holds that the water dilutes the irritating secretions, and washes away the remnants of decomposed food in the Alimentary canal, increases the blood pressure and dissolves the toxins, and carries the poisons away from the system. The stools become more natural, the temperature falls and the child recovers, especially when this treatment is adopted early in acute cases, and when the children are not too young.

In very young children a wet nurse is the best treatment, and if the child won't suck draw off the milk and give it by the spoonful.

Asses milk may also be used in the same way. Koumiss is also useful. Veal broth has nothing to

* These de Paris B. M. J. Vol.1,97 p.64.

recommend it being an inferior food and is not specially digestible.

Stimulants are essential, Brandy or Whiskey may be given in water according to the state of collapse; from 5 to 10 drops every 4 hours for a month old, and 10 - 15 drops more per month of the child's age. Brandy is narcotic so that this must be borne in mind if opium in any shape is being given.

For the great collapse enemata may be given of peptonised beef juice and brandy, as much as one or two drachms to the ounce; the child may be given *a hot bath, 100° F. for 3 or 4 minutes and then wrapped in hot flannels and warmed by hot water bottles.

When the sickness has ceased for at least 24 hours, it may be advisable to venture upon some more nutritious food. Raw meat juice and cream may be cautiously given, added to a highly dextrinised artificial food, and gradually increased if tolerated. Cows milk should not be resumed for some days, and then should be scalded and added in small quantities to the other food. The greatest care should be exercised as to the origin of the milk and the absolute

* Eustace Smith Dis. of Chil. p.419.

cleanliness of all food. During convalescence, if diarrhoea still persists diluted acids with pepsine or astringents such as catechu or Kino, are the best remedies.

Constipation.

*In constipation the stools are dry and pale with excess of mucus. An evacuation takes place once a day, or once in every two or three days, usually with much straining. The child is usually weakly, anaemic and dyspeptic, though not necessarily badly nourished as far as fat is concerned. The majority of cases are due to want of tone in the large bowel, the intestinal juices are scanty, bile is deficient in quantity and mucus is secreted in excess. The condition is sometimes hereditary. The cause is commonly a deficient power of digesting the milk curd, which appears in the faeces.

To treat such cases it is important to reduce the quantity of curd in the milk and increase the fat; a malted food may be given with advantage, or extract of malt, a cream food or oatmeal water may have the desired effect.Koumiss is sometimes of use. Saline aperients given regularly and continuously will gen-

* Ashby & Wright p.75.

erally relieve the condition.

Rickets.

Rickets usually appears during the first 2 years of life, it is occasionally congenital.

It is a profound constitutional disease, affecting not only the bones, but the muscles, nerves and mucous membranes as well.

*In all cases of any degree of severity there is evidence of pre-existing failure of the digestive powers.

**Pheiffer believes that the tendency to rickets is hereditary and acts as a predisposing cause, whilst a deficiency of phosphates in the breast milk acts as an exciting cause.

Ashby & Wright believe that in the immense majority of cases where nurslings become rickety, it is because the mothers milk is poor, and of improper quality, from her having taken too little care in the matter of her own diet and the infant suffers in consequence. At the end of the natural period of lactation the milk is apt to be poor in nitrogenous

* Ashby & Wright 363.
** Jahrbuch J. Kindklk XXIV

and fatty constituents, whilst the milk sugar is in abundance, and the infant may be fat, but none the less weak and rickety.

Weakly and premature infants may become rickety even when most carefully fed, suggesting that the state of the mothers health during pregnancy has had a predisposing influence on the child. The importance of the mothers health as a factor is seen specially in very large families where the youngest is often rickety; also occasionally the first child of a very young mother. But as a rule it is not the infants that are nursed at the breast that are rickety; by far the greater number are bottle fed children and especially those who have had a history of some gastro intestinal trouble.

Causes.

General Malhygiene, foul air, want of light, inherited tendency, congenital syphilis, defects of diet and food disorders producing vomiting and diarrhoea may all play a part in the production of rickets, but the only *constant factor always present in the food factor. Sometimes it is the only factor. The error is generally one of quality rather than quantity.

* Cheadle p.175.

The child has a diet containing an insufficient amount of fresh milk with an excess of starchy or other foods. How far the absence of fresh milk, and the substitution of condensed milk, or starchy food produces rickets it is difficult to say: Children may have been tried persistently on fresh milk and it always gave rise to vomiting of curd, so that condensed milk or some other food which was not vomited was given; such children are probably weakly and have suffered from catarrh of their intestinal canals, and this may have been the cause of the rickets rather than the absence of the cows milk, which could not be digested.

Moreover, typically healthy children, quite free from rickets may be found who were reared entirely on condensed milk or starchy foods. Such cases are by no means uncommon amongst the poor.

Still on the whole children fed upon Farinaceous food run a great risk of becoming rickety sooner or later although the food may seem to agree with them well. It is probably the intestinal catarrh set up by starchy foods and excess of sugar and curd of milk that assists chiefly in causing the rickets.

*The absence or small amount of Fat and digestible nitrogenous stuffs in the food is probably a more important factor than the presence of starch &c. The essential elements in food to prevent rickets are animal Fat and proteid and probably earthy salts (Phosphate of Lime)

Blands Suttons experiments on the diet of young Lions are very conclusive. When fed upon the flesh of old horses and once a week goats flesh**, they became extremely rickety and one died. But when fresh milk, cod liver oil and pounded bones were added, in three months they became perfectly healthy. In every other respect their life had remained the same, the only change being the addition of Fat and bone salts to their diet.

Rickets is very common in poor and crowded districts where fresh milk is a luxury; it is very rare amongst the well to do where parents are strong and mothers nurse their own children or where rational dieting is the rule.

The Symptoms of Rickets are shortly these: The child is characteristically thin and pallid, is

* Ashly & Wright p.365.
** Both extremely lean and deficient in fat.

miserably whitefaced and spiritless, forehead projects, Fontanelle open, muscles flabby, beaded ribs, pigeon breast, enlarged ends of long bones, sweating of the head at night, Protuberant belly, curved arms and clavicles, knockknee or Bowlegs, contracted pelvis, Curved spine. The teeth are late in appearing and decay soon, the child has a tendency to bronchitis, Laryngismus Stridulus, Convulsions, Tetany; Lymphatic glands may be enlarged. May be anaemic with enlarged liver and spleen; and suffer from diarrhoea.

The condition of the blood and the digestion act and react upon each other; the digestive organs are weak because their blood supply is poor, and the blood supply remains poor because the digestive juices are weak The child requires to be treated with fatty and Albuminous food in concentrated and easily digested form, while saccharine and starchy matters should be taken in great moderation.

If any dyspepsia is present with large quantities of undigested curd in the motions, the curd in the milk should be reduced by diluting with whey, or giving peptonised milk gruel or Benger's oatmeal food.

In very severe cases milk may have to be withdrawn all together, and Fat in the form of Cod

liver oil and cream, and proteid in the shape of raw meat juice, substituted. Older children may have raw meat pulp in place of the juice.

Dextrin and Maltose are preferable in any form to sugar in excess or starch. Kepler's extract of Malt with Cod liver oil is an excellent preparation. Other Cod liver oil emulsions are also useful, they should be given in small doses (10 to 20 drops) to start with and then increased. Lacto-phosphate of lime may be given to augment the supply of lime salts. Where there is no dyspepsia to speak of the milk supply may be increased. Orange juice and Lemon juice will probably be advisable since the condition is so often associated with scurvy.

Fresh air, mountain or sea air, sunlight and an outdoor life, are also important factors in the treatment.

Scurvy.

In contra-distinction to Rickets, Scurvy is more commonly found amongst the children of the well to do, due probably to the use of Sterilised, Peptonised, and other prepared foods so much in vogue, Scurvy also occurs during the period of bottle feeding, and is very often associated with rickets. It

is characterised by progressive anaemia accompanied by cachetic earthy complexion, marked muscular debility, apathy and depression. The characteristic signs soon appear, Petechial spots on the skin, then larger superficial and deepseated extravasations of blood causing puffy swellings on the periosteum, in the muscles, especially on the anterior aspect of the legs, popliteal spaces and elbows; Haemorrhages occur very readily into the loose connective tissue especially if subjected to any pressure or slight injury, which may easily be mistaken for bruises.

The limbs are tender, ankles oedematous, often Albumen in the Urine, sometimes blood. The chief feature is the condition of the gums, they are soft, purple and spongy and may protrude so as to cover the teeth, (when present).* They bleed freely, may slough and cause very foetid breath. The teeth become loose and fall out. When the teeth are not through, the gums are most spongy just above the growing tooth.

*The antiscorbutic property of certain fresh foods is well known, but whether that property is due to organic acids, such as Citric malic or Tartaric acid in combination with potash or not, it is certain that a diet in which those foods are excluded

* Garrod.

will in all probability produce scurvy, and when they are added to the food the patient will recover.

The antiscorbutic property is present in fresh vegetable juices, fresh raw meat and milk and when these are given the disease is cured. Condensed milk and sterilised milk lose the property and it never was present in any of the Farinaceous foods.

The treatment of scurvy in young children consists in adding fresh milk to their dietary and raw meat juice. In older children fresh fruit juices such as lime and orange juice. Fine Potatoe gruel may also be administered. *It is prepared by rubbing thoroughly steamed floury potatoes through a fine seive, and beating this up well with milk until it is as smooth and of the consistence of cream.

It is well to begin with about a teaspoonful of this mixture to each bottle at first, gradually increasing it to 2 or 3 if it is found to agree. Well boiled carrots may be used in the same way. In dealing with older children the state of the mouth must be taken into consideration. When there is stomatitis and the gums are very tender, swollen or bleeding; the mildest of soft unirritating food should be given which require no mastication, as fresh milk, eggs, meat, broths, and soups, purees of fresh vegetables together with orange and lemon juice.

A great deal more might be done than is already done to improve the chances of an infant surviving the first year of its life.

The chief trouble is the contamination of dairy milk from outside sources of infection.

The health of each cow should be a matter of careful investigation, and if there is any one diseased that cow should be excluded. The milk should be taken from the whole herd, for by so doing the quality is more likely to be constant than if taken from "one cow" as was at one time advocated. The quantity and quality of the milk from "one cow" varies of course according to the time it has been in milk.

The feeding of cows is a matter that should have very careful consideration since sudden changes in the cow's diet have been known to have been followed by serious disturbances in the children fed on the milk. One case is reported in which the cows were fed on the waste from a distillery and alcohol was excreted in the milk.

With a view to keeping the milk of a fairly constant quality, the food should be kept as uniform as possible. This is more easily attained in dairies

where the cows are kept under cover in towns, but such cows are not so likely to maintain their health as th those in the country: therefore the transition from winter food to summer food should be made as gradual as possible, the grass taking the place of the turnips, etc.

I have had some cows fed upon oats, corn, and hay exclusively, no oilcake, which gives an excess of fat to the milk, and no grass, which cannot be obtained in winter.

The merit of this dietary is that it admits of no variation, and consequently there is less likelihood of the character of the milk being changed at all, and therefore no risk of gastro-intestinal disturbances being set up from such a change. These cows are kept in a shed so that winter and summer alike their milk remains practically constant.

After its 3rd or 4th calf a cow is no longer used for dairy purposes, the quality of the milk becoming much impaired and very inferior.

Before milking the cows udders are thoroughly washed with hot water, (which is drawn from a

boiler): the early morning milking is as efficiently carried out as those later in the day, the hot water supply being constant and abundant.

The attendant's hands are also well washed with soap and water before milking.

When milking cows the first part is always drawn off and used for some other purpose, the last drawn milk is the richest in cream.

The milk is kept in special vessels, and not adulterated in any manner, no preservatives or colouring matters whatever are added, a habit unfortunately of wide distribution amongst dairies.

The analysis of the milk is as follows:-

Fat	3.10
Proteid	3.60
Sugar	5.26
Salts	0.75
Water	87.29

with a footnote "Extremely free from Bacteria. Not readily coagulated by acids".

In other respects the milk did not differ materially from the average cows milk; but when

treated as described by the Goertner process, diluted with barley water and comparatively sterilised "producing a food which I have found very satisfactory for infants.

One of the chief difficulties to contend with in feeding infants is the great ignorance displayed on the subject by mothers and nurses.

Midwives and Monthly nurses should certainly be taught during their course of instruction more than they at present know on the subject of infant feeding, on them often devolves, especially in the case of first confinements, the instruction of the mother in the art of bringing up her child and in this particular their knowledge is often deficient.

The advent of such a scientific system as the Walker Gordon Laboratories in the country would be an inestimable boon, and would without doubt reduce the risks attendant on Infant life and to compel the at present more or less haphazard experimentation to give place to an exact science of infant feeding.

Notes on a few cases fed on "Nursery Milk".

D. S. Born at full time. The mother's milk failed within three weeks. Child was given humanised milk from a large dairy for a few weeks when this was discontinued at the parents wish, and a patent food given also at the parents own wish. The child seemed to thrive, was seldom sick, and put on weight. At 8 months was excessively fat and had only two teeth, a mild attack of gastro-enteritis with from 5 to 8 motions a day, without much vomiting but considerable loss of substance. Opened the way to discontinuing the patent food and introducing the "Nursery Milk" scalded and diluted with barley water. It was well taken, the child became firm and rosy, and two more teeth are being cut.

H. S. Born at 8½ months (weight 6lbs). Mother young and not very strong. Her milk left her at three weeks after the child's birth. It did not seem to have been of very good quality since the child was very slow in making progress; vomited fairly frequently after its food and had cold extremities.

The mother fed the child on a patent food (Mellins) from that time; but although it was rarely

sick, and only occasionally had diarrhoea its weight was scarcely a stone at 10 months, and it was 11 months old before the first tooth was cut.

Put upon the Nursery milk, with Cod liver oil and Malt Extract (about half a teaspoonful thrice daily, 1 teaspoonful of cream to each feed, and one teaspoonful of raw meat juice to a bottle two or three times a day, it got steadily better and increased in weight and vigour.

D. C. Prematurely born at 7th month: the mother was unable to nurse at all. The child was fed on Nursery Milk, humanised, 2/3 of the casein removed at first and gradually increased to ½. The child has made remarkable progress beyond all expectations and has been extraordinarily free from gastro-intestinal disturbances.

Several cases are taking the milk and are doing very well upon it, but one case, a child of a woman of 44 who was being fed on the milk had a very severe attack of gastro-enteritis and died within a week in spite of every effort to save it. I was unable to find any cause for this attack in the milk supply. The child was 4 months old and its mother

and father (52) were both past their first youth which must have given it an unfavourable start in life.

Artificial Foods.

1. Sterilised Cream and Whey mixture.

Take of ordinary cream (20 per cent) 1 ounce
Whey 2 ounces
Sugar of Milk 1 teaspoon.

Mix and sterilise for half an hour.

2. Whey.

Prepared by adding essence of pepsin to fresh milk which is to be gently warmed. When the milk is"set" break up the curd repeatedly and allow it to settle each time straining off the whey until the whole is separated. The whey should then be rapidly heated to boiling point, when a further quantity of casein,(technically "fleetings") separates which should be removed by straining through clear muslin.

3. Barley Water.

Take two tablespoonsful of barley meal and place in a clean jug. Pour on to it a pint of

boiling water, stand by the fire for an hour, stir frequently and add a pinch of salt. The same quantity of ground rice or oatmeal can be used instead of barley. It should be freshly made and cannot be given with safety if more than 6 hrs old.

4. Meigs Mixture.

Allow one pint (mornings) milk to stand in a cool place for three hours in a long cylinder with a stop cock half way down; draw off the upper half and use 3 parts of this to 5 parts of water, which produces a mixture containing about the same amount of fat and casein as in Human milk. Thus:-

Weak cream as above prepared	3 oz.
Water (boiled)	3 oz.
Lime Water	2 oz.
Sugar of Milk	3½ drachms.

5. Rotoch's Mixture.

Cream 20%	1½ oz.
Milk	1 oz.
Water	3 oz.
Lime Water	½ oz.
Milk Sugar	2 drachms.

6. Peptonised Milk. (Burney Yeo, 542).

Prepared by putting a pint of milk into

a clean quart bottle, add a quarter of a pint of water and a tube of Fairchild's powder, shake well. Put the bottle into a saucepan of water at 150°F. and let it stand for half an hour; then boil for a minute or two, (this stops all further action of the ferment. Cold arrests it temporarily and if kept in ice, boiling is unnecessary).

7. Raw Meat Juice. (Eustace Smith, 272).

Put two ounces of lean raw mutton or beef very finely minced into an earthen vessel, pour upon the meat enough cold water to cover it. Stand inside the fender before the fire for two hours. Strain and squeeze through a sieve.

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