

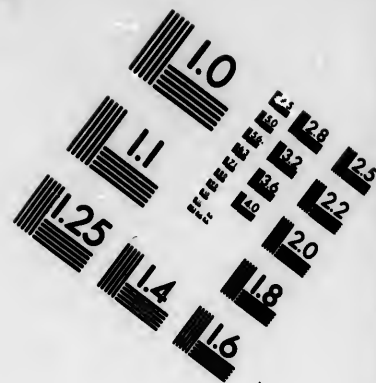
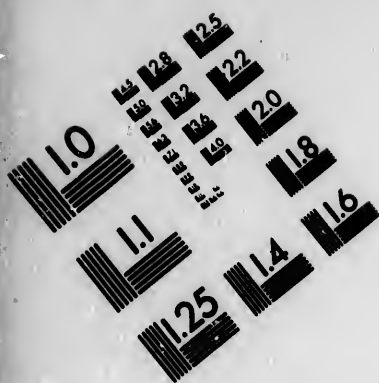
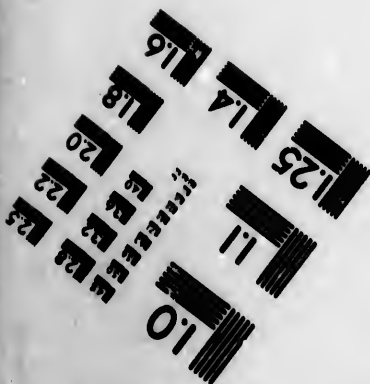
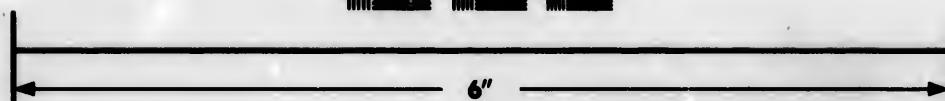
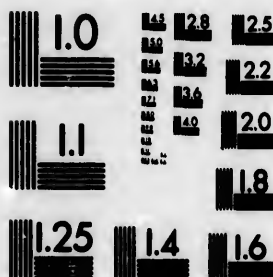


IMAGE EVALUATION TEST TARGET (MT-3)



Photographic
Sciences
Corporation

23 WEST MAIN STREET
WEBSTER, N.Y. 14580
(716) 872-4503

**CIHM/ICMH
Microfiche
Series.**

**CIHM/ICMH
Collection de
microfiches.**



Canadian Institute for Historical Microreproductions / Institut canadien de microreproductions historiques

© 1985

Technical and Bibliographic Notes/Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming, are checked below.

L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

- ☒ Coloured covers/
Couverture de couleur
- ☐ Covers damaged/
Couverture endommagée
- ☐ Covers restored and/or laminated/
Couverture restaurée et/ou pelliculée
- ☐ Cover title missing/
Le titre de couverture manque
- ☐ Coloured maps/
Cartes géographiques en couleur
- ☐ Coloured ink (i.e. other than blue or black)/
Encre de couleur (i.e. autre que bleue ou noire)
- ☐ Coloured plates and/or illustrations/
Planches et/ou illustrations en couleur
- ☐ Bound with other material/
Relié avec d'autres documents
- ☐ Tight binding may cause shadows or distortion
along interior margin/
Le reliure serrée peut causer de l'ombre ou de la
distorsion le long de la marge intérieure
- ☐ Blank leaves added during restoration may
appear within the text. Whenever possible, these
have been omitted from filming/
Il se peut que certaines pages blanches ajoutées
lors d'une restauration apparaissent dans le texte,
mais, lorsque cela était possible, ces pages n'ont
pas été filmées.
- ☐ Additional comments:/
Commentaires supplémentaires:

- ☐ Coloured pages/
Pages de couleur
- ☐ Pages damaged/
Pages endommagées
- ☐ Pages restored and/or laminated/
Pages restaurées et/ou pelliculées
- ☒ Pages discoloured, stained or foxed/
Pages décolorées, tachetées ou piquées
- ☐ Pages detached/
Pages détachées
- ☒ Showthrough/
Transparence
- ☐ Quality of print varies/
Qualité inégale de l'impression
- ☐ Includes supplementary material/
Comprend du matériel supplémentaire
- ☐ Only edition available/
Seule édition disponible
- ☐ Pages wholly or partially obscured by errata
slips, tissues, etc., have been refilmed to
ensure the best possible image/
Les pages totalement ou partiellement
obscurcies par un feuillet d'errata, une pelure,
etc., ont été filmées à nouveau de façon à
obtenir la meilleure image possible.

This item is filmed at the reduction ratio checked below/
Ce document est filmé au taux de réduction indiqué ci-dessous.

10X	14X	18X	22X	26X	30X
☐	☐	☐	☒	☐	☐
12X	16X	20X	24X	28X	32X

The copy filmed here has been reproduced thanks to the generosity of:

Medical Library
McGill University
Montreal

The images appearing here are the best quality possible considering the condition and legibility of the original copy and in keeping with the filming contract specifications.

Original copies in printed paper covers are filmed beginning with the front cover and ending on the last page with a printed or illustrated impression, or the back cover when appropriate. All other original copies are filmed beginning on the first page with a printed or illustrated impression, and ending on the last page with a printed or illustrated impression.

The last recorded frame on each microfiche shall contain the symbol ➡ (meaning "CONTINUED"), or the symbol ▼ (meaning "END"), whichever applies.

Maps, plates, charts, etc., may be filmed at different reduction ratios. Those too large to be entirely included in one exposure are filmed beginning in the upper left hand corner, left to right and top to bottom, as many frames as required. The following diagrams illustrate the method:



L'exemplaire filmé fut reproduit grâce à la générosité de:

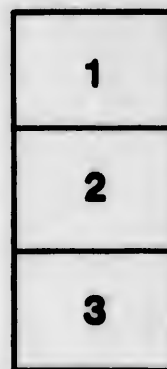
Medical Library
McGill University
Montreal

Les images suivantes ont été reproduites avec le plus grand soin, compte tenu de la condition et de la netteté de l'exemplaire filmé, et en conformité avec les conditions du contrat de filmage.

Les exemplaires originaux dont la couverture en papier est imprimée sont filmés en commençant par le premier plat et en terminant soit par la dernière page qui comporte une empreinte d'impression ou d'illustration, soit par le second plat, selon le cas. Tous les autres exemplaires originaux sont filmés en commençant par la première page qui comporte une empreinte d'impression ou d'illustration et en terminant par la dernière page qui comporte une telle empreinte.

Un des symboles suivants apparaîtra sur la dernière image de chaque microfiche, selon le cas: le symbole ➡ signifie "A SUIVRE", le symbole ▼ signifie "FIN".

Les cartes, planches, tableaux, etc., peuvent être filmés à des taux de réduction différents. Lorsque le document est trop grand pour être reproduit en un seul cliché, il est filmé à partir de l'angle supérieur gauche, de gauche à droite, et de haut en bas, en prenant le nombre d'images nécessaire. Les diagrammes suivants illustrent la méthode.



VA

Evans, J. J.

618-9

X

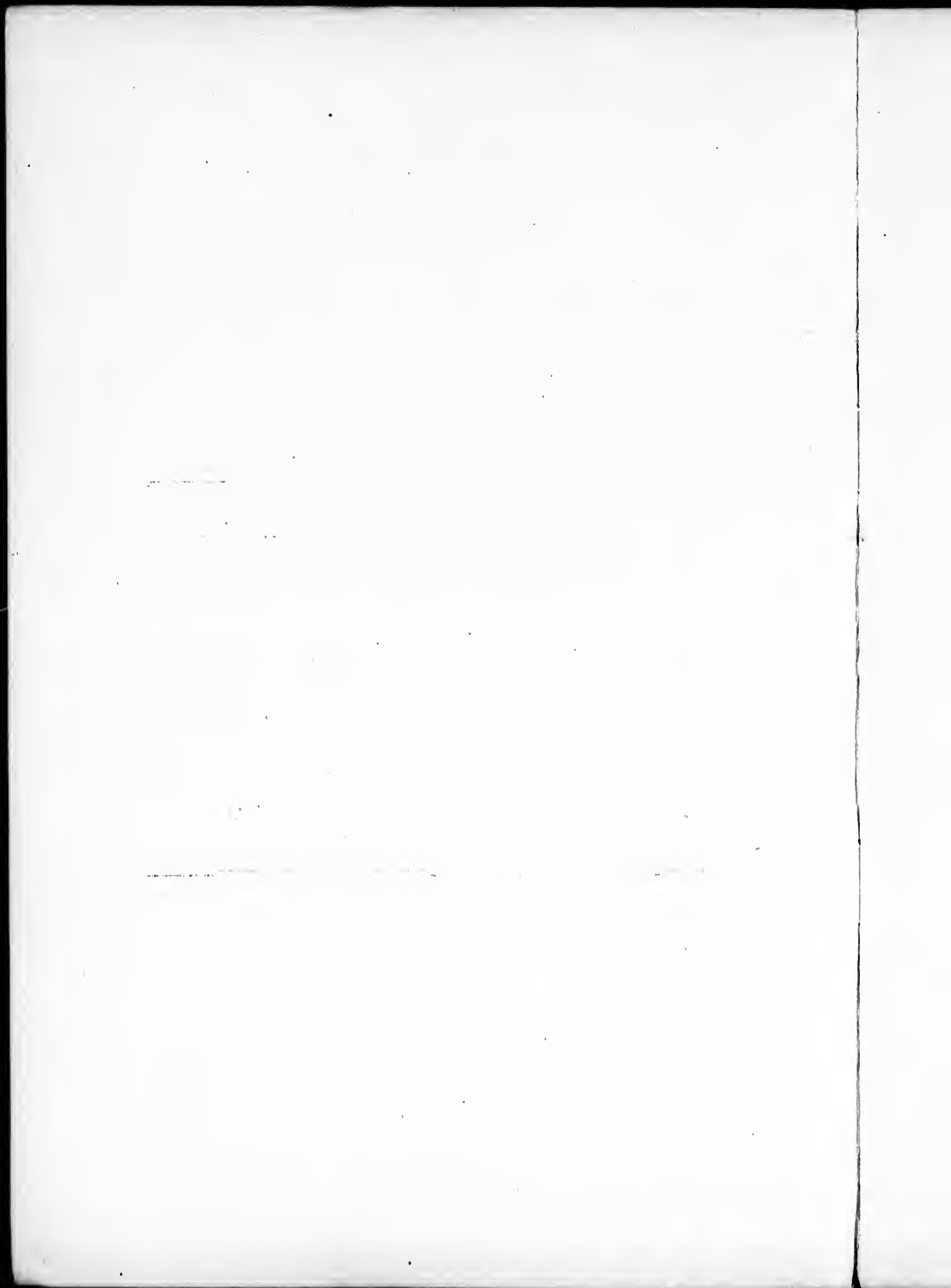
THE VALUE OF MODIFIED COW'S MILK IN INFANT FEEDING.

BY

DAVID JAMES EVANS, M.D.

Demonstrator of Obstetrics and Diseases of Infants, McGill University ; Physician
to the Montreal Foundling and Baby Hospital.

(Reprinted from *Montreal Medical Journal*, October, 1897.)



THE VALUE OF MODIFIED COW'S MILK IN INFANT FEEDING.

BY

DAVID JAMES EVANS, M.D.,

Demonstrator of Obstetrics and Diseases of Infants, McGill University; Physician to the Montreal Foundling and Baby Hospital.

My effort this evening is not to present an exhaustive study on the value of modified cow's milk in infant feeding, but rather to review briefly the principle of the use of modified cow's milk and to report the experience of others, as well as my own, in its employment and limitations in practice.

As civilization advances, a constantly increasing proportion of mothers are unable to nurse their children. Among the rich luxurious habits of life, and among the poor over crowding with its attendant evils and poor food bring about the same result, loss of the function of lactation. Substitute or artificial feeding of infants is thus becoming daily a more and more important problem.

The offspring of all mammals are carnivora, and the human infant is no exception to this rule.

The constituents of the food of all young mammals are essentially animal and never vegetable. Therefore a vegetable element in the food of young infants would seem to be a foreign element.

The theory that the addition of such elements tended to make the curd of milk finer and therefore more easily digested has been proved to be fallacious.

Empirical feeding of infants, hitherto almost universal, has ever introduced a considerable proportion of vegetable matter into infant foods.

For our present scientific method of infant feeding we are indebted chiefly to Dr. Rotch, of Boston, who, associated with Mr. G. E. Gordon, a veterinarian, has simplified the problem and brought it to such practical perfection that we can now write a prescription for a food, with the same certainty that it will be accurately filled, as when we write a prescription for an apothecary.

Maternal milk is the best food for infants and there is but little doubt that no food will ever be found which will fully supply its deficiency.

Human Milk.—Human milk must therefore be the standard we must copy.

But it is well known that human milk is subject to great variation as those who have had much experience with wet nurses know Breast milk on which one infant may thrive, may prove utterly unsuited for another of the same age and weight.

A brief review of the composition of human milk and of some of its variations may not be out of place at this point. According to the most recent analysis, the composition of human milk is as follows:

	AVERAGE.	COMMON VARIATIONS.
Fat	4.00	3.00 To 5.00
Sugar	7.00	6.00 " 7.00
Proteid	1.50	1.00 " 2.25
Salts	0.20	0.18 " 0.25
Water	87.30	89.82 " 85.50
	100.00	100.00 100.00

The fat is subject to considerable variation but the percentage of four is about the average. Roughly speaking the proportion of fat to proteid in human milk is three to one.

The sugar is simply lactose in solution. Its proportion varies from 6 to 7 per cent. and is very constant.

The proteids of human milk are very complex and though much work has been done upon them they are not as yet completely understood. The most important are casein, lactalbumin, and lactoglobulin. The proteids vary from 1.50 to 2 per cent. being high at first but soon averaging 1.50 per cent.

The salts are numerous but average about 0.20 per cent. and are very constant throughout lactation.

The reaction is generally slightly alkaline and it is as a rule free from germs.

The amount supplied to the infant varies from 10-16 oz. per diem at the end of the first week, to 30-40 oz. from the sixth to the ninth month.

When the analysis of human milk yielded us definite knowledge of its elements and their proportions we were in a position to look for an efficient substitute.

The milk of all animals must be modified to correspond to human milk; hence cow's milk as being most easily obtainable is best suited for the purpose.

Milk of Cows of Various Breeds.—There is not time for me to refer even briefly to the investigations which have been carried out as to the proportion of the elements in the milk of various breeds of cows. Suffice

it to say that by scientific feeding and mixing of the milk of various breeds, a standard milk has been obtained ; that is a milk containing a fairly steady average in the percentage of the various elements.

Cow's Milk.—Cow's milk contains exactly the same constituents as human milk but in different proportions. The proportion of the elements is : Fats 4.00, sugar 4.50, proteids 4.00, ash 0.70. It is acid in reaction and is apt to be contaminated with germs.

We have thus in cow's milk, an excess of proteids and salts and a deficiency in the amount of sugar while the fat is about the same.

The problem was to obtain the elements separately, and then to recombine them to meet the need of individual cases. For the power to do this we are indebted as I said before to Dr. Rotch.

Two questions suggest themselves at this point. (1) In the process of separation of the elements will any change be brought about which would spoil them for use ? (2) Is there not some difference in the composition of the proteids of cow's milk which causes them to be more difficult of digestion by the infant ?

The process of separation has not been proved to cause any change in the elements. The emulsion of the fat is not disturbed.

The question of the proteids not yet being settled, it is difficult to say if any difference exists, but if there is it is not sufficient to be seriously considered.

Dilution with water, which is necessitated by the proteids, brings the salts down to their proper proportions, so they do not require separate consideration.

New Nomenclature.—In modern scientific feeding of infants it is necessary for the sake of accuracy to adopt a new method of nomenclature, as it were, which makes it seem at first sight a little difficult of comprehension. Instead of specifying the amount of cream and milk in a food we indicate the proportion of the elements.

This difficulty is soon mastered, as it must be, in order to properly prescribe milk in infant feeding.

It is this power of specifying the elements which enables us to modify the food to suit each individual case, as by varying the elements we can find out exactly which is at fault in the patient being fed.

We are fortunate in having in this city a milk laboratory where this process of preparing cow's milk for the scientific feeding of infants is carried out.

The Walker-Gordon Laboratory Co., has adopted the term " Modified Milk " to designate their process of putting into effect the prescriptions of physicians upon any basis of milk they may elect to use.

These laboratories have the oversight of the feeding and care of the cows ; and the handling of the milk to insure its purity, cleanliness

and freshness. They have trained men to carry out the preparation of the food called for by the prescriptions.

At the present time there are about 30,000 infants being fed by these laboratories in the United States and Canada, and they are everywhere giving satisfaction.

Rotch in a recent paper said: "The position which it seems fair for us to take is that the principle of the modification of milk is scientific, is practical, is right, and that in the milk laboratory we have one more instrument of precision to aid us in our work."

In infant feeding there are three important factors. (1) Quantity. (2) Quality. (3) Idiosyncrasy. It is impossible to give exact rules for modification, but in ordering milk for an infant not only its age, but its weight must be taken into account. A large healthy child for its age requires, not infrequently, the quantity and percentage of food advised for an average child of some weeks older.

As a rule it is well to begin with a low percentage and work up till a percentage and quantity is reached which the infant will digest and gain an average amount in weight per week upon.

It is absolutely necessary to insure success, that a close watch be kept of the infant's weight. It should be weighed at least once a week. The weekly gain in a healthy infant should be from three to eight ounces; at four months an average infant should have doubled its birth weight and at one year have trebled it.

As a rule I think there is a tendency to give an artificially fed infant too large a quantity of food.

Amount of Feeding.—During the first month of life, an average infant requires about ten feedings of from one to two ounces daily. During the second and third months, from two to four ounces and so on. As the amount is increased the number of feedings must be reduced and the interval between each lengthened.

An average formula for a healthy infant during the first week of life would be: Fat 2.00, sugar 6.00, proteid .60. The percentage may then be gradually increased to reach: Fat 3.00, sugar 6.00, proteid 1.00, by the end of the first month. By the third month a healthy infant thrives well on a fat 4.00, sugar 7.00, proteid 1.50 mixture.

As a rule those of largest experience find they get the best results from rather low percentage mixtures.

Modifications called for by Particular Symptoms,—Proteids.—The modifications called for by particular symptoms are important. If the proteids are in excess they are passed as undigested curds in the motions. These proteid curds are small and hard. It is proteid indigestion which gives rise to most of the colic of early infancy and as a rule a proper management of the proteids means success in infant

1.50
3.60
P. .50

feeding. Proteid indigestion may be shown by restlessness, sometime by diarrhoea, but more frequently by constipation; the latter is prone^s to occur with a great excess of proteid. Vomiting of small proteid curds is not infrequently met with.

Fat.—An excess of fat is usually shown by frequent motions of normal colour, containing large soft flocculi, which we call fat curds. Vomiting and regurgitation also occur from an excess of this element in the food. It is rare that fat indigestion is a cause of colic. Dry hard motions occur if the percentage of fat is too low.

Sugar.—If the sugar percentage is too low the gain in weight is apt to be slow. Excess of sugar is shown by colic and thin acid motions, which cause irritation of the buttocks, and have a sour yeasty odour. Generally we have eructations of gas and a sour odour to the breath, with an excess of sugar in the food.

Holt summarises the most important indications as follows: "If not gaining in weight without special signs of indigestion, increase the proportions of all the ingredients; if habitual colic, diminish the proteids; for frequent vomiting soon after feeding, reduce the quantity; for the regurgitation of sour masses of food, reduce the fat, and sometimes also the proteids; for obstinate constipation, increase both fat and proteids."

Premature Infants.—The signal value of the exact modification of cow's milk as carried out by the laboratories is shown in the feeding of premature infants. Here the gastro-enteric tract is undeveloped and unfit to digest even human milk. I have had experience of a few successful cases of this kind where at the start the infant could only digest a food containing fat 1.50, sugar 3.00, proteid .25, of which a drachm every hour was administered. It is most satisfactory to see cases of this kind improve, and finally take and digest easily the mother's milk. I think that at the present time it is unwise to attempt any other form of feeding in the case of these premature infants.

Unhealthy and Feeble Infants.—The proper feeding of unhealthy and feeble infants, is one of the most trying and difficult undertakings. One is not infrequently called upon to superintend the feeding of an infant of five or six months of age, weighing scarcely more than at birth, with a digestive tract that has been struggling to nourish its proprietor from all kinds of so-called infant foods, and has finally given up the attempt or refuses to retain anything committed to it. These are the most trying cases and require the greatest care and perseverance to ensure success. No gain in weight can be looked for till the digestion has improved. In the modification for these cases, as a rule the sugar is not at fault and need not be reduced below 4-4.50 per cent. It is the proteid that gives the most trouble, then the fats.

It is well to start these cases on a formula of about: Fat 2.00, sugar 6.00, proteid .60, and then gradually increase as the symptoms of indigestion pass away. In my experience, at first small quantities at short intervals, then larger quantities of the same formula at longer intervals, give the best results.

It is extraordinary in these cases what severe symptoms will follow the slightest excess of the element of the food at fault, thus the increase in percentages must be made with the greatest care and precaution.

Marasmus.—In the treatment of marasmus cases in children, of from 6 to 18 months, it is not infrequently the case that the fat must be kept low, while the proteid can be quite rapidly increased.

Diarrhœa.—In the treatment of summer diarrhœa the results of modified milk feeding are most satisfactory.

In a series of 115 cases treated under Dr. Rotch's direction last summer, five died, one was not improved and one hundred and nine recovered. The average age of the infants was 6.42 months. The milk was pasteurized in all cases; the average number of feedings was 7.5, with an average amount of 4.5 ounces. The average percentages were: Fat, 2.6; sugar, 6.8; proteid, 1.2. The important point is to keep the percentage of fat as low as possible.

The chief objection to modified milk, as prepared by the laboratories, is the expense. But it is a rule of life that one cannot have a good thing without paying for it. The average expense is from \$2.10 to \$2.40 per week, which includes bottles and nipples, and cannot be considered excessive when the whole process is considered.

For some years I have, in feeding infants, rarely made use of anything but modified milk, and the more experience I gather the stronger is my faith in this scientific and accurate method.

Of course, in home modification one cannot hope to obtain any great degree of exactness, and, therefore, there is apt to be a greater proportion of failures.

Home Modification.—Home modification is inaccurate because it is impossible to procure a standard milk and cream. Rotch recently had the cream from a reputable dairy tested on four successive days with the result of a variation in the samples of from 10.13 to 28.34 per cent.

Then it is difficult to secure the care and attention to detail from the parents or nurse necessary to ensure success.

A safe milk cannot be obtained under ordinary circumstances in large cities. This difficulty cannot be overcome until the public has been trained to recognize the advantages of a pure milk supply, and

is willing to pay a sufficiently high price for it to ensure the conscientious care necessary on the part of the producer.

The relationship between contaminated milk and the severe diarrhoeas of infancy is too well known to be more than referred to.

Provided the milk is fresh when delivered, fairly accurate results may be obtained, in healthy cases especially, from home modification.

It has been my habit to depend upon a 12 per cent. and an 8 per cent. cream, diluted as required by a 6, 7 or 10 per cent. sugar of milk solution. With these, several of the most ordinary percentage food mixtures can be obtained.

I usually order the cream of the percentage desired from the laboratory, where it is pasteurized before delivery.

A 12 per cent. cream may be obtained by taking two parts of gravity or skimmed cream (16 per cent.) and diluting with one part of milk.

8 per cent. cream may be obtained by diluting one part of skimmed cream with two parts of milk.

The sugar solutions are obtained by adding sugar of milk to boiling water in the following proportions ;

A 10 per cent. solution by adding one ounce of sugar of milk to ten ounces of water.

A 7 per cent. solution by adding one ounce of the sugar to fourteen ounces of water.

A 6 per cent. solution by adding the same quantity of sugar to sixteen and a half ounces of water.

The alkalinity is secured by adding lime water or bicarb. of soda to the food as required.

Let us suppose, for example, that we wish to prescribe a food for a healthy infant of one month, of average weight. We would require ten feedings of two ounces each with the following percentages : Fat 3.00 ; sugar, 6.00 ; proteid, 1.00.

This is prepared each morning by diluting five ounces of a 12 per cent. cream with fifteen ounces of a filtered 7 per cent. sugar solution. A half teaspoonful of soda bicarb. is added, and the food put on the ice and used as required.

The dilution here is one part of the cream to three of sugar solution. By adding two and a half parts of sugar solution to one part of the cream, one would have a food containing : Fat, 3.50 ; sugar, 6.00 ; proteid, 1.20, and so on.

If the physician is careful to give exact directions in writing any intelligent person can prepare the food.

As to results. In private practice, with healthy infants, I have seldom failed to obtain good results with home modification, where

those in charge of the infant were intelligent and careful in the preparation of the food.

In the Montreal Foundling and Baby Hospital we have been using modified milk for the past eighteen months, with the most satisfactory results.

As we have become more familiar with the practical working of this method of feeding our results have improved. We have at present forty-four infants in the hospital, which is greatly overcrowded, and not one of them is the subject of marasmus.

Our mortality during the first four months of this year is half of what it was during the same period of last year.

The admissions so far this year were exactly double those of the same period last year.

We attribute our success in a great measure to this system of feeding. Most of the modification of food is done in the hospital by the nurse girls in training.

Recently, in order to test whether pasteurization of the food could be dispensed with, the infants were fed on unpasteurized milk. In a few days every infant so fed was suffering from indigestion and passing green motions with undigested curds. These troublesome symptoms disappeared entirely, without the use of drugs, on resuming the pasteurization.

The Walker-Gordon Co. report having put up prescriptions for over two thousand physicians with a mortality of $2\frac{1}{2}$ per cent. in healthy infants.

In closing I may be permitted to quote the recent utterances of two of the most eminent authorities :

Dr. Holt, of New York, says : " After two years' experience I have found the laboratory of great value in difficult cases of infant-feeding, and it soon becomes almost as much of a necessity to the physician practising among young children as does the apothecary shop to the general practitioner."

Dr. Rotch, in a paper read before the New York Academy of Medicine on April 3rd last, stated as follows : " I have never yet seen an infant who was carefully fed on milk during the first ten or twelve months of its life, by carefully changing the percentage of the milk constituents, and on nothing else, not enter on its second year with firm flesh and an average development. I have found the teeth to be sound, and to come at the usual age. I have found the functions of sitting, walking, standing, and the amyolytic functions all appear and develop normally. I have followed these children into their third, fourth and fifth years, and have found them strong, ruddy, with good bones and teeth, and with digestions which permit them to be fed on a general mixed diet of all the food elements."

