

A CLINICAL AND RADIOGRAPHIC STUDY OF RICKETS,
WITH SPECIAL REFERENCE TO THE ROLE OF THE
FAT SOLUBLE "A" VITAMIN IN ITS ETIOLOGY

by

JAMES BIGGAM DOUGLAS GALBRAITH, M.B. Ch.B.

ProQuest Number: 13916235

All rights reserved

INFORMATION TO ALL USERS

The quality of this reproduction is dependent upon the quality of the copy submitted.

In the unlikely event that the author did not send a complete manuscript and there are missing pages, these will be noted. Also, if material had to be removed, a note will indicate the deletion.



ProQuest 13916235

Published by ProQuest LLC (2019). Copyright of the Dissertation is held by the Author.

All rights reserved.

This work is protected against unauthorized copying under Title 17, United States Code
Microform Edition © ProQuest LLC.

ProQuest LLC.
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106 – 1346

C O N T E N T S.

	<u>PAGE</u>
INTRODUCTORY REMARKS.	1.
SCHEME OF INVESTIGATION.	2.
THE DIAGNOSIS OF RICKETS	2.
{ a. By Radiograph.	
{ b. Clinically.	
1. THE OBSERVATION OF CHILDREN FOR A LONG PERIOD ON A DEFINITELY FAT SUFFICIENT DIET, AND THE NOTING OF ANY INCIDENCE OF RICKETS.	4.
2. A SIMILAR OBSERVATION ON CHILDREN ON A FAT POOR DIET.	9.
3. THE INVESTIGATION OF DIET HISTORIES FROM BIRTH OF DEFINITELY RACHITIC CHILDREN, WITH SPECIAL REFERENCE TO THE PROBABLE FAT SOLUBLE A CONTENT.	11.
3.a. THE OBSERVATION IN THE SPRING MONTHS OF APPARENTLY NORMAL BABIES OF LESS THAN 1 YEAR OF AGE.	15.
{ 1. Noting the incidence of rickets.	
{ 2. Correlation of rickets with diet.	
{ 3. Progress of rickets during the summer months.	
4. COMPARISON OF RESULTS OF TREATMENT WITH VARIOUS MEASURES -	20.
1. Cod liver oil.	
2. Massage.	
3. Phosphorus.	
4. Violet Rays.	
5. Remaining untreated.	
6. On fat poor diet.	
CORRELATION OF RADIOGRAPHIC WITH CLINICAL FINDINGS.	28.

	<u>PAGE.</u>
THE CRITERIA OF CURE IN RICKETS.	29.
HYGIENIC CONDITIONS IN HOUSES OF RACHITIC CHILDREN.	31.
SUMMARY AND DISCUSSION.	34.
The Seasonal Incidence of Rickets.	
Muscle Tone in Rickets.	
CONCLUSIONS.	41.

A P P E N D I C E S.

- A. Details of diet of children developing rickets under observation on fat sufficient diet.
- B. Graphs comparing normal fat intake with that observed in children developing rickets on a fat sufficient diet.
- C. Details of diet of children under observation on fat deficient diet.
- D. Graphs comparing normal fat intake with that of children observed on a fat deficient diet.
- E. Tables showing estimation of fat intake from patent foods.
- F. Details of diet histories of definitely rachitic children.
- G. Tables to show results of treatment.

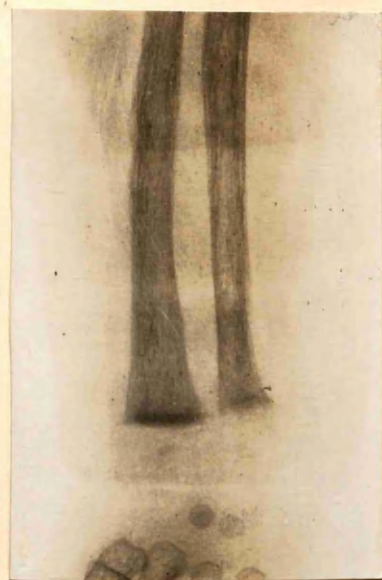
A CLINICAL AND RADIOGRAPHIC STUDY OF RICKETS, WITH SPECIAL REFERENCE TO
THE RÔLE OF THE FAT SOLUBLE A VITAMIN IN ITS ETIOLOGY.

This research was undertaken on the suggestion of Dr. Leonard Findlay and under the auspices of the Medical Research Committee, by whom the expenses were borne. Its main object has been to investigate the relationship of deficiency of fat in the diet to the development and cure of rickets; and, secondly, to collect a large series of radiographs of the bones in rachitic children, and to attempt to correlate the severity of the lesions with the clinical findings.

A study of the literature shows that by far the greatest bulk of the work on rickets, at least of late years, has been experimental and conclusions have been drawn as to the etiological factors in human rickets from the production of a similar condition in the bones of animals, usually rats or puppies. The hypothesis has been that experimental rickets is exactly analogous to human rickets and should, therefore, by any chance, . . . this hypothesis prove to be incorrect then much of the value of this work is lost. Furthermore, the natural tendency of animals kept in laboratories to develop spontaneous rickets is well known, and militates against definite conclusions being drawn from such work. Recently McCollum, Shipley, Simmonds and Parsons (1) after describing the production of rickets in rats by feeding them on any of eleven distinct varieties of diet, conclude by saying "Many years experience with feeding experiments, however, have demonstrated to us how dangerous it is to draw conclusions from apparently obvious experimental data. Any suggestions regarding the absence of a specific anti-rachitic substance, or a deficiency of either fat soluble A and calcium as the primary agent in the production of rickets would be ill considered, and might be far from the truth." Eventually one must come back to the study of rickets in the rachitic child, and whatever the experimental findings are they must be applied to the human. It was for this reason that the present investigation on healthy and rachitic children was carried out.

The main object of the research has been to put the theory of fat soluble A deficiency as the main causative factor of rickets to the clinical test. From a logical stand point, if the deficiency of the

TO ILLUSTRATE THE RADIOGRAPHIC CHANGES IN
DEVELOPING RICKETS.



T. Small
5
1/2 20. VII. 21

20. IX. 21

7. XI. 21

23 XII. 21



3. II. 22.

3. III. 22

14 IV. 22

11. V. 22

fat soluble A vitamin is the principal etiological factor then we should expect the following clinical findings:-

- (1) No child observed on a diet containing a sufficiency of the vitamin should develop rickets.
- (2) Conversely, children on a diet not containing a sufficiency of the vitamin should develop rickets.
- (3) In the investigation of the previous diet of definitely rachitic children, a deficiency of this vitamin in the diet should be apparent.
- (4) The curative effects of supplying the vitamin should be prominent, and healing should not progress unless a sufficiency be presented.
Furthermore, healing should not be influenced by other factors.

From a consideration of these points my investigations have been arranged on the following lines:-

- (1) The observation for a long period of children on a definitely fat sufficient diet, and the noting of any incidence of rickets.
- (2) The observation for a long period of children on a definitely fat deficient diet, and the noting of any incidence of rickets.
- (3) The investigation of diet histories from birth of definitely rachitic children, with special reference to its probable fat content.
- (3)a. An additional dietary investigation was made by taking a series of some 50 young babies brought to the Out Patient Department for circumcision, radiographing the bones, and attempting to correlate any incidence of rickets with the nature of the diet the child was receiving.
- (4) Noting and comparing the effects of treatment, under varying conditions, of children on fat sufficient and fat deficient diets.

I propose to discuss the results of my investigation in accordance with the classification given above.

The diagnosis of rickets. At the outset it is necessary to explain in some detail the grounds on which a diagnosis of rickets was made.

a. By radiograph. No case was accepted as rachitic unless the clinical findings were substantiated by a positive radiographic picture. In cases which eventually developed rickets, the first abnormality was that the detail of the bone throughout its whole length became less clearly defined

TO SHEW THE "FRINGE" FORMATION DURING THE PROCESS
OF HEALING.

A. Shetty 2 $\frac{3}{12}$ yrs

Both treated with Cod Liver Oil.



24.VII.21



6.X.21



12.XI.21



3.II.22

A. Russell 2 $\frac{1}{2}$ yrs



22.VII.21



19.VIII.21



20.IX.21



12.XI.21

and, as the trabeculae assumed a coarser texture, the fine reticular appearance was lost. At the same time the periosteum of the shaft showed a thickening, probably an attempt to compensate for the weakening of the bone (as recently suggested by Park and Howlands) (2). A slight widening of the ulna (the wrist was the part chosen for radiography in each case) was next seen, and then, gradually, the normal clearly defined lower ends of the shafts of the ulna and radius became indistinct and showed some degree of irregularity. The changes were usually earlier and more severe in the ulna. Park and Howland (2) describe a fringe of fine, thread-like prolongations from the end of the shaft as a sign of advancing rickets. In my experience this phenomenon occurs, not as a sign of progressing rickets, but as one of the first signs of healing (See illustration). As the disease advances the typical rachitic picture is seen, with cupping and marked irregularity of the epiphysis and gross change of structure of the bone of the shaft.

Delay in the appearance of centres of ossification of the carpus, radius and ulna has not been given prominence as a diagnostic point as it is thought that other conditions, such as gastro-intestinal troubles and malnutrition, influence the time of appearance of these centres.

b. Clinically, One looked for the usual signs, delayed closing of the fontanelles, craniotables, delayed or irregular dentition, epiphysial enlargement, beading of the ribs, and curvatures of the long bones. I think that a slight enlargement of the epiphysis at the wrist is the most constant and earliest sign, but one must know the normal thoroughly well before diagnosing the abnormal. The "rickety rosary", in my experience, both as a negative and a positive sign, is unreliable in the diagnosis of early rickets, and this sign, in itself, was not used in this investigation. Lawson Dick (3) in his recent book, lays much stress on the presence of cranio-tables as an early diagnostic sign: unfortunately, I did not at first pay any special attention to the presence or absence of this sign, but when, in the later cases I did look for it, this did not appear to be a common early sign.

Symptoms of rickets are described by many writers (4) as being usually present before any sign or bone change can be detected. These writers

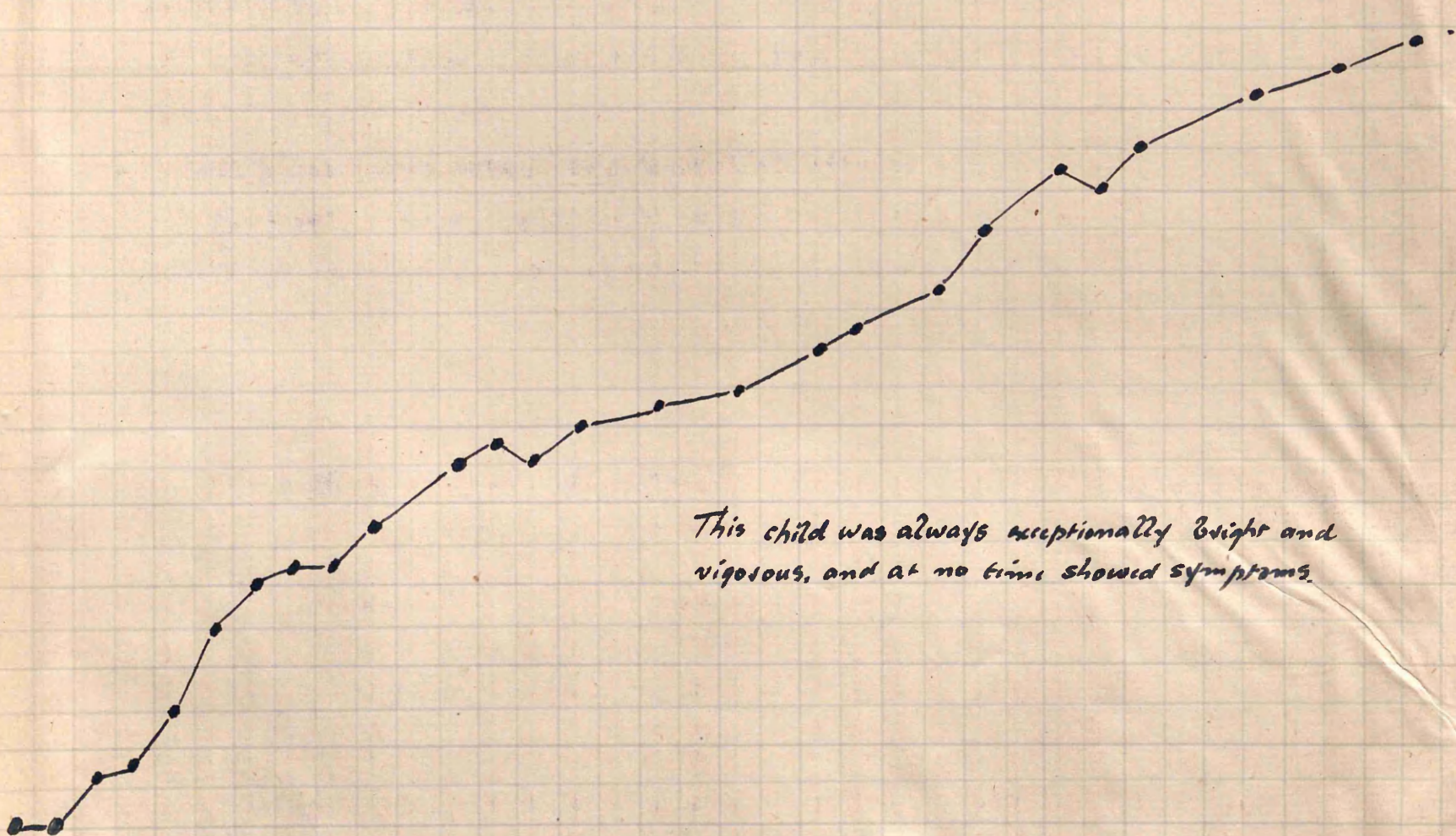
WEIGHT CHART OF CHILD DURING PERIOD IN WHICH SUCCESSIVE RADIOGRAPHS SHOWED RACHITIC CHANGES.

NAME, **ELIZABETH CONNELLY** Born **7. VIII. 21**

INDEX No.

December				January				February				March				April				May				June				July				August				
9	16	23	30	6	13	20	27	3	10	17	24	3	10	17	24	31	7	14	21	28	5	12	19	26	2	9	16	23	30	7	14	21	28	4	11	18

20 "
19 "
18 "
17 "
16 "
15 "
14 "
13 "
12 "
11 "
10 "



This child was always exceptionally bright and vigorous, and at no time showed symptoms.

X RAYS:-

-ve

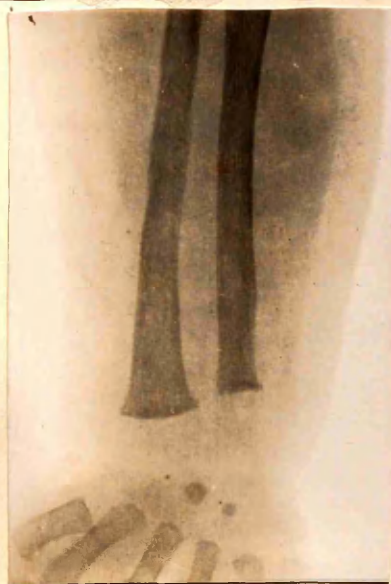
-ve

+ve

+ve

+ve

+ve.



JANUARY 6th



MARCH 3rd



MARCH 31st



JUNE 16th

appear to base their views on the nutritional theory of the causation of the disease, and claim that failure to thrive satisfactorily, and the occurrence of gastro-intestinal upsets are early symptoms. My experience has been that there are very often no symptoms at all in an uncomplicated case of rickets. In many instances, I observed children who continued to be plump, healthy looking and contented, with a steadily increasing weight chart whilst successive radiographs showed progressing rickets. Head-sweating, tenderness of the limbs, gastro-intestinal disturbances and failure to thrive were conspicuous by their absence.

I. THE OBSERVATION OF CHILDREN FOR A LONG PERIOD ON
A DEFINITELY FAT SUFFICIENT DIET.

The system adopted in the Royal Hospital for Sick Children, Glasgow, by which many babies dismissed from the wards are brought to the hospital regularly as out-patients until they are a year old was of particular advantage in carrying out this part of the investigation.

System of investigation. Altogether 55 babies were observed on a sufficient diet, some of them being under observation from the age of a few weeks. They were seen weekly or fortnightly, weight charts being kept and clinical notes made, and they were radiographed regularly, usually once a month. Written instructions of the diet were given to the mothers and they were questioned frequently, so that although the children were not under direct observation as indoor cases, as in the experiments described recently by Miss Chick (5) one could be fairly sure that the diets prescribed were being actually given. All those cases in which/

there was the slightest doubt were discarded.

Standard of fat intake. A standard of normal fat intake had to be fixed before any comparisons could be made. This was arrived at by calculating the amount of cows milk required at each month up to 1 year to supply the calories needed (according to Rubner's scale), taking the number of grams of fat thus supplied as the ideal for intake, and dividing this number by the average normal weight of a child of that age, to give a standard of grams of fat per kilogram of body weight for each month up to 1 year. For example, at 6 months 570 calories daily are required. Taking 1 ounce of milk to be equal to 17 calories we find that 30 ounces of milk daily would supply 510 calories, so that less than 4 drachms of sugar would be required in the day to make up the calories needed, 30 ounces of milk would supply 27 grams of fat, and 27 divided by 7 (taking 7 kilograms as the average normal weight of a six months old child) is 3.9. That is, a supply of 3.9 grams of fat per kilogram of body weight is the normal average for a 6 months old child. A 3% milk fat was assumed throughout: this seems to be a fair assumption, for vigilance on the fat content of town milk is well sustained, and although the actual purity of the milk may be far from ideal, the fat content would appear to be fairly constant. The following facts, kindly supplied by the Medical Officer of Health for Glasgow, bear evidence of this. Of the official samples of sweet milk examined during the past year, the average monthly fat percentage amounted to 3.4, the lowest monthly average being 3.38, and the highest 3.62. The average for the 6 winter months approximated that for the 6 summer months, being 3.48% fat in the former and 3.64% fat in the latter. A fat percentage of 2.85 or less was generally taken as the index for prosecution and of 824 samples examined, only 23 prosecutions were undertaken. That is to say, 97.3% of

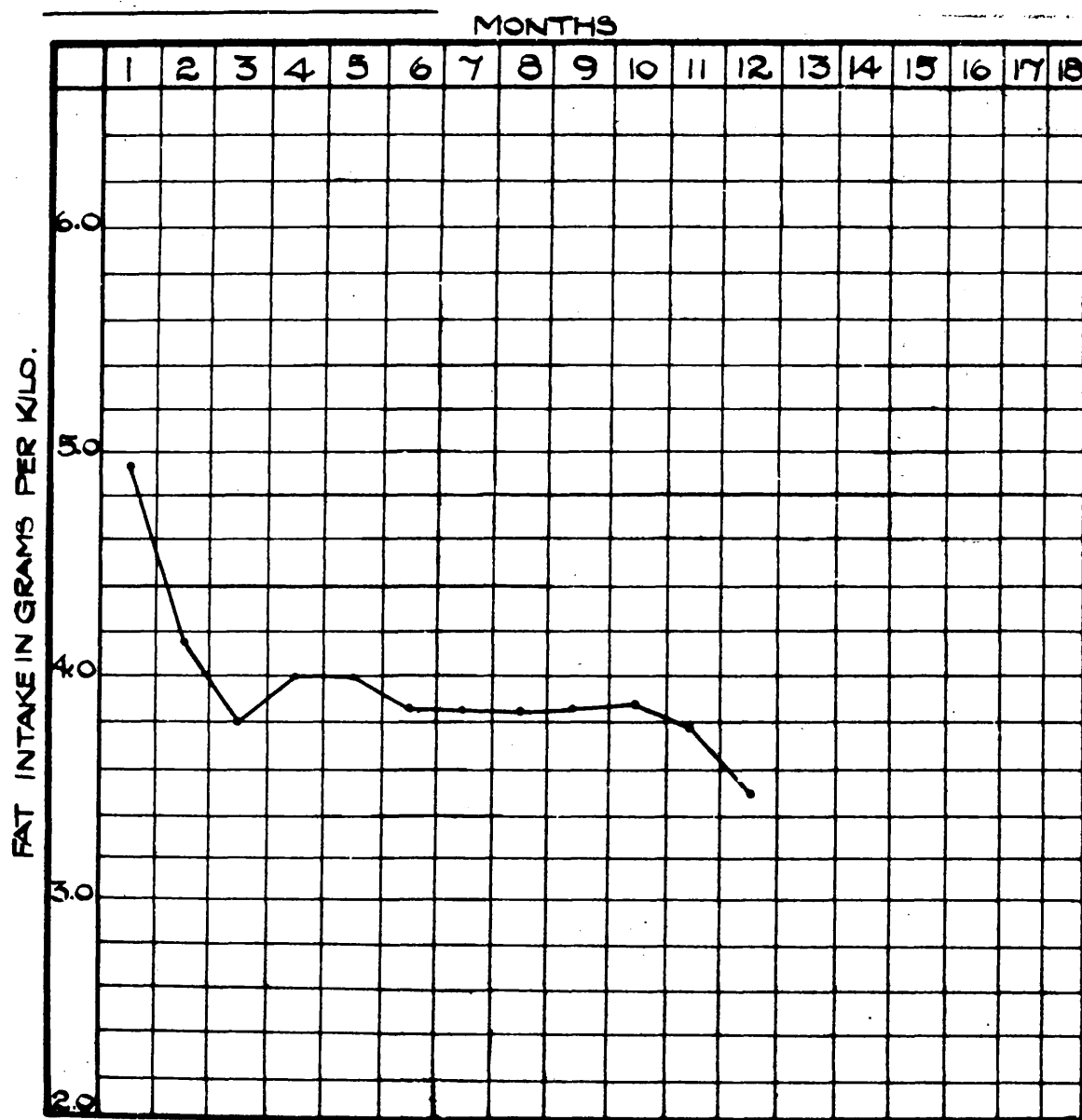
/

the samples of milk examined contained a legal sufficiency of fat. Nor can it be said that the milk sold in the poor class districts is more likely to be deficient in fat than that sold in the better class districts, for the comparison of analysis of samples from the different wards of the city shows no such discrepancy. Therefore, the evidence is strongly in favour of the statement that practically all the milk retailed in Glasgow, both in summer and in winter, contains at least 3% fat, and the assumption of a 3% fat standard in this investigation seems justified. In 33% of the children who were observed on a fat sufficient diet in the winter months a further guarantee is afforded by the fact that the milk was supplied free of charge, under the Corporation Relief Scheme, from a well known dairy company, and that this milk, on repeated examinations by the Public Health Department, showed a monthly average of 3.3% fat and was never less than 3.2% fat. The question of the probable vitamin content of this milk will be discussed later.

TABLE TO SHEW AVERAGE NORMAL FAT INTAKE.

Month.	Calories required.	Amount of milk in ounces.	Calories supplied by milk.	Drachms of sugar in day required to complete calories.	Fat intake in Grams.
1.	370.	20.	340.	2.0	18.0.
2.	430.	22.	374.	4.0	19.8
3.	470.	24.	408.	4.0	21.6
4.	510.	28.	476.	2.0	25.2
5.	550.	30.	510.	2.5	27.0
6.	570.	30.	510.	4.0	27.0
7.	590.	32.	544.	3.0	28.8
8.	610.	33.	561.	3.5.	29.7.
9.	620.	34.	578.	3.0.	30.6.
10.	630.	35.	595.	2.5	31.5
11.	650.	35.	595.	3.5.	31.5
12.	670.	35.	595.	4.5.	31.5.

GRAPH TO SHEW AVERAGE NORMAL FAT INTAKE.



The fat sufficient diet to 10 months or 1 year, consisted of undiluted cows' milk, and after that a general diet containing milk, soup, gravy and usually butter was accepted as sufficient, since it is difficult both to lay down a definite normal standard of fat intake after a year and to estimate the actual intake. *The children were fed according to age, i.e. according to expected weight and not actual weight.*

Breast fed children. The following particulars were ascertained - the mother's health during pregnancy and lactation, the mother's diet during pregnancy and lactation, if the father were in steady employment, and if not, did the mother receive a free issue of food from the Corporation. If the mother's health and diet had been and was good, and the supply of breast milk ample, then the milk was accepted as fat sufficient. Because of the difficulties and possible inaccuracies besetting the analysis of breast milk this was not done as a routine, but in 3 cases classed as fat sufficient the respective analysis were 3%, 2.6% and 2.5%. In these cases an effort was made to obtain the whole of the secretion for 24 hours from one breast, and a sample was taken from this.

Whilst thus assured that the amount of fat presented to the child was sufficient, a natural criticism would be that it is not proved that this food is absorbed. But (1) There was an absence of diarrhoea and vomiting, the average weight chart shows a steady and normal rise and the children appeared to be thriving well. (2) It has been shown by Hutchison (6) that there is no deficiency of fat assimilation in rickets.

TABLE TO SHEW THE INCIDENCE AND SEVERITY OF RICKETS ON FAT SUFFICIENT DIETS.

Season.	Number of Cases.	Nature of Feeding.	Number developing Rickets.	Percentage developing Rickets.	Percentage developing moderately severe or severe Rickets.
Winter.	23. 18.	Artificial. Breast.	21. 13.	91%. 72%.	69%. 44%.
Summer.	8. 6.	Artificial. Breast.	1. 0.	12%. 0%.	} 0%.

It will be seen from the above table that of the children observed during the winter months over 90% of those on a sufficient artificial diet developed rickets, and of the breast fed babies where

RICKETS ON A FAT SUFFICIENT DIET UNDER OBSERVATION



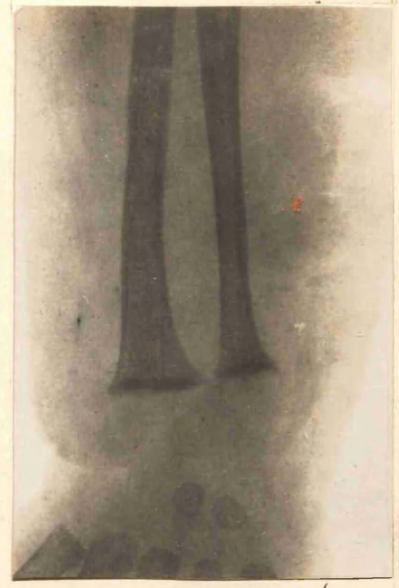
ALEX GRAY $9\frac{1}{2}$



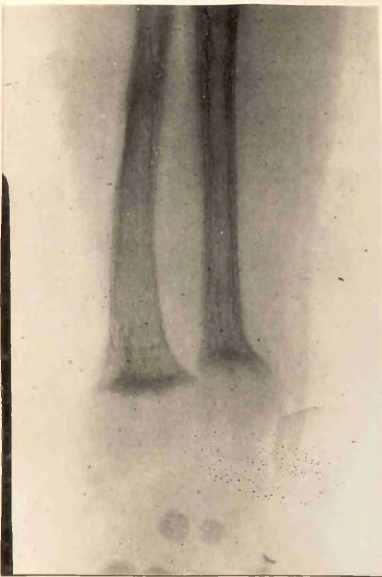
JAMES MURRAY $9\frac{1}{2}$



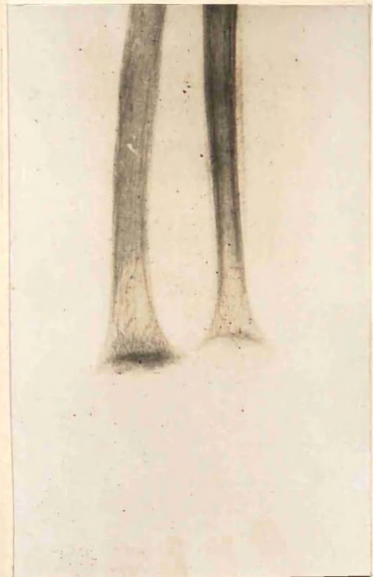
ARCHIBALD HOLMES $10\frac{1}{2}$



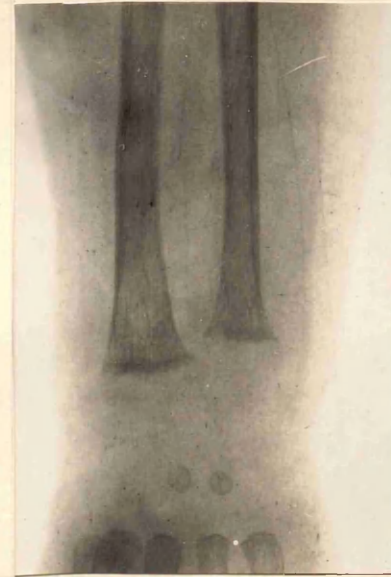
JAMES COCHRANE $1\frac{1}{2}$



JOHN MELNRAITH $1\frac{3}{4}$



ANDREW NAYLOR $1\frac{6}{12}$



HENRY DICK $1\frac{3}{4}$



JANE CONNELLY $1\frac{6}{12}$

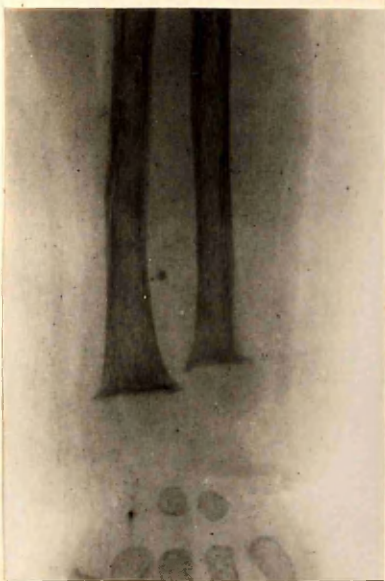


JOHN ROBERTSON $1\frac{3}{4}$

RICKETS DEVELOPING IN CHILDREN UNDER OBSERVATION

ON A FAT SUFFICIENT DIET.

4.



MARY HAY $1\frac{3}{12}$.



ANNIE CHISHOLM $1\frac{1}{12}$



DAVID WARK $1\frac{4}{12}$



AGNES HARLEY $1\frac{3}{12}$



CHARLES McQUIGAN $1\frac{1}{12}$



JOHN HILL. $1\frac{4}{12}$.



JOHN HAMILTON. $\frac{10}{12}$



PATRICK CROSSAN $1\frac{4}{12}$



PHYLLIS McLEAN $\frac{6}{12}$



JAMES MCKENZIE $2\frac{5}{12}$



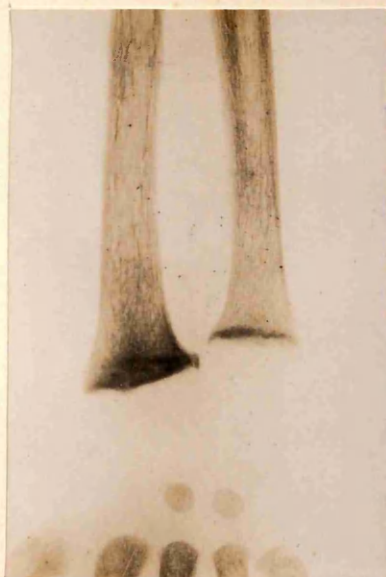
JAMES COYLE $1\frac{4}{12}$



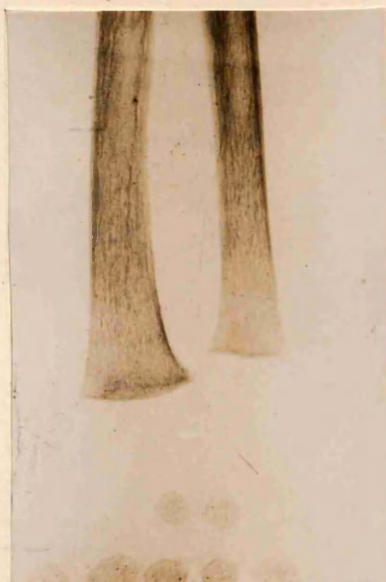
ALFRED QUINN $1\frac{6}{12}$

RICKETS HEALING DURING THE SUMMER AND RECURRING IN
THE FOLLOWING SPRING, WITHOUT ANY SIGN OR SYMPTOM.

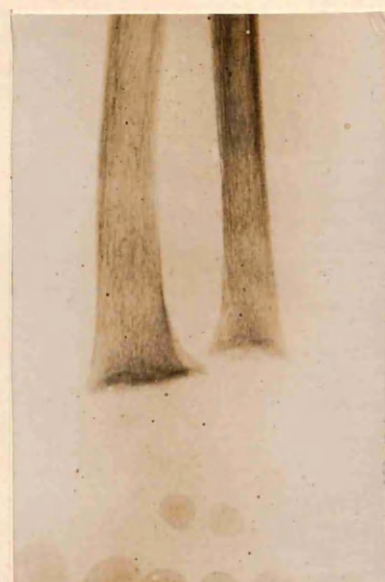
JM Kenzie
 $\frac{8}{12}$ yrs.



JUNE 1921



OCTOBER 1921

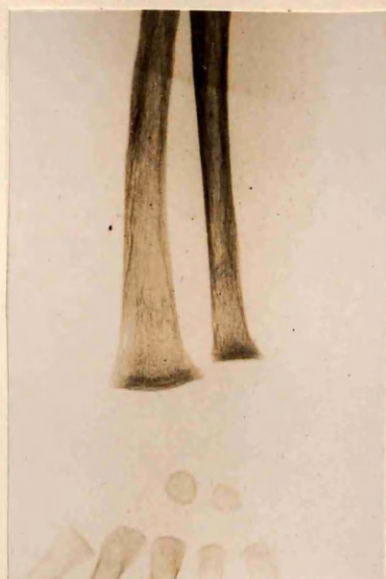


MARCH 1922.

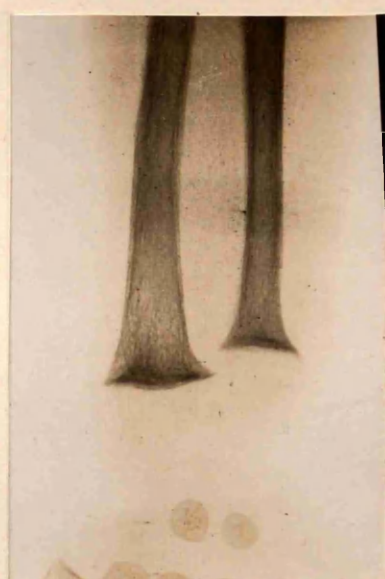
T. White
 $\frac{7}{12}$ yrs



MAY 1921

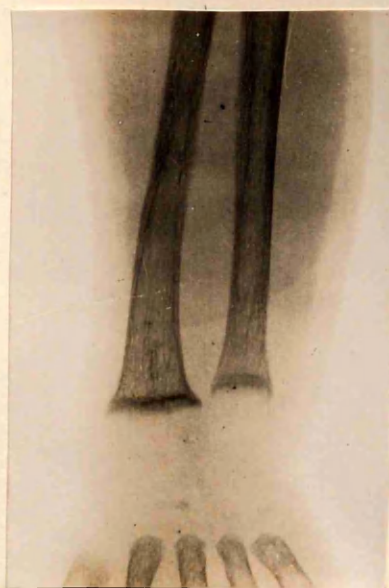


JULY 1921

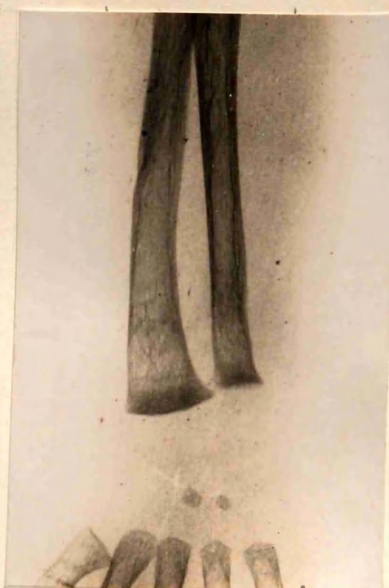


APRIL 1922

A. Quinn
 $\frac{8}{12}$ yrs



JULY 1921



SEPTEMBER 1921.



MARCH 1922.

the fat appeared to be sufficient, over 70% developed the disease. In most of these the fat intake, in grams per kilo. of body weight, was considerably higher than the normal average.

Moreover, as will be seen from the accompanying radiographs, the disease was in many cases severe. In the summer months, on the other hand, only 1 child out of 14 developed rickets, and this was after a prolonged illness in hospital.

A summary of the diets of the artificially fed children developing rickets follows, and also a detailed monthly table and a graphical record of the fat intake.

This experiment has differed from that carried out recently by Miss Chick (5) in that to an ordinary fat sufficient diet she added cod liver oil. It is possible that the difference in results is due to some constituent of cod liver oil other than the fat soluble A vitamin. It may be said that the milk supplied to these children was not tested for the fat soluble vitamin or growth factor. But the evidence of the presence of the vitamin was given by the normal growth of these children. The testing for vitamin content of the milk supplied to children in the city would be a very big task. If the milk fat is present in sufficient amounts it seems fair to assume that the attached vitamin is also present. The question of the possible variation of the vitamin content of cow's milk at different seasons of the year is discussed more fully later on in this paper, but in any case any such variation would not explain the high incidence of rickets in breast fed babies. The mothers of these children were on a good general diet containing animal fat, and were not, therefore, dependent on their consumption of cows milk for a supply of vitamin.

Conclusions.

1. Cases of severe rickets occurred in children under observation on a diet whether natural or artificial which contained the normal sufficiency of fat, and therefore, apparently of the fat soluble A vitamin. It follows, therefore, that the deficiency of this vitamin cannot be an indispensable factor in the production of the disease.
2. The diets were well balanced and did not contain an excess of

RICKETS DEVELOPING ON THE BREAST.



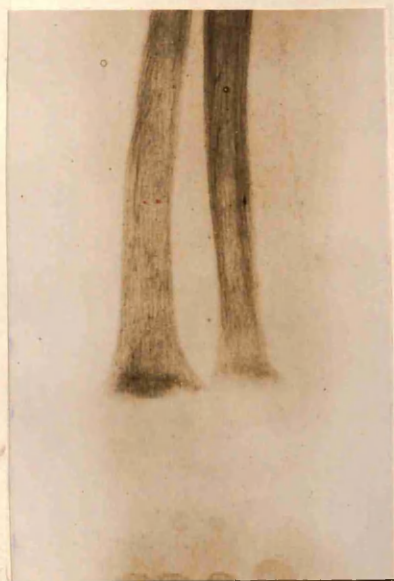
JOHN LESLIE $\frac{6}{12}$



JOHN MCGREGOR $\frac{7}{12}$



KEVIN FARRELL $\frac{6}{12}$



WILLIAM DOUGLAS $\frac{9}{12}$



EDWARD WALLACE $\frac{4}{12}$



MARGARET PATERSON $\frac{10}{12}$



MATILDA M'EWAN $\frac{1}{12}$



MARY CURRIE $\frac{1}{12}$

2. (Contd.)

carbohydrate. Improper diet or excess of carbohydrate do not therefore appear to be necessary etiological factors.

3. In children in whom the onset and progress of rickets was observed symptoms and signs of not thriving and of gastrointestinal disturbances were rare.

4. The seasonal incidence of the disease was marked, practically every case developing in the first quarter of the year.

5. In a few cases ^hwere rickets had developed during the first winter of life and had healed during the summer there was a relapse during the second winter, as shown by radiographs, but without any further sign or symptom.

II. THE OBSERVATION OF CHILDREN FOR LONG PERIODS ON FAT DEFICIENT DIET.

....

This observation was conducted in exactly the same way as in the one just described, but instead of the ordinary fat sufficient diet, a diet definitely deficient in fat was given, by prescribing mixtures of 1%, 1.5%, and 2% fat, the 1.5% mixture, Von Pirquet's diet, being the one usually given. To make up the required number of calories large amounts of carbohydrate had to be given. The cases were divided into winter and summer groups, and the following table shows the results.

TABLE TO SHEW THE INCIDENCE AND SEVERITY OF RICKETS ON FAT DEFICIENT DIETS.

Season.	Number of Cases.	Nature of Feeding.	Number developing Rickets.	Percentage developing Rickets.	Percentage developing moderately severe or severe Rickets.	Number of doubtful cases.
Winter.	17. 4.	Artificial. Breast.	12. 3.	70% 75%	41% 33%	1.
Summer.	12.	Artificial.	1.	8%	0%	2.

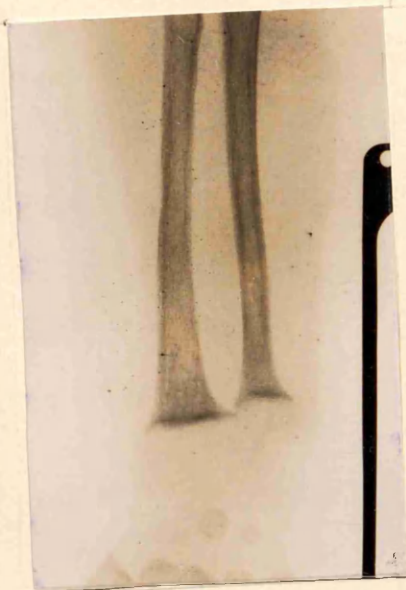
RICKETS DEVELOPING ON A FAT POOR DIET IN THE WINTER.



ELIZ. CONNELLY $\frac{7}{12}$



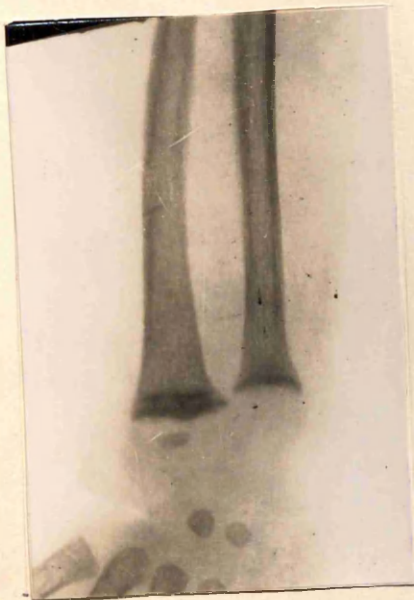
MATTHEW MAXWELL $\frac{1}{12}$



JAMES DONNACHIE $\frac{1}{12}$



ELIZ. DAVIES $\frac{6\frac{1}{2}}{12}$



THOS WYLLIE $\frac{11}{12}$



JESSIE MUIR $\frac{1}{12}$



JAMES DOUGLAS $\frac{6}{12}$



DAN WEDGEWOOD $\frac{2}{12}$

Winter cases:- The percentage developing rickets is slightly lower than that in the children observed on a fat sufficient diet, as is also the percentage of severe or moderately severe cases. This is all the more striking when one considers that the deficiency of fat in the diets, as shown in the tables in the appendix, is considerably greater than what is likely to occur in the usual diet given by the mother when not under medical guidance. Moreover the large amounts of carbohydrate given and the consequent rapid growth should, according to the deficiency theory, have made these diets pre-eminently ricket-producing.

In the children remaining free from rickets, the diet was continued for from 3 to 4 months.

In the one doubtful case, the ulna was not quite normal when the diet was commenced (the diet having been fat sufficient up to that date). After 4 months on poor fat diet there was a slight increase in the widening of the lower end of the ulna but not a definitely rachitic condition. Further observation was prevented by the child's death from bronchopneumonia.

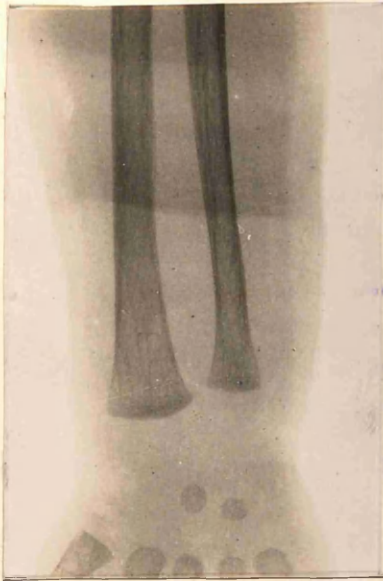
Summer Cases:- It will be seen that only 1 child out of 13 developed rickets, and this was a slight case in a child who had been kept in hospital for metabolism experiments. It is of interest that a recrudescence of the rachitic condition occurred in the child the following spring on a fat rich diet.

Practically all the diets were 1.5% fat. The amount of carbohydrate was very large, and the periods on the diet were long, ranging from 3 to 7 months and averaging $5\frac{1}{2}$ months. One child received phosphorus whilst on the diet, but since the others who had no phosphorus also remained free from rickets, this does not affect the issue. 3 cases have been classed as doubtful because the radiograph, although probably negative for rickets, is not just absolutely normal. Neither of these children showed any clinical sign, each having 6 teeth and a well closed anterior fontanelle at 9 or 10 months and they were standing strongly with support.

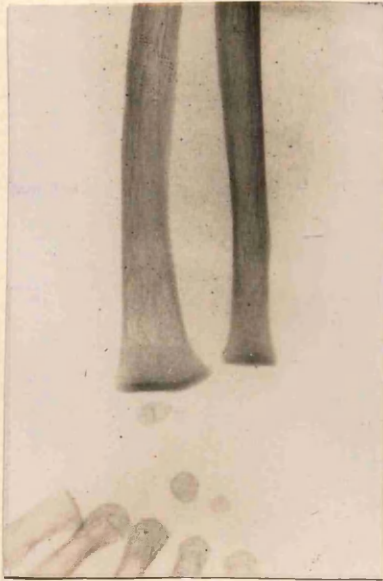
Complete diet details and graphs of fat intake will be found in appendices C and D.

FAT DEFICIENT DIET.

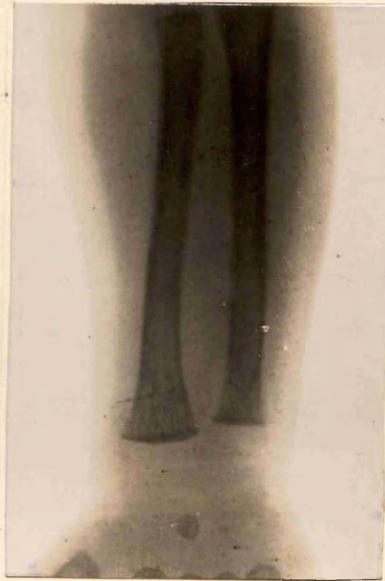
RADIOGRAPHS OF CHILDREN OBSERVED ON FAT DEFICIENT DIETS DURING
THE WINTER MONTHS AND REMAINING FREE FROM RICKETS.



Mary Angus. $\frac{15}{12}$.



Alex Kiddell $\frac{16}{12}$.

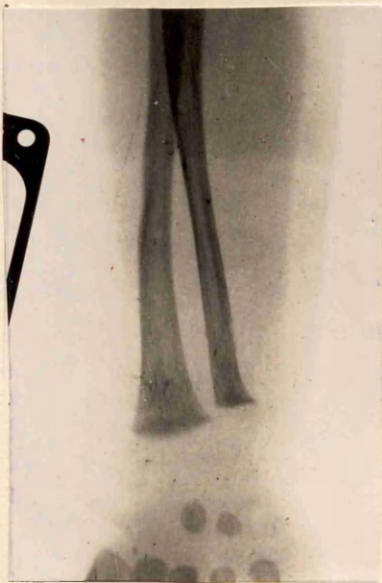


Jean Syme $\frac{6}{12}$.

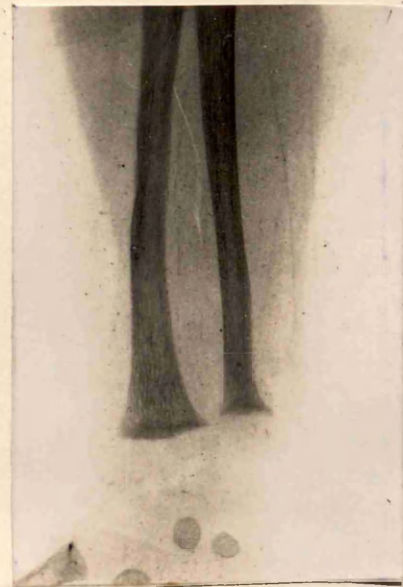


Thos Willis $\frac{15}{12}$.

RADIOGRAPH CLASSED AS DOUBTFUL. OF CHILD ON
FAT DEFICIENT DIET DURING WINTER.



Margaret Hollingsworth $\frac{4}{12}$
[RADIOGRAPH TAKEN WHEN
DEFICIENT DIET COMMENCED]



Margaret Hollingsworth $\frac{8}{12}$.
[RADIOGRAPH TAKEN AT END
OF DEFICIENT DIET PERIOD.]

SOME DETAILS OF CHILDREN REMAINING FREE FROM
RICKETS ON A FAT POOR DIET.

A. Winter.

Name.	Age when diet commenced.	Duration of feeding on fat poor diet.	Negative Radiographs
1. Mary Angus.	8 months.	3 months.	At 9th, 10th, 11th and 14th months.
2. Alex. Liddell.	7 "	4 "	At 7th, 8th, 9th, 10th, 11th, and 13th months.
3. Jean Syme.	2 "	4 "	At 6th month.
4. Thos. Willis.	8 "	3 "	At 12th and 15th months.

B. Summer.

1. Francis Muir.	4 months.	3 months.	At 7th, 8th and 13th months.
2. Edward Farmer.	4 "	6 "	At 4th, 9th and 10th months.
3. Marg. McMonigal.	9 "	3 "	At 10th, 13th, 14th months.
4. Thelma Winning.	3 "	7 "	At 3rd, 4th, 5th, 8th and 10th months.
5. Chas. Lockhart.	3 "	7 "	At 5th, 6th, 8th and 10th months
6. Robert Williamson.	2 "	5 "	At 3rd, 5th, and 7th months
7. Sarah Doyle.	2 "	7 "	At 2nd, 4th, 6th, 7th, and 9th months.
8. Robt. McPake.	2 "	7 "	At 2nd, 7th, and 9th months
9. Jas. Paice.	4 "	4 "	At 3rd, 7th and 8th months.

DOUBTFUL CASES.

A. Winter.

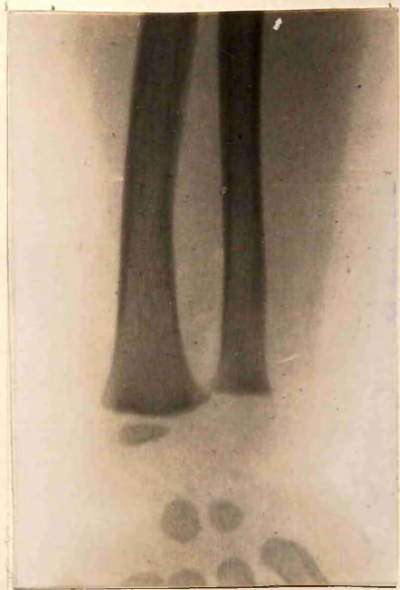
1. Mary Hollingworth.	4 months.	4 months.	Radiograph was suspicious for rickets when diet commenced. A very slight further widening of the lower end of elna was apparent at end of diet period.
-----------------------	-----------	-----------	--

B. Summer.

1. Mathew Shannon,	2 months.	7 months.	At end of diet period, radiograph showed slight widening of lower end of ulna. (over)
--------------------	-----------	-----------	---

FAT DEFICIENT DIETS.

RADIOGRAPHS OF CHILDREN OBSERVED ON FAT DEFICIENT DIETS
DURING THE SUMMER MONTHS AND REMAINING FREE FROM RICKETS.



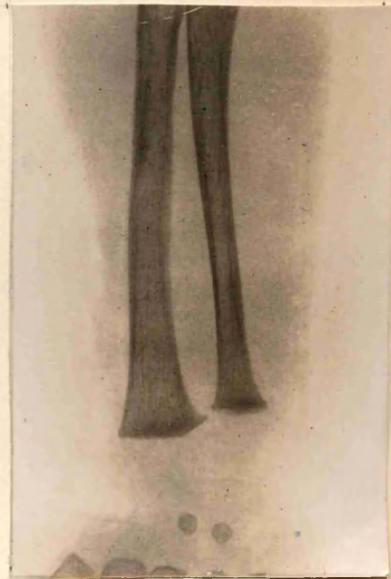
Frances Muir. $1\frac{6}{12}$.



Edward Farmer. $\frac{10}{12}$.



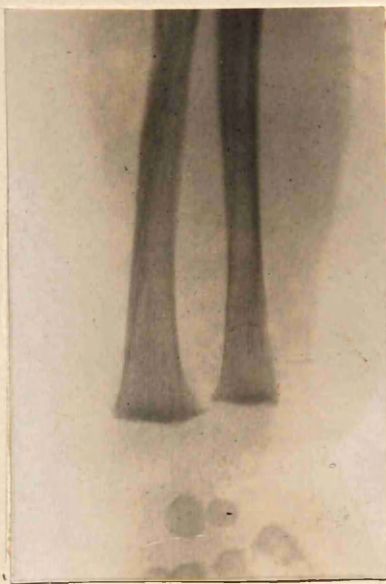
Margaret McMonigal. $1\frac{3}{12}$.



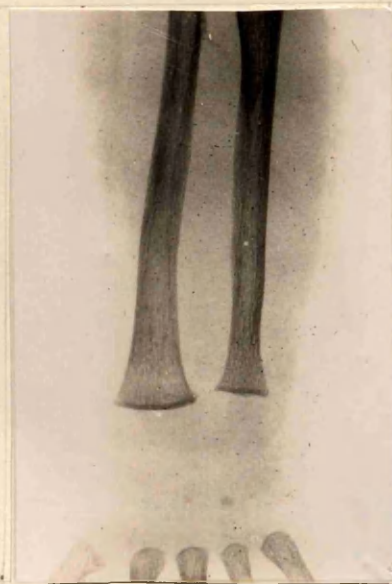
Thelma Winning. $\frac{10}{12}$.



Charles Lockhart. $\frac{10}{12}$.



Robert Williamson. $\frac{4}{12}$.



Sarah Doyle. $\frac{9}{12}$.



Robert McPake. $\frac{10}{12}$.



James Paice. $\frac{8}{12}$.

DOUBTFUL CASES (Contd.)

B. Summer.

Name.	Age when diet commenced.	Duration of feeding on fat poor diet.	Negative Radiographs.
1. Mathew Shannon.	3 months.	7 months.	At end of diet period radiograph showed slight widening of lower end of ulna. No clinical evidence of rickets.
2. John Sinters.	5 "	5 "	Query very slight widening of ulnar epiphysis. No clinical evidence of rickets.

FAT DEFICIENT DIET.

Developed
RADIOGRAPH OF CASE IN WHICH RICKETS DEVELOPED DURING THE SUMMER
ON A FAT DEFICIENT DIET.



ALFRED QUINN $\frac{10}{12}$

RADIOGRAPHS CLASSED AS DOUBTFUL OF CHILDREN ON
FAT DEFICIENT DIET DURING THE SUMMER.



MATTHEW SHANNON $\frac{9}{12}$



JOHN SUNTER $\frac{10}{12}$

Conclusions:-

1. The percentage of children developing rickets under observation both in summer and winter was lower in those on a fat poor diet than on a fat rich diet.
2. In the summer months 76% of children fed for long periods on a diet very deficient in fat remained free from any suspicion of rickets. Lack of fat, and so presumably of fat soluble A in the diet cannot therefore be a necessary factor in the production of rickets.
3. These diets contained very large amounts of carbohydrate. Excess of carbohydrate, therefore, does not appear to predispose to rickets.
4. The seasonal effect is again strikingly shown in the low summer incidence of the disease.

III. THE INVESTIGATION OF DIET HISTORIES FROM BIRTH
OF DEFINITELY RACHITIC CHILDREN, WITH SPECIAL
REFERENCE TO ITS PROBABLE FAT CONTENT.

-----*---*-----

In this part of the investigation the particulars of the previous diet had to be elicited from the mother, and much care had to be exercised to get this information as accurate as possible, many cases having to be rejected on this account.

The standard of fat sufficiency adopted was that used in the two previous investigations. Information as to whether the father had been in steady employment, if he had had unemployment allowance, and if a free issue of Corporation milk had been obtained was also taken into consideration. In breast fed children, the same particulars were elicited as described previously. Since some of the children had been on patent foods during the first year of life, the average intake of fat from these at the various months had to be ascertained. This was done by weighing in grams the amount advised by the makers

to be used in the day and then estimating the fat in this by using the table of analysis by Dr. E. Bronson given in Thomson's "Diseases of Children". The estimations for the more commonly used foods are shown in the appendix. A case showing any deficiency for more than 6 weeks at any period is classed as deficient. Since the protective influence of breast milk against rickets is often spoken of, particular attention has been paid to the duration of breast feeding in these rachitic children.

The results are shown in the following tables:-

TABLE SHOWING PROPORTION OF RACHITIC CHILDREN RECEIVING SUITABLE BREAST MILK FOR A PERIOD OF 3 OR MORE MONTHS, FOLLOWED BY ARTIFICIAL SUFFICIENT OR DEFICIENT DIET.

Number of Cases.	Duration of breast feeding.	Followed by fat sufficient diet.	Followed by fat deficient diet.
13	3 months	8	5
2	4 "	0	2
2	5 "	1	1
3	6 "	2	1
1	7 "	0	1
4	8 "	3	1
7	9 "	6	1
4	10 "	4	0
1	11 "	1	0
17	12 "	16	1
12	Over 12 "	9	3
<u>66</u>		<u>50</u>	<u>16.</u>
		i.e. 76%	i.e. 24%.

TABLE SHOWING PROPORTION OF RACHITIC CHILDREN RECEIVING SUITABLE BREAST MILK FOR LESS THAN 3 MONTHS, FOLLOWED BY ARTIFICIAL SUFFICIENT OR DEFICIENT DIET.

Number of Cases.	Followed by fat sufficient diet.	Followed by fat deficient diet.
17	7	10

TABLE SHOWING PROPORTION OF RACHITIC CHILDREN FED FROM BIRTH ON ARTIFICIAL FAT SUFFICIENT OR FAT DEFICIENT DIET.

Number of Cases.	Fat sufficient diet.	Fat deficient diet.
29	11	18.

N.B. In the above tables if the breast milk is considered to have been deficient, the case is put in the fat deficient group.

So that of 112 cases investigated, the diet appeared to have been sufficient in 68, i.e. 30%.

The degree of deficiency of fat intake in the deficient group was estimated, 3 degrees of deficiency being adopted:-

1. Slight = Less than 20% ; or 40% for less than 3 months.
2. Moderate = 20% - 40% for over 3 months.
3. Marked = Over 40%.

The following table gives the results:-

Total number of rachitic children reared on fat deficient diet.	Degree of fat deficiency in diet of rachitic children.					
	Slight (20%)		Moderate (20-40%)		Marked (over 40%)	
	Number of cases.	%	Number of cases.	%	Number of cases.	%
44	11	25%	13	30%	20	45%

Correlation of severity of rickets with the diet.

Of 68 children developing rickets on a fat sufficient diet, 38 were severe cases, i.e. 48%.

Of 44 children developing rickets on a fat deficient diet, 20 were severe cases, i.e. 45%.

Summary of Results:-

1. In 30% of the cases investigated, the diet appeared to have been sufficient. This is all the more striking in view of the high standard of normal fat intake adopted.
2. 30% of these rachitic children had been breast fed to 10 months or more, and in 88% of these the breast had been followed by an apparently sufficient diet.
3. The percentage of severe cases was slightly higher in the fat sufficient than in the fat deficient group.

Conclusions. The disease appeared to have developed as readily in children on fat sufficient diets as on fat poor diets. In fact, rickets was found with almost any diet, whether the indiscriminate one given by the careless mother, or the apparently well balanced one of the careful mother. Many children had had milk and butter daily in continuance of

LATE RICKETS

SUSAN
BELL
5 $\frac{9}{12}$ yrs.



28.I. 22.



28.I. 22.



28.VIII. 22.

AGNES
HAMILTON
9 $\frac{1}{12}$ yrs.



28.IV. 22



28.IV. 22

a diet fat sufficient to the time of weaning. One child showing definite rickets at 1 year had been getting 2 pints of milk daily direct from a farm in the country. Several had been given cod liver oil emulsion at various periods.

From a consideration of the above data it will be seen that in this part of the investigation the evidence is decidedly against the idea of the fat soluble A vitamin being related to the etiology of rickets.

Late Rickets.

During the course of the investigation I met with two cases which I considered to be late rickets. The following is a synopsis of the histories and findings, and radiographs are shown:-

1. Susan Bell, aet. $5.\overset{9}{12}$ years was brought with the complaint of pains in the legs and stiffness in walking of 9 months duration.

Feeding. Breast to 1 year, then good general diet with almost 2 pints milk, butter and soup daily. At 2 years meat was added. Had continued on a good diet with milk, butter and meat, and there had been no change in diet preceding the present illness.

Development. 1st. tooth cut at 10 months. Walked alone at $1.\overset{3}{12}$, and continued to run about until 5 years old.

Clinically there was tenderness of the legs, epiphysial enlargement at wrists and ankles, slight curving of tibiae and a rosary.

X ray of wrist ossification well advanced in carpus. Lower end of radius and more especially of ulna irregular, with areas suggestive of osteoporosis.

Wassermann Reaction was negative.

This child was put on to massage, the diet remaining unaltered, and the improvement was rapid. Within a month the pains had gone, and she was running about again. Radiographs showed improvement.

2. Agnes Hamilton, aet. $9.\overset{7}{12}$ years, was admitted to hospital for tetany and pyelitis. She had been quite well until 6 months

previously when she began to complain of pain and weakness in her legs. 3 months later tetany developed.

Feeding. Breast to 1.³/₁₂. Then general diet with $\frac{1}{2}$ pint milk, soup, gravy and margarine. Diet had not altered before illness commenced.

Development. 1st tooth at 6 months. Walked at 1.⁶/₁₂ years.

Clinically. Marked epiphysial enlargement, curving of tibiae and fibulae, rosary, F.P.

X Ray ossification of carpus normal. Definite rickets.

Death occurred from pyonephrosis a few days after admission.

III.a. THE OBSERVATION, IN THE SPRING MONTHS, OF APPARENTLY
NORMAL BABIES OF LESS THAN 1 YEAR OF AGE.

For this purpose 55 babies were observed. These were babies brought to the Dispensary for circumcision or for some other ailment such as a mild attack of diarrhoea. They were all radiographed in the spring months and some of them were observed during the ensuing summer months, being seen regularly and clinical notes made, and were radiographed again at the end of the summer. No attempt was made to alter the diet or hygiene, but any dietetic changes made by the mother were recorded. From this part of the investigation it was hoped to:-

1. To get some idea of the incidence of rickets in poor class children less than 1 year old.
2. Correlate the incidence of rickets with exact details of diet.
3. Note the progress of rickets during the summer months.

Results:-

1. Incidence of rickets. Of 55 babies observed, 51% showed definite radiographic evidence of rickets and 5% were doubtful. It is of interest that in many instances the clinical signs were slight and, in practically every case, there was no symptom. In probably 50% of the cases the ordinary routine examination would have passed the child as being normal, and even after seeing the radiograph, I could not be sure in one or two cases of any definite clinical sign.

One or two of these babies had been accepted for experiments on the

RADIOGRAPHS TAKEN IN THE SPRING MONTHS
OF APPARENTLY NORMAL BABIES.



MARY KING. $\frac{9}{12}$



VIOLET O'ROURKE $\frac{11}{12}$



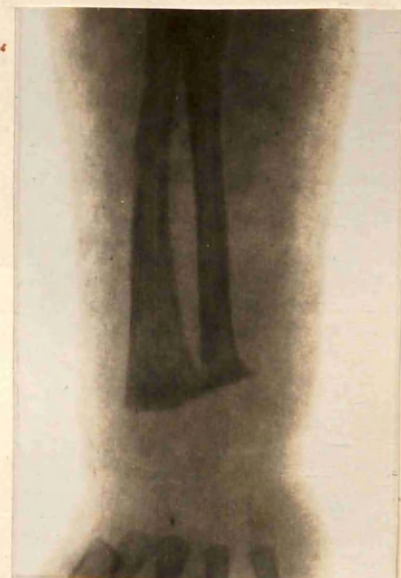
JOHN COLETTA $\frac{6}{12}$



JOHN MCGREGOR. $\frac{5}{12}$



JACK ADAMS $\frac{8}{12}$



JAMES NELSON. $\frac{3\frac{1}{2}}{12}$



JOAN KERR. $\frac{9}{12}$



JANE NEWLANDS. $\frac{10}{12}$



LAURENCE LAWSON $\frac{9}{12}$

calcium and phosphorus content of the blood in normal children when the routine radiograph showed evidence of rickets. Here, again, a degree of epiphysial enlargement at the wrist I found to be the most constant early sign. The age incidence is of interest in that 35.7% of the cases rickets was present at or before 6 months and was observed as early as 3½ months.

Schmorl (7) in the examination of 386 children dying between the ages of 2 months and 4 years, found signs of rickets in 90%, and of 33 children aged 2-3 months, 60% were rachitic. From these figures and from those obtained in this investigation, it is obvious that the majority of the babies in the poorer classes show evidence of rickets at some period, and that in many cases the disease is present before the child is 6 months old. If the very poorest class of city dweller were taken, the incidence would probably be much higher.

2. Correlation of the incidence of rickets with the diet:-

Table to show respective numbers on fat sufficient and fat deficient diets in children showing evidence of rickets.

Fat in diet.	Nature of Diet.	Number of children.	Percentage
Sufficient.	Entirely breast fed.	4. }	78.5%.
	Breast followed by cow's milk.	10. }	
	Entirely on cow's milk.	5. }	
	Full cream Glaxo and cow's milk.	2. }	
	Full cream Glaxo entirely.	1. }	
Deficient.	Entirely breast fed.	2. }	21.5%.
	Cow's milk in insufficient quantities.	2. }	
	Nestle's milk.	2. }	

It will be seen from the above table and from the detailed diet sheets which follow that rickets occurred on a large variety of diets, and in 78.5% of the cases, the diet should have contained an ample supply of the fat soluble A vitamin.

3. Noting the progress of rickets during the summer months.

This is dealt with in detail in the next section of the investigation under the heading of "Children remaining untreated."

It may be noted here that of 16 rachitic babies observed during

the summer months, radiographic healing occurred in all but one, and that at the end of the summer the clinical signs were absent or very slight in more than half the cases.

Conclusions.

1. 1. Of a series of apparently normal babies under 1 year old, 51% showed radiographic evidence of rickets.
2. Clinical signs were very slight and were not present in all the cases. Symptoms were rare.
3. In 35.7% of the cases rickets was present before 6 months.
2. There was no apparent correlation between the incidence of rickets and the nature of the diet. Rickets occurred on a large variety of diets and in 78.5% of the cases there appeared to be fat sufficient.
3. In 94% of the cases, radiographic and clinical improvement occurred during the summer months, even when the diet remained unaltered.

DIET OF BABIES SHOWING EVIDENCE OF RICKETS.

A. Fat sufficient.

Name.	Age.	Diet.	Degree of Rickets.
1. John Adams.	8 months.	Breast to $\frac{3}{12}$ when W.M. 2 to 3 pints.	Moderately severe.
2. Henry Bryan.	6 "	W.M. 16 to 20 ounces. (Weight = 5.2 kilos.)	" "
3. Joan Kerr.	9 "	Breast to $\frac{3}{12}$, when Sister Laura's food with W.M.	" "
4. Jane Newlands.	10 "	Breast to $\frac{2}{12}$, Glaxo (F.C) and W.M. 10 ounces. Cod Liver Oil 3 drachms daily, from 9/12.	" "
5. Francis Taylor.	6 "	Breast to $\frac{2}{12}$, then Sister Laura's food with W.M.	" "
6. Edward Wallace.	7 "	Breast only (2.4% fat)	Severe.
7. Joseph Agnew.	13 "	Glaxo (F.C.) to $\frac{6}{12}$, then W.M. 2 to 3 pints.	Definite.
8. James Brady.	4 $\frac{1}{2}$ "	W.M. 2 pints.	"
9. John Coletta.	6 "	Glaxo to $\frac{3}{12}$, then W.M. 2 pints.	"
10. Mary King.	9 "	Breast only.	"
11. Archibald McCrae.	7 "	Breast to $\frac{2}{12}$. Sister Laura's food with W.M.	"
12. Hugh McGuire.	8 "	W.M. 1 pint. By $\frac{6}{12}$, 1 $\frac{1}{2}$ pints and then 2 pints.	"
13. Matilda McEwan.	12 "	Breast only (2.9% fat)	"
14. John McKinney.	5 "	Glaxo (F.C.)	"
15. James Wilson.	3 $\frac{1}{2}$ "	Breast to 14 days. Then W.M. 1 pint (Weight = 4 kilos.)	"
16. Margaret Patoson.	10 "	Breast to 9 months. Then W.M. 2 pints.	"
17. George Syme.	10 "	Breast to $\frac{2}{12}$. Sister Laura's food with W.M. to $\frac{3}{12}$ then 2 pints W.M.	"
18. David Wallace.	10 "	Breast to $\frac{2}{12}$. Sister Laura's food with W.M. to $\frac{3}{12}$ Then 2 pints W.M.	"
19. Laurance Lawson.	9 "	W.M. 2 pints.	"
20. William Lang.	6 "	Breast to 6 weeks. Then Sister Laura's food with W.M.	Slight.

(over)

DIET OF BABIES SHOWING EVIDENCE OF RICKETS (Contd.)

A. Fat sufficient (Contd.)

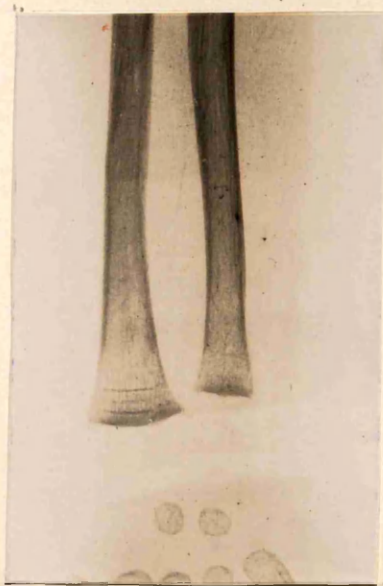
Name.	Age.	Diet.	Degree of Rickets.
21. James Milligan.	7 months.	Breast to 6 weeks. Then W.M. 2 pints.	Slight.
22. James Simpson.	4½ "	W.M. 1½ pints.	"

B. Fat deficient.

Name.	Age,	Diet.	Degree of rickets.
1. John McGregor.	3½ months.	Breast (1.1% fat)	Moderately severe.
2. Charles Boyd.	11 "	W.M. about 1 pint.	Definite.
3. Margaret Dailly.	8 "	Breast (food scarce) supplemented from 5½ with W.M. 6 ounces. 12	"
4. Edward Murray.	4 "	W.M. 1 pint to 2 12, then Nestle's Milk.	"
5. Violet O'Rowke.	11 "	Breast to 3 12, then W.M. up to 1½ pints.	"
6. Jessie Muir.	11 "	Allenbury No.1 to 4 12. Nestle's Milk to present.	Slight.

Note:- In all cases Sister Laura's Food given with W.M. according to directions (see table of analysis of Patent Foods).

TO SHOW THE 'LINES' INDICATIVE OF RICKETS HAVING
BEEN PRESENT.



MATTHEW
MURRAY.



W. T. TRAYNOR.



RADIOGRAPH AT END OF HEALING TO SHOW
HOW LINE IS FORMED.



Improvement in the rachitic condition was gauged by both radiographic and clinical evidence and it is necessary here to state briefly the radiographic and clinical signs which I considered to be evidence of healing.

1. Radiographic signs of healing. The study of a large number of radiographs taken during this investigation shows that in the process of healing, the first deposition of lime salts is in the cartilage on the epiphysial side of the transitional zone. Park and Howland (2) have recently described this, confirming Schmorl's histological findings. Finger-like processes extend down from the ragged end of the shaft through into the transitional zone, which gradually becomes more opaque as the calcium is deposited. The distal parts of these processes unite to form a line and this line demarcates the new end of the shaft. A thickening of the periosteum goes on simultaneously with these changes, and, should a fracture be present, the deposition of calcium around it is well marked. This mass of new bone in the transitional zone would appear to be, for a time, denser than the rest of the shaft and a clearly cut line is present at the level where healing commenced. This white line appears to persist for a long period afterwards, and gives indication, in an otherwise normal bone, of a previous rachitic condition. Gradually the excess of calcium is absorbed, the shaft becomes fairly uniform in density throughout its whole length, its structural detail becomes more apparent and the ends are narrowed and smoothed off into their normal sharply defined appearance. The ossific centres become more distinct, and fresh ones may appear. Reference to the radiographs shown will demonstrate these points.

2. Clinical signs of healing. Whilst the time taken for the child to walk unsupported was used as the main clinical test, notes were also kept of the eruption of teeth, decrease in size of the fontanelles, lessening of the epiphysial enlargements, and also of the child's health in general.

The strictly logical division of the scheme of treatment in testing the fat soluble A hypothesis should be (1) Effects of treatment on a fat sufficient diet. (2) Effects of treatment on a fat deficient diet. Since most of the children who were treated were on a mixed diet, it would

13

TREATMENT BY COD LIVER OIL IN SUMMER.

AGNES
RUSSELL
2yrs.



24. VI. 21



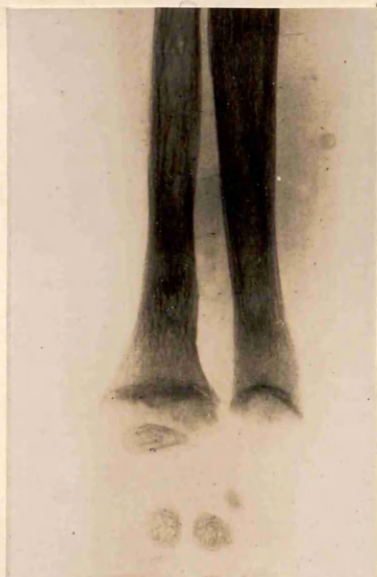
22. VII. 21



19. VIII. 21



30. IX. 21



12. XI. 21



6. IV. 22

The bones are not yet completely healed after over 9 months administration of oil. Was an inpatient in the country branch of the hospital until the end of October.

MARGARET
KINGDALE
1 1/2 yrs



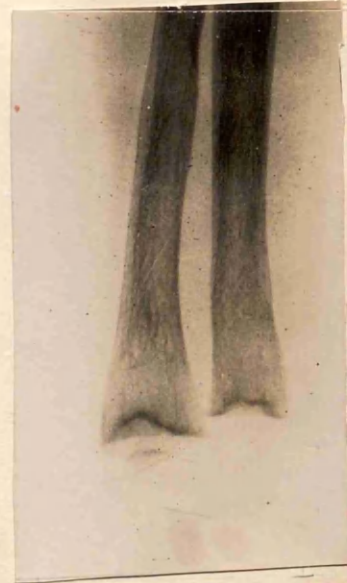
1. III. 22



6. IV. 22



8. V. 22



22. VI. 22

TO SHOW BONES NOT QUITE HEALED AFTER 9 MONTHS
CONTINUOUS ADMINISTRATION OF COD LIVER OIL.

ALEX. SHERRY 21yrs

[Out-patient]

Received cod liver
oil $\frac{1}{2}$ T.I.D for
6 months, and
then $\frac{1}{2}$ ss T.I.D



28.V.21



28.VI.21



27.VII.21



5.X.21



12.XI.21



22.II.22

SHOWING POOR RESPONSE TO COD LIVER OIL ADMINISTRATION.

AMELIA HART

[In-patient]

Received Cod oil emulsion
 $\frac{1}{2}$ T.I.D for 1 month,
then Dec Phosphat. $\frac{1}{2}$ T.I.D,
with $\frac{1}{2}$ cod oil T.I.D,
during second
month.



10.I.22



12.II.22



23.III.22

12

TREATMENT BY COD LIVER OIL IN WINTER.

All indoor patients.

RICHARD
M^{rs} GREGOR
 $\frac{6}{12}$ 45



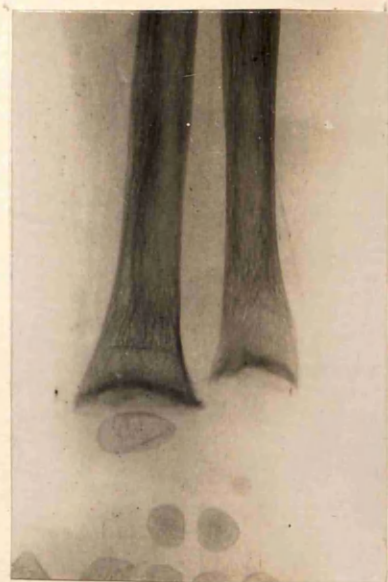
16. IX. 21



19. X. 21



28. XI



2. I. 22

AGNES MILLAR
 $\frac{10}{12}$



19. X. 21



19. XI. 21



6. I. 22

ANNIE LEITCH
 $\frac{10}{12}$



18. X. 21



17. XI. 21



8. II. 22

have been a matter of considerable difficulty to arrange a fat poor diet. 4 cases are described where this was possible. In most cases the previous diet was continued when treatment was commenced, but in one class large amounts of fat soluble A containing substance were given, in the form of cod liver oil and butter, whilst in the other class entirely different curative measures were adopted, and no addition was made to the fat soluble A intake. Massage, phosphorus and violet rays were used. Controls were kept under observation because of the well known tendency to spontaneous healing of rickets during the summer. It was endeavoured to keep the diet of these children unchanged, although other factors such as fresh air, exercise and general hygiene could not, of course, be accurately controlled.

In order that the details of treatment could be more strictly supervised 34 children were admitted to the Royal Hospital for Sick Children, Glasgow, and 11 of these were treated in the Country Branch of the Hospital. Every effort was made to have these in-door cases as comparable as possible in the severity of the disease. All indoor cases were on a general diet containing $1\frac{1}{2}$ pints milk, gravy, margarine, and 3 oz. meat. Those children on cod liver oil treatment had butter instead of margarine.

Treatment with Cod Liver Oil.

Norwegian cod liver oil was used, this being supplied either at the Hospital or at the Dispensary, and care was taken that the out-patients received the supply regularly.

Treatment was commenced with 3 drachms and increased to 1 ounce daily. The children treated in hospital were kept in their cots, so that, to a certain extent, their amount of exercise was limited.

Radiographic Results.

1. Definite improvement occurred in 93% of the indoor cases and in 83% of the outdoor cases, if the treatment extended to 2 months or more.
2. This occurred equally in summer or winter.
3. The average period necessary to produce normal bones in a severe case was about 5 months.

A COMPARISON OF RESULTS OF TREATMENT IN TWINS.

1. TREATED BY MASSAGE AND COD LIVER OIL.

(31 T.I.D)

Hensietta Lawson 2yrs.

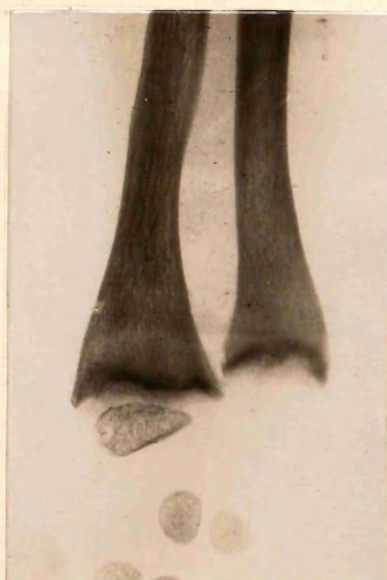
Both walked alone in 3 weeks.



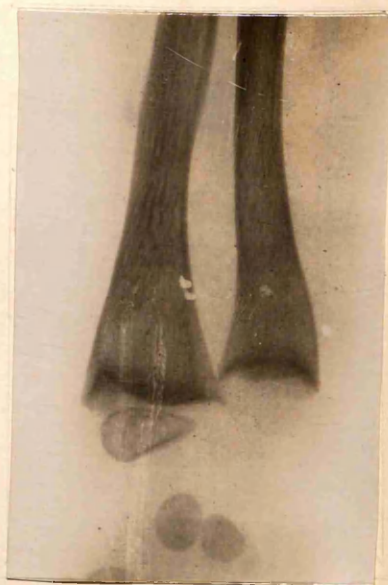
26.I.22.



22.II.22



16.V.22



18.VII.22

2. TREATED BY MASSAGE ALONE.

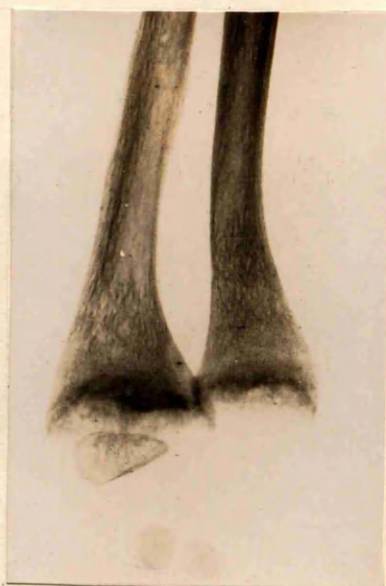
Jessie Lawson 2yrs



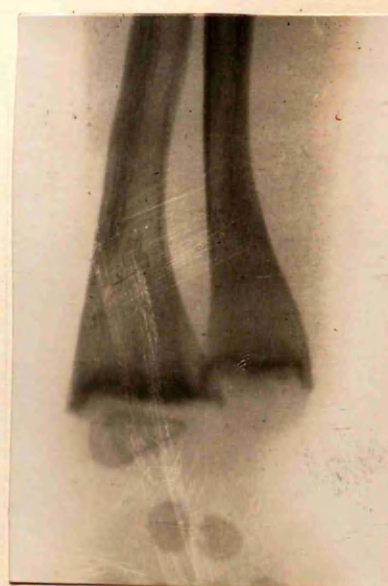
26.I.22



22.II.22



16.V.22



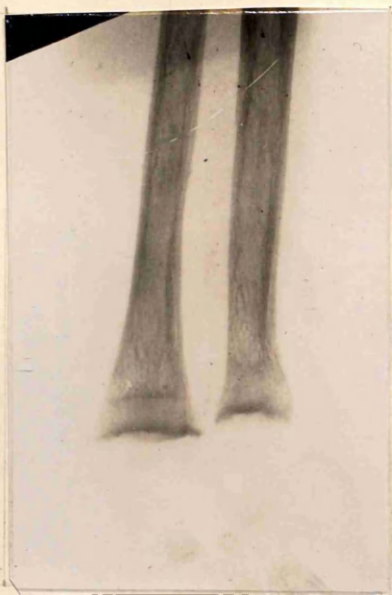
18.VII.22

19
HEALING BY MASSAGE IN SPRING AND EARLY SUMMER.

EDWARD McCRAE
2 $\frac{1}{2}$.
[IN-PATIENT]



1. II. 21



30. V. 21



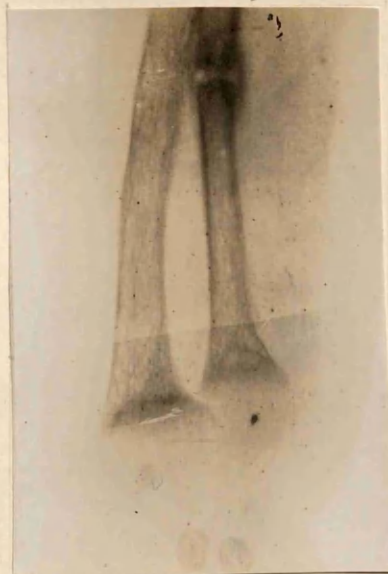
2. VIII. 21

TREATMENT BY MASSAGE IN SUMMER.

ELIZ
COLLINS
 $1\frac{11}{12}$
[Out
patient]



11.V.21



2.VI.21



30.VI.21



8.X.21

OLENDO
MARZAROLI
 $1\frac{3}{12}$
[In Patient]



23.VI.21



12.VIII.21



30.IX.21



21.X.21

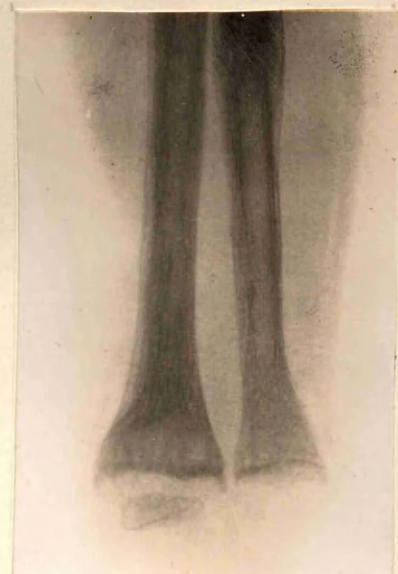
JOSEPH
MCABE
 $3\frac{10}{12}$
[In Patient]



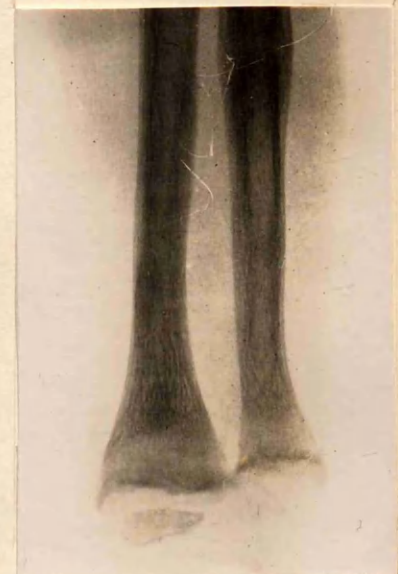
24.IV.22



29.VI.22



24.VII.22



18.VIII.22

TREATMENT BY MASSAGE IN WINTER.

MARY McVEY ¹⁰/₁₂.
[Inpatient]



14. II. 22



18. III. 22



14. IV. 22

JESSIE LAWSON 2yrs
[Out-patient]



22. II. 22

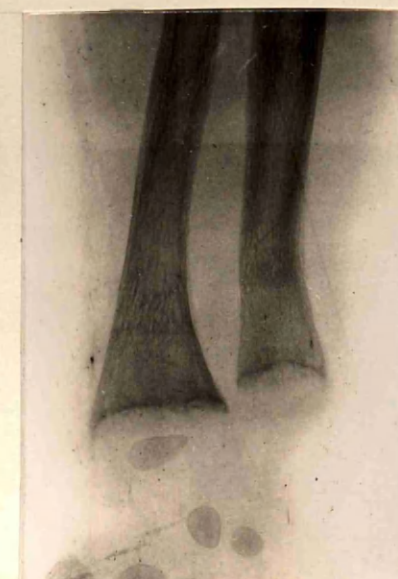


16. V. 22

ALEX. CURRIE 2yrs.
[Inpatient]



9. XI. 21



16. XII. 21

[Died of Measles]

TREATMENT WITH PHOSPHORUS [SUMMER]

ELIZABETH
WATSON $\frac{10}{12}$
[Inpatient]



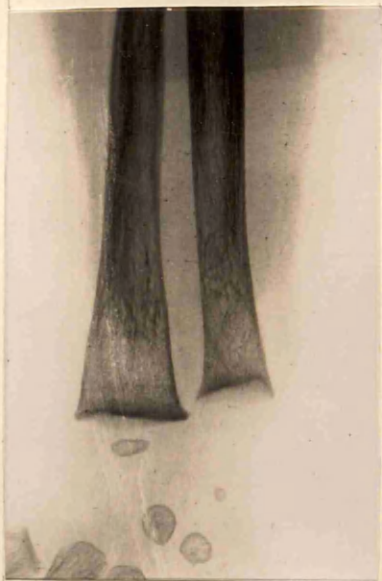
2.VI.21



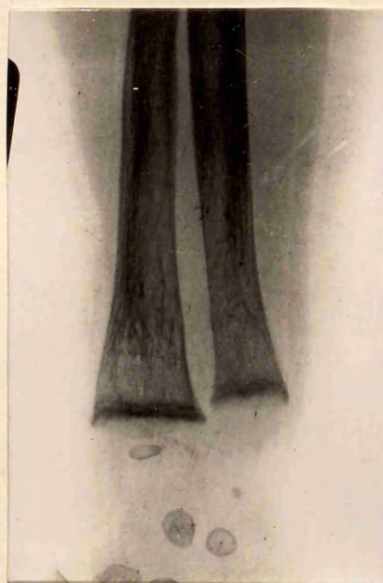
1.VII.21



18.VII.21



26.IX.21



19.XI.21

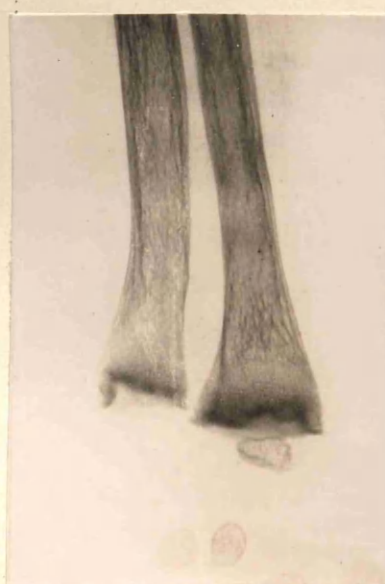
BERNARD
HOEY $\frac{5}{12}$
[Inpatient]



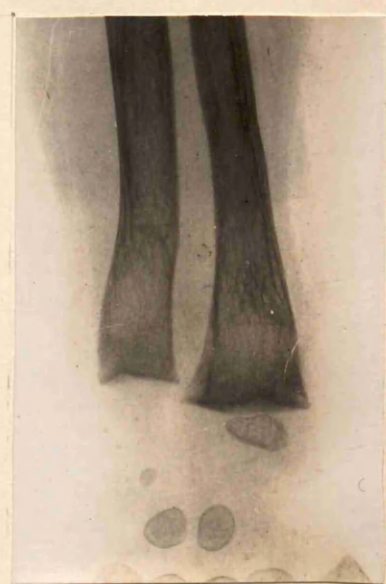
15.N.21



24.VI.21



12.VIII.21



24.IX.21

4. The action was not so specific as that claimed by Shipley, Park, Simmonds & McCollum (8) in rats, and by Park and Howlands (2) in children. Radiographs are shown of a child (Alex. Sherry) who, after constant administration of cod liver oil for 9 months still showed definite rickets.

5. There was little difference in the results of the children treated in hospital and those treated in the Country Branch.

Clinical Results.

1. These were disappointing and the improvement was not nearly so marked as the radiographic.

2. Of the indoor patients 20% walked alone in $3\frac{1}{2}$ months or more, whilst 46.6% showed only slight or very slight improvement, even after a period extending in one case to 7 months.

3. Improvement was most marked in children treated as out-patients and least marked in those treated in hospital.

Treatment with Massage.

To in-patients, massage was given for about half an hour daily every second day, and the child was encouraged to be on his feet as much as possible. The children treated at Dispensary attended three times weekly.

In the out-patients the diet remained unaltered.

Radiographic Results.

1. In summer the improvement was as definite as that obtained with cod liver oil and the time taken to obtain normal bones was of about the same duration, that is, 5 months.

2. In winter there was usually no or only very slight improvement. In 25% of the cases the improvement was slight. In 2 cases, however, one in-door and one out-door, there was definite improvement.

3. There was very little difference in results in the 3 groups - out-patients, treated in hospital, and treated in the Country Branch.

Clinical Results.

1. Improvement was much more marked and more constant than in the cod liver oil cases.

TREATMENT BY MASSAGE IN SUMMER.



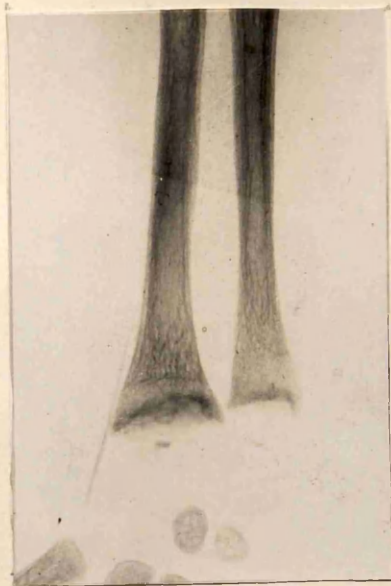
5.V.21



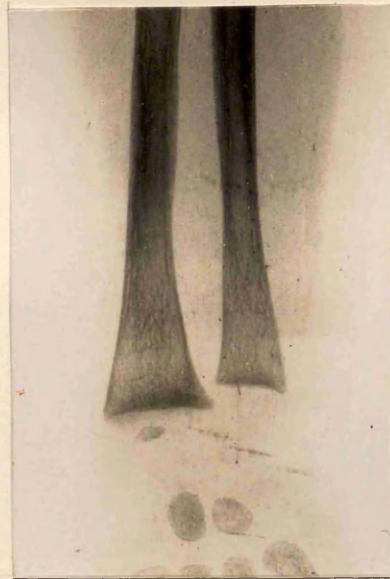
16.VI.21



8.VII.21



2.VIII.21



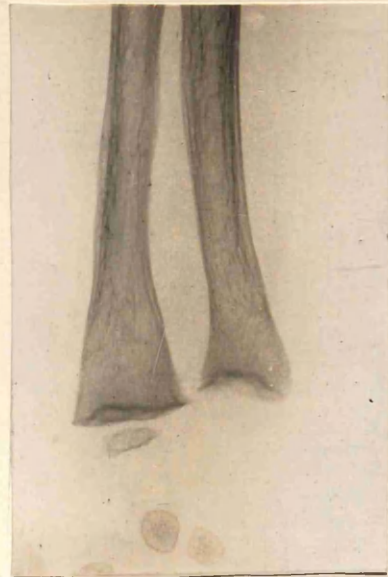
5.X.21



3.II.21



17.VI.21



12.VIII.21

JOHN
VILLIERS
11
12

[Inpatient]

ELIZABETH
WADE.
11
12

[Inpatient]

2. 20% of the in-door cases walked alone in 2 months, and in only 33% of the in-door cases was the improvement only slight.
3. Of 12 cases treated as out-patients at the Dispensary 100% walked alone in 3 to 6 weeks.
4. Of all groups improvement was least marked in the in-patients, and there was little difference between those treated in hospital and those treated in the country.

Treatment by massage at the Dispensary.

The results in this group are so striking that a slightly more detailed description may be permissible. The massage was given by the Sister in charge of the Medical Department, and it is largely due to her enthusiasm and patience that the results are so good, for the personal element enters considerably into this form of treatment. The mothers were instructed to continue the massage at home and to "keep the children on their feet." All the cases treated were severe, and the results were uniformly good, and the average period before they were walking alone was 1 month. Moreover, the improvement in the general health was as marked as the improvement in the rickets. Dr. Leonard Findlay (9) has already reported a series of cases treated in this way, and the results of the present investigation correspond closely with his. By many teachers the treatment of active rickets by rest and even by splinting of the limbs is still advocated, and it is looked on as little less than criminal to put a child with active rickets on to his feet daily and to endeavour to make him walk. The foundation of this teaching appears to be in the fear that deformities may develop or that existing ones may be made worse. It has been pointed out by Dr. Findlay that this does not happen. Certainly, in the present investigation, comparing the children treated by massage and kept on their feet although the radiographs showed severe rickets with those treated with cod liver oil until the bones were fairly normal before having much weight put on the legs, the amount of deformity is certainly no more marked in the one case than in the other.

Treatment with Phosphorus.

TREATMENT By VIOLET RAYS.

A. SUMMER

THOMAS MALLON.
 $\frac{7}{8}$ yrs

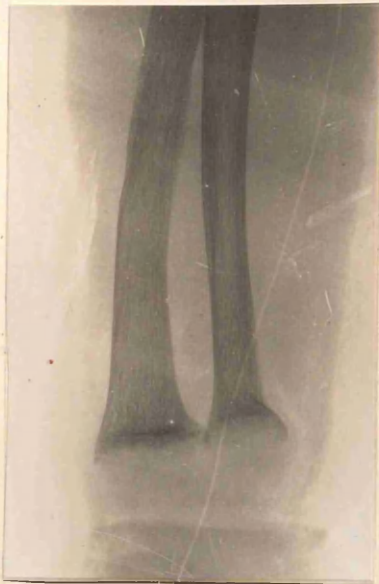


26.VI.21



1.VIII.21

ROBERT McKENDRICK
 $1\frac{1}{2}$



14.V.21



20.VI.21

B. WINTER

JDE GEOGHEGIN.
 $1\frac{8}{12}$



9.II.22



9.IV.22.

Treatment with Phosphorus.

The numbers treated by this method are too small for definite conclusions being drawn. The phosphorus was given either in pill form, commencing with 1/100th grain and increasing to 1/50th grain three times daily or as the oil of phosphorus 3 minims to 5 minims in olive oil thrice daily.

Radiographically, healing progressed during the summer months and the bones, in a severe case, became normal in about 5 months. Only one child, an out-patient, was treated for a sufficiently long period in the winter, and in this case there was no improvement in 4 months. In the few cases which it was given, phosphorated cod liver oil did not seem to influence the rate of healing any more markedly than did cod liver oil alone.

Clinically. Whilst clinical improvement was present in the out-patients, it was practically absent in 2 children treated in hospital for 4 and 6 months respectively. These children were on a good diet, but their amount of exercise was limited. At the end of the period of treatment when the bones of these children had become almost normal, one could only walk with considerable support, and the other made no attempt to stand even when supported.

To summarize then:-

1. Bone healing occurred during the summer.
2. There was practically no clinical improvement.

Treatment with Violet Rays.

It had been hoped to treat a fairly large number of children by this method during the winter months, but unfortunately measles developed in several of the children selected for treatment and the material was lost. In one case only was the method given a really fair trial in the winter and in this child the radiographic improvement was marked, and there was also definite clinical improvement. The radiographic improvement was well marked in 2 months and was quite as

TO SHOW RADIOGRAPHIC PROGRESS OF RICKETS IN BABIES

WITHOUT TREATMENT DURING THE SUMMER MONTHS.

2. With dietetic changes (continued).

TAKEN IN
SPRING.



CHARLES BOYD $\frac{11}{12}$.



MARGT. PATERSON. $\frac{10}{12}$.



HUGH McGUIRE. $\frac{8}{12}$.

TAKEN IN
AUTUMN.



CHARLES BOYD $\frac{4}{12}$.



MARGT. PATERSON. $\frac{2}{12}$.



HUGH McGUIRE. $\frac{1}{12}$.

TO SHOW RADIOGRAPHIC PROGRESS OF RICKETS
IN BABIES, WITHOUT TREATMENT, DURING THE
SUMMER MONTHS.

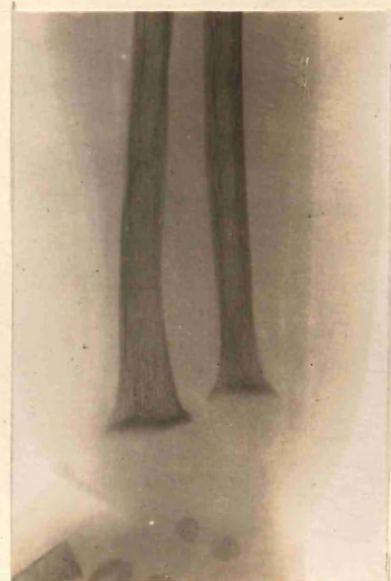
3. With dietetic changes (shown in appendix)



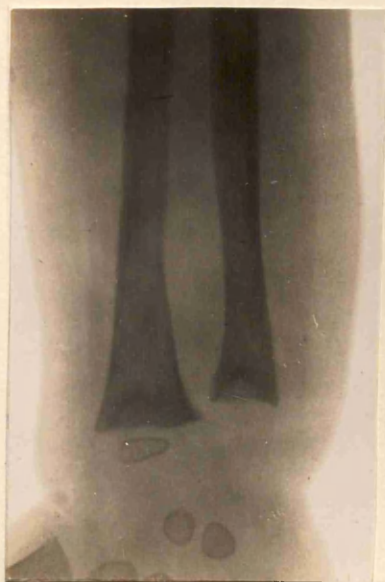
JANE NEWLANDS $\frac{9}{12}$.



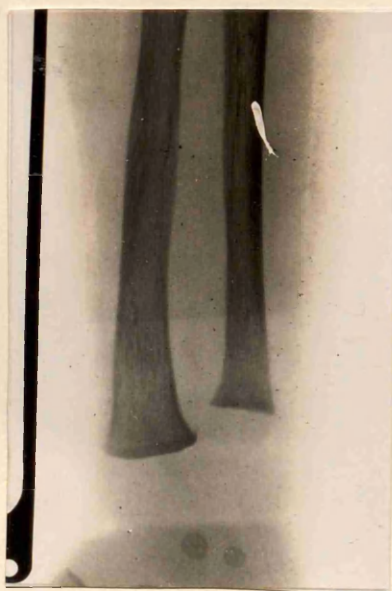
VIOLET O'ROURKE $\frac{11}{12}$.



MARY KING $\frac{9}{12}$.



JANE NEWLANDS $\frac{1}{12}$.



VIOLET O'ROURKE $\frac{1}{12}$.



MARY KING $\frac{2}{12}$.

TAKEN IN
 SPRING.

TAKEN IN
 AUTUMN.

22

TO SHOW RADIOGRAPHIC PROGRESS OF RICKETS IN BABIES
WITHOUT TREATMENT DURING THE SUMMER MONTHS.

a. Diet remaining unchanged.



GEORGE SYME $\frac{10}{12}$



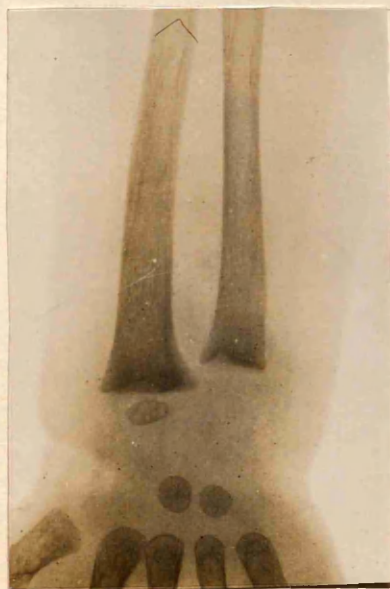
MARGT. DRILLY $\frac{8}{12}$



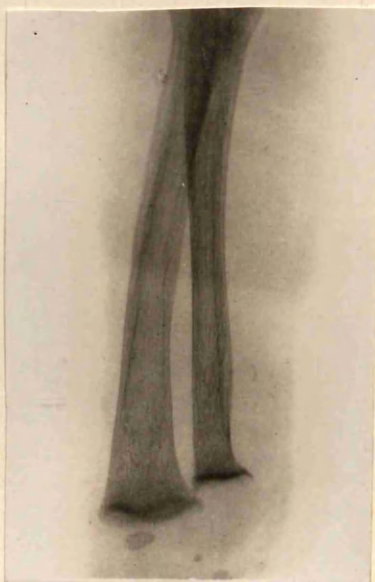
FRANCIS TAYLOR $\frac{6}{12}$



JOAN KERR $\frac{9}{12}$



GEORGE SYME $1\frac{2}{12}$



MARGT. DRILLY $1\frac{1}{12}$



FRANCIS TAYLOR $1\frac{1}{4}$



JOAN KERR $1\frac{1}{4}$

TAKEN IN
SPRING

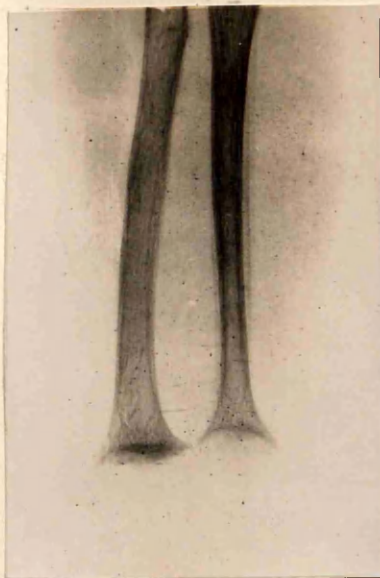
TAKEN IN
AUTUMN

RICKETS HEALING DURING THE SUMMER WITHOUT TREATMENT.

This child was under observation in the country branch of the hospital on a diet similar to that he had been having at home.



28. IV. 22



26. V. 22

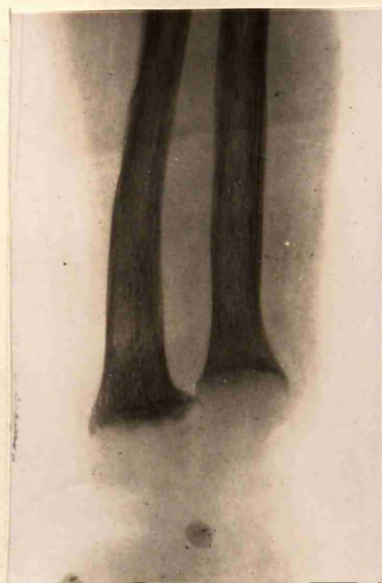


25. VI. 22



25. VIII. 22

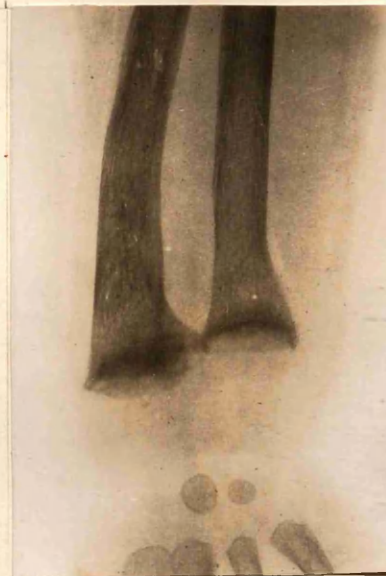
A. NAYLOR.
1 1/2 yrs



5. IV. 22



26. VI. 22



14. VIII. 22

E. WALLACE ^{1 1/2}
Rickets observed at ^{1 1/2}
whilst child on breast
(2.4% fat).
Remained on breast with
1/2 pint of milk in
addition.
Marked healing
occurred during July
and August, and
September.



15. IX. 22

definite as that obtained with cod liver oil, but it is obviously impossible to generalize on such a small number of cases

Children remaining untreated.

In these cases no instructions were given to the parents, and the diet remained unchanged. The results fall into 2 sharply defined groups of a. Summer, b. Winter cases.

- a. Summer.
 - 1. Radiographic improvement was present in 100% of the cases, and in a few cases where the bone changes were moderately severe, the healing was as marked as in children receiving cod liver oil or other therapeutic measures.
 - 2. Clinical improvement was present in 89% of the cases.
- b. Winter.
 - 1. Radiographic improvement was present in only 22% of the cases, and in these the improvement was very slight. No case was observed in which definite improvement occurred.
 - 2. Clinical improvement was practically absent.

Observation during the summer months of young rachitic babies.

16 of the rachitic babies observed in the investigation 3a (observation of apparently normal babies) were followed during the summer months: notes were kept of their diet and they were all radiographed again at the end of the summer, when the following results were found.

Results.

- a. Radiographic.
 - 1. In 69% of the cases the bones were normal or almost normal.
 - 2. In 94% there was definite evidence of healing.
- b. Clinical.
 - 1. In 94% of the cases clinical improvement was definite.
 - 2. In 38% there was no sign nor symptom of rickets to be found.

(Hugh McGuire)

The 1 child, whose rachitic condition became worse during the summer months developed measles in June. After dismissal from hospital, he was on a good diet but lived in a sunk basement, dark and insanitary, and quite inaccessible to ^{direct} sunlight. Moreover, the mother was ill and was unable to take the child out to the fresh air.

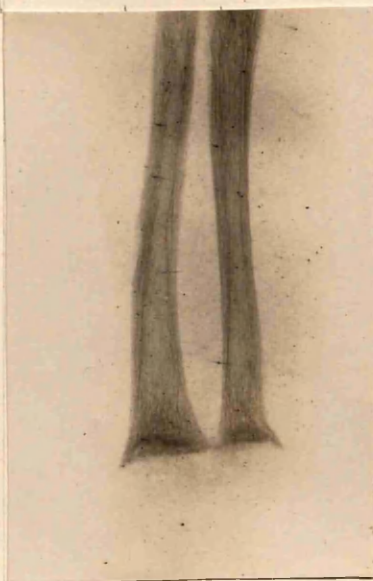
Diet. In 44% of the cases the diet was unchanged from that in which

TO SHOW HEALING DURING SUMMER ON POOR FAT DIET.

DAVID
ROSE
 $\frac{14\frac{1}{2}}{12}$



24.IV.22



1.VI.22



10.VIII.22



10.IX.22

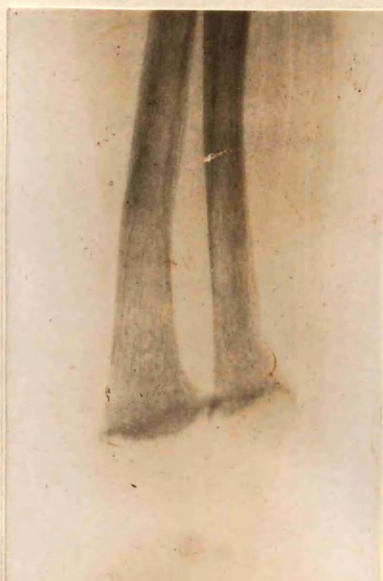
Breast fed to 2 months, then 1.5% fat diet. Healing occurred from June onwards.

Grams of fat put into	during	June	=	2.6
"	"	July	=	2.8
"	"	August	=	2.7
"	"	Sept.	=	3.0

JOHN
M^{rs} GREGOR
 $\frac{6}{12}$



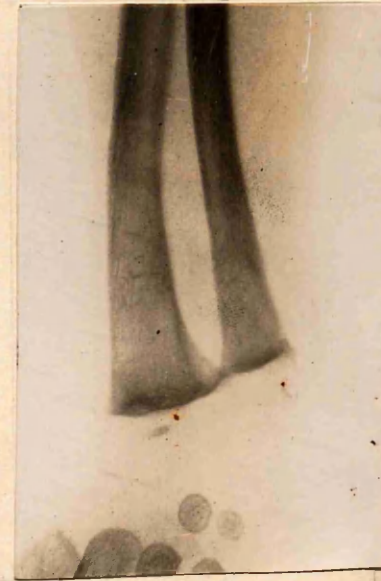
30.III.22



23.VI.22



10.VIII.22



15.IX.22

Breast fed to 8 months (1.1% fat). Then weaned and put on to 1.5% fat diet.

Grams of fat put into	during	June	=	2.3
"	"	July	=	2.0
"	"	August	=	2.6
"	"	Sept.	=	2.4

TO SHOW HEALING IN SUMMER ON A POOR FAT DIET.

A. WITHOUT ANY OTHER TREATMENT EXCEPT ADVISING FRESH AIR.



5.V.22



16.VI.22



11.VIII.22.



19.IX.22.

Healing on a 1.5% fat diet, averaging 2.3 to 2.7 gm. of fat per kilo.

[See chart of fat poor diet cases]

B. PHOSPHORUS ADDED TO DIET. (*Oleii Phosphorati* ^{milli} T.I.D.).



22.III.22



8.V.22



5.VI.22



18.VIII.22

EDWARD
MURRAY
 $\frac{4}{12}$
[Out-patient]

Rickets present at $\frac{4}{12}$
(had been on Nestle's milk).
Child put on to a
Van Piquet Diet
with Phosphorus.

Marked healing occurred during a period when the child
was on a 1.5% fat mixture, with an average fat intake
of 2 grams per kilo.

rickets had developed and in 100% of these children radiographic and clinical signs of healing were marked.

Conclusions.

1. Marked radiographic and clinical improvement occurred during the summer months without the diet being in any way altered from that on which rickets had developed, and without applying any therapeutic measures.
2. In the one child who did not improve during the summer, the hygienic conditions were extremely unfavourable.
3. Almost 40% of the babies who showed definite evidence of rickets in the spring months showed no radiographic nor clinical signs nor any symptom at the end of the summer. Had these babies come under observation for the first time at the end of the summer, their previous rachitic condition would not have been suspected.

Treatment on Fat Deficient Diet.

An observation was made on 4 children with rickets who were of suitable age to be kept on a poor fat diet. All four were observed during the summer months, 3 being put on a 1.5% fat mixture and no other treatment given except that the mothers were advised to take them out to the fresh air as much as possible, whilst the fourth had a 1.5% fat mixture and, in addition, 3 minims of the oil of phosphorus three times daily.

Results.

Radiographic and clinical improvement was marked in 100% of the cases, and although the degree of rickets had been moderately severe, the bones were almost normal by the end of the summer. Healing was not more rapid nor complete in the child receiving phosphorus than in the others.

Conclusions.

The main point to be decided here is whether the evidence is in favour of the fat soluble A vitamin being essentially connected with rickets or not. Does the supplying of this vitamin in large amounts always lead to healing of the disease, or on the other hand, is this healing influenced by other factors? It does not necessarily follow, of course, that the supplying of an element whose deficiency has led to the development of a pathological condition will always cure the condition. Still, on general grounds, the vitamin should have a definite curative effect, healing should be more marked when it is presented in large amounts, and certainly, healing should not progress when it is deficient. Cod liver oil is looked on as the typical fat soluble A containing substance, and many workers have demonstrated the beneficial results of cod liver oil on calcification. That these are due to its fat soluble A content is not proved, and the fact that healing was seen to progress on a diet of low fat soluble A content would appear to show that it is not the vitamin which is the important factor. This investigation supports the previous findings that cod liver oil has in most cases a definite action in bringing about calcification, and its chief advantage lies in the fact that it produces these changes during the winter months, a period during which healing is difficult to attain by other methods. The tables of results and the radiographs shown will demonstrate that this action does not always occur, and that there are cases which resist the treatment. Clinically the results with cod liver oil were disappointing, especially in those children where the amount of exercise was limited.

Summary:

1. Marked spontaneous healing of bones and clinical improvement was observed during the summer months. Therefore all summer results should be discarded.
2. The fact that the diet remained unaltered in these untreated cases, and that the diet of children of this class who are over 1 year old contains very little milk or fat soluble A containing substances does not favour the view that this spontaneous healing is due to any

2. (Contd.) increase in the vitamin content of the diet during the summer months.
3. Definite radiographic improvement follows the administration of cod liver oil, both in summer and winter, but the action is not specific.
4. Clinical improvement with cod liver oil is not commensurate with the radiographic improvement.
5. Definite radiographic improvement occurred in the winter months with measures such as violet rays and massage, which would appear to be in no way connected with the fat soluble A vitamin.
6. The most marked clinical improvement was obtained with massage,
7. Healing progressed in children on a definitely fat deficient diet, whose fat soluble A content must have been extremely low.

CORRELATION OF RADIOGRAPHIC WITH CLINICAL FINDINGS.

Generally speaking, I found that in this series of cases, the severity of the bone lesion was comparable with the clinical severity of the disease. This, however, is by no means universal, and it has been already shown that cases treated with cod liver oil in the winter show definite radiographic and very little clinical improvement whilst those treated by massage show marked clinical and very little radiographic improvement. Thus the following combinations may occur:-

1. Healed or almost healed bones with only slight clinical improvement.
2. Little or no bone healing with marked clinical improvement, and the child walking alone.

One does not expect the radiographic and clinical improvement to absolutely coincide, but still it would seem reasonable to expect that after a child has been walking alone for 6 months or more and has been in good general health, the bones should be fairly normal. The converse that the bones may steadily heal whilst there is no real clinical improvement is even more difficult to understand. Does this mean that calcium metabolism, as evidenced by ossification, has become normal, but that rickets still remain? The following case histories will illustrate

TO SHOW LACK OF CORRELATION BETWEEN
RADIOGRAPHIC AND CLINICAL PICTURES.



ANGUS McDONALD 4yrs
W.A. FOR $1\frac{3}{4}$



BENJAMIN CHALMERS 3 $\frac{3}{4}$
W.A. FOR $1\frac{3}{4}$



WILLIAM SLATER 3yrs
W.A. FOR $1\frac{6}{12}$



ELLEN TIMOTHY 1 $\frac{5}{12}$
W.A. FOR $\frac{7}{12}$



THOMAS MCKAY 5yo
W.A. FOR 2 $\frac{1}{2}$ yrs



JOHN PROCTOR 3yo
W.A. FOR $1\frac{7}{12}$



GEORGE TIMOTHY 6 $\frac{6}{12}$
W.A. FOR $1\frac{1}{12}$



JAMES BRADY 3yo
W.A. FOR $1\frac{1}{4}$

W.A. = Walking alone.



ANNIE DUFFY 2yo

Compare severity of bone lesion in above radiographs with this of a child, Annie Duffy who has never attempted to walk.

these points.

1. E.W. had phosphorus administered for 6 months in hospital, and at the end of that time the radiographs approximated the normal, yet clinically there was no improvement: the child made no attempt to stand and the limbs were very tender.
2. G. McD. had massage at the Dispensary and walked alone in 6 weeks. After that, she kept very well and was running about all day long, yet a radiograph taken 9 months later still showed a moderately severe degree of rickets.

Cases of the latter type suggested to me that it might be of interest to see the condition of the bones in older children with signs of "healed rickets" who had been well and running about alone for a long period. Accordingly eight children were radiographed who had been brought to the Dispensary for some other complaint. Some of these children had been walking alone for $1\frac{1}{2}$ years and a degree of genu valgum or varum, or a slight epiphysial enlargement were the only remaining signs of rickets. All the radiographs were taken in the winter months and instead of the normal bones I expected to find, the changes were quite definite in every case and in some were as severe as those in children making no attempt to stand. For example, radiographs are shown of twins aged $3.\overset{4}{1}3$ yrs. It will be seen that there is little difference in the severity of the bone lesions, yet the girl (A.McK.) could only stand with much support and had never walked alone, whilst her brother had been running about alone for $1\frac{1}{2}$ years. Healing occurred in both these children during the following summer. The tendency for bone changes to return during the winter without any clinical sign or symptom has already been spoken of.

CRITERIA OF CURE IN RICKETS.

What, then, is to be our criterion of the arrest of the rachitic process? Is the child cured who has fairly normal bones but is unable to stand; and has the child still got active rickets who is

TO SHOW LACK OF CORRELATION BETWEEN RADIOGRAPHIC AND CLINICAL PICTURES.



E.W. 2 $\frac{3}{12}$ yrs. Radiograph taken
after 6 months treatment with
phosphorus. The child makes no
attempt to stand.



G.M.D. 3 $\frac{6}{12}$ yrs. Treated by massage
and walked alone in 6 weeks.
Radiograph taken 9 months later
still shows definite rickets.



A.D. 2 $\frac{5}{12}$ yrs. Radiograph taken
after 5 months treatment with
cod liver oil. The child can only
stand with much support.

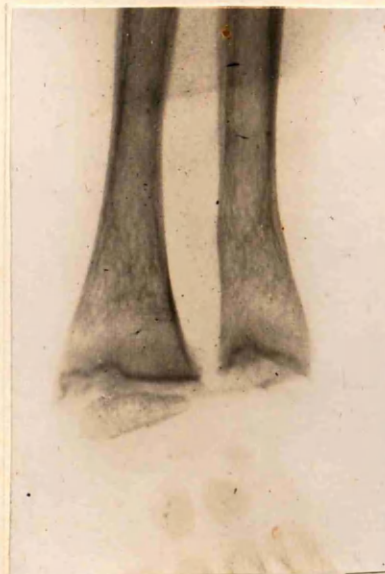
A COMPARISON OF RADIOGRAPHS OF TWINS.

AGNES McKECHNIE, 3 $\frac{4}{12}$

This child has never made
any attempt to stand
or walk.



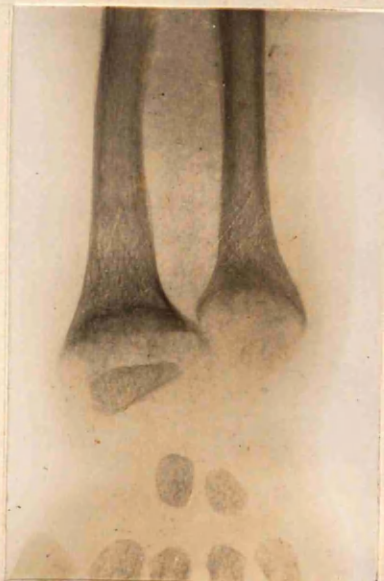
SPRING



AUTUMN.

JOHN McKECHNIE, 3 $\frac{4}{12}$

This child has been running
about alone since he was
1 $\frac{10}{12}$ yrs. old.



SPRING



AUTUMN.

running about and appears to be very well, but whose bones show moderately severe changes? If it is admitted that rickets is a general disease, and that the bone changes are only a manifestation, then so soon as the general health becomes good and the child runs about freely one is justified in saying that the disease is arrested even although the radiographs still show definite rickets. The fact that clinical improvement can be so marked whilst ossification remains deficient, and that the converse also occurs, seems to me to indicate that the healing of rickets may not be so intimately associated with the putting right of calcium metabolism as has been thought. With reference to this question of calcium metabolism the radiographs of a girl M. McG., aged $2.\overline{12}$ yrs. are of interest. This girl was admitted to hospital on the 29th September, 1921, for bronchopneumonia, having been ill for 14 days before admission. The whole ^{couse} cause of the illness in hospital was a febrile, although there was definite consolidation, and the child was on general diet. In a radiograph of the chest taken on admission the outline of the upper end of the humerus was quite normal. Succeeding radiographs showed progressive decalcification until, 7 weeks later, there was actually marked cupping of the bone. Recalcification then recommenced and a radiograph taken 1 month later showed definite healing. The child had rachitic stigmata, and a radiograph of the wrist showed a moderate degree of rickets. A complicating factor was introduced by the presence of a positive Wassermann reaction. What then was the cause of this active decalcification? Diet cannot be incriminated, nor can the confinement consequent on the illness for the child had hardly ever been taken out of the house during the preceding months, owing to the mother being blind. Was the decalcification due in some way to the pneumonia 'per se'; perhaps by action of toxins? Recently Grove and Vines (10) have deduced that the ionic calcium of the blood becomes deficient in cases where a chronic toxæmia is present, and claim considerable success in treatment by parathyroid therapy.. If, then, a condition of calcium metabolism and of ossification similar to that found in rickets can be produced

30

SHOWING PROGRESSIVE DECALCIFICATION OF UPPER END OF HUMERUS
OCCURRING DURING AN ATTACK OF BRONCHOPNEUMONIA.



1st October 21



4th October 21



11th October 21



20th October 21



4th November 21



16th November 21



22nd November 21



28th January 22.

in this way, that is, by toxins, is it not conceivable that the disease itself may be caused in a similar way?

Conclusions.

1. The radiographic and clinical pictures in rickets, whilst showing general agreement, often show marked variations.
2. The variability of ossification under different conditions, in so far as one can accept ossification as an index of calcium metabolism, suggests that the disturbance of calcium metabolism may be a concomitant of rickets rather than the primary change.

HYGIENIC CONDITIONS IN THE HOUSES OF RACHITIC CHILDREN.

Whilst investigating the diet histories of definitely rachitic children, an effort was made to gain information with regard to the hygienic surroundings of these children. Very complete investigations in Glasgow by Leonard Findlay (11) in 1915 and Miss Ferguson (12) in 1918, revealed a much closer relationship between bad hygienic surroundings and rickets than between deficient diet and rickets. The present investigation was much more limited in its scope. The method used was to note (1) The number of apartments and persons in the house of the rachitic child. (2) How much the child had been taken out to the fresh air.

(1) Air space in houses of rachitic children:- The number of apartments in the house is divided by the number of inmates, and the result expressed as a fraction.

The following table shows the results:-

Total number of cases = 125.

Number showing 1 person to each apartment	= 2	= 1.6%.
" " 2 persons " " "	= 20	= 16.0%.
" " 3 " " "	= 28	= 22.4%.
" " 4 " " "	= 25	= 20.0%.
" " 5 " " "	= 30	= 24.0%.
" " 6 " " "	= 15	= 12.0%.
" " 7 " " "	= 2	= 1.6%.
" " 8 " " "	= 3.	= 2.4%.

(2) The time spent by the rachitic children in the fresh air. The mothers were asked if the child had been taken out every day, and for how long: also if they had taken the child to any Public Park or open space.

The results were as follows:-

Number of cases investigated	100.
Exercise sufficient.	14%.
Exercise deficient.	75%.
Exercise doubtful.	11%.

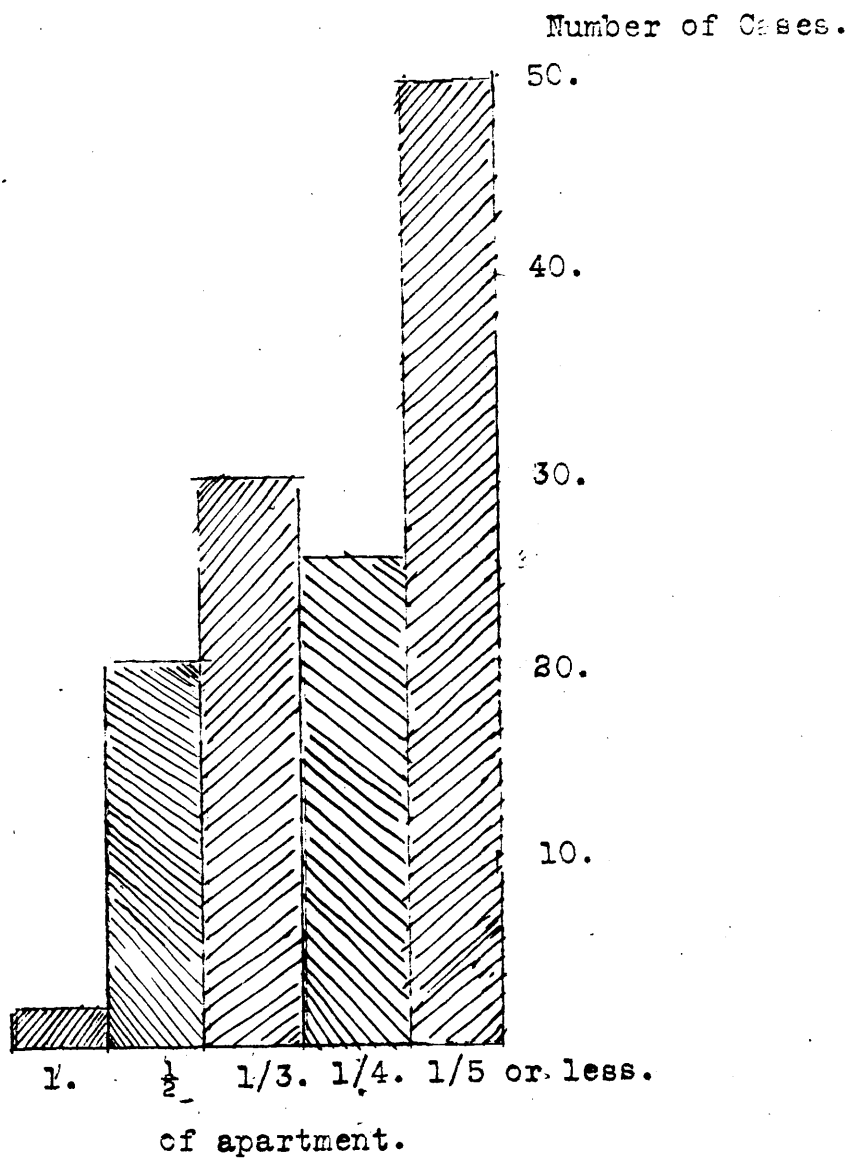
In a very large number of cases the history spontaneously given by the mother was that the child was very seldom taken out of doors in the winter, sometimes not for weeks together. This was explained by the illness of the mother, the bad weather, the birth of another child, to the child being "chesty", or to some definite illness of the child who, in many instances, had gone off his feet after one of the infectious fevers. Other mothers would at first reply that the child had been taken out frequently, but further questioning usually revealed the fact that this meant an hour's shopping expedition twice or thrice weekly "if the weather was good."

Conclusions.

The above tables show that (1) The air space in the houses of these rachitic children was deficient. (2) In 75% of the cases the

children were seldom taken out to the open air. So that most of the histories show definite indications of the presence of bad hygienic conditions. At the same time, in a small number of cases, no such evidence could be adduced.

CHART TO SHOW AIR SPACE TO EACH INDIVIDUAL IN HOMES
OF RACHITIC CHILDREN.



SUMMARY AND DISCUSSION.

It is necessary now to bring together the results obtained in the various parts of this investigation and to see whether they lend support to the theory that rickets is a deficiency disease/^{due} to a deficiency of the fat soluble A vitamin in the diet, or whether they point to any other factor playing the principal part. The results in the divisions of the investigation have been:-

1. (a) 91% of the children observed during the winter months on an artificial fat sufficient diet, and 72% of the breast fed babies in cases where the milk fat appeared to be present in its normal amounts, developed rickets.
(b) 12% of the children observed in the summer months on an artificial diet developed rickets. No breast fed baby developed the disease during the summer.
2. (a) 70% of the children observed during the winter months on an artificial diet poor in fat, and 75% of the breast fed babies in cases where the milk fat appeared to be deficient, developed rickets.
(b) ~~12%~~^{8%} of the children observed in the summer months on an artificial diet poor in fat developed the disease.
3. The investigation of the previous diet of definitely rachitic children revealed no deficiency in the fat content in 60% of the cases.
- 3 (a) In a series of apparently normal babies 51% were found to show radiographic evidence of rickets during the spring, although the diets in these cases were very varied and in 78.5% of the cases the diet was apparently fat sufficient. The majority of these young rachitic babies continued to thrive satisfactorily and showed no evidence of any nutritional defect.
4. Healing was produced in rachitic children by using therapeutic measures such as massage and violet rays which have no apparent connection with the fat soluble A vitamin, the diet remaining unaltered. Healing progressed during the summer months in the absence of remedial measures and without making any alteration in the diet even when this was definitely deficient in fat. The administration of large quantities of cod liver oil, and, therefore, apparently, of the fat soluble A vitamin, in the winter months, certainly induced calcification of the bones more rapidly, and surely than did any other method, but the clinical improvement was slow. In the summer months, healing with cod liver oil was no more rapid than with phosphorus, massage or violet rays. There seems to be insufficient evidence to show whether the potent factor in cod liver oil in inducing calcification is the fat soluble A vitamin, or whether it contains some other active substance, as suggested by McCollum and others (8).

The above results, therefore, strongly oppose the theory that rickets is a disease of dietary origin, and, in particular, that it is due/

due to a deficiency of fat in the diet. That a poor diet may be an influencing factor in the development of the disease is quite possible, just as it is a factor in the production of many generalized diseases. To say that it is the principal or indispensable cause of the disease is an entirely different matter.

The following additional results were obtained during the course of the investigation.-

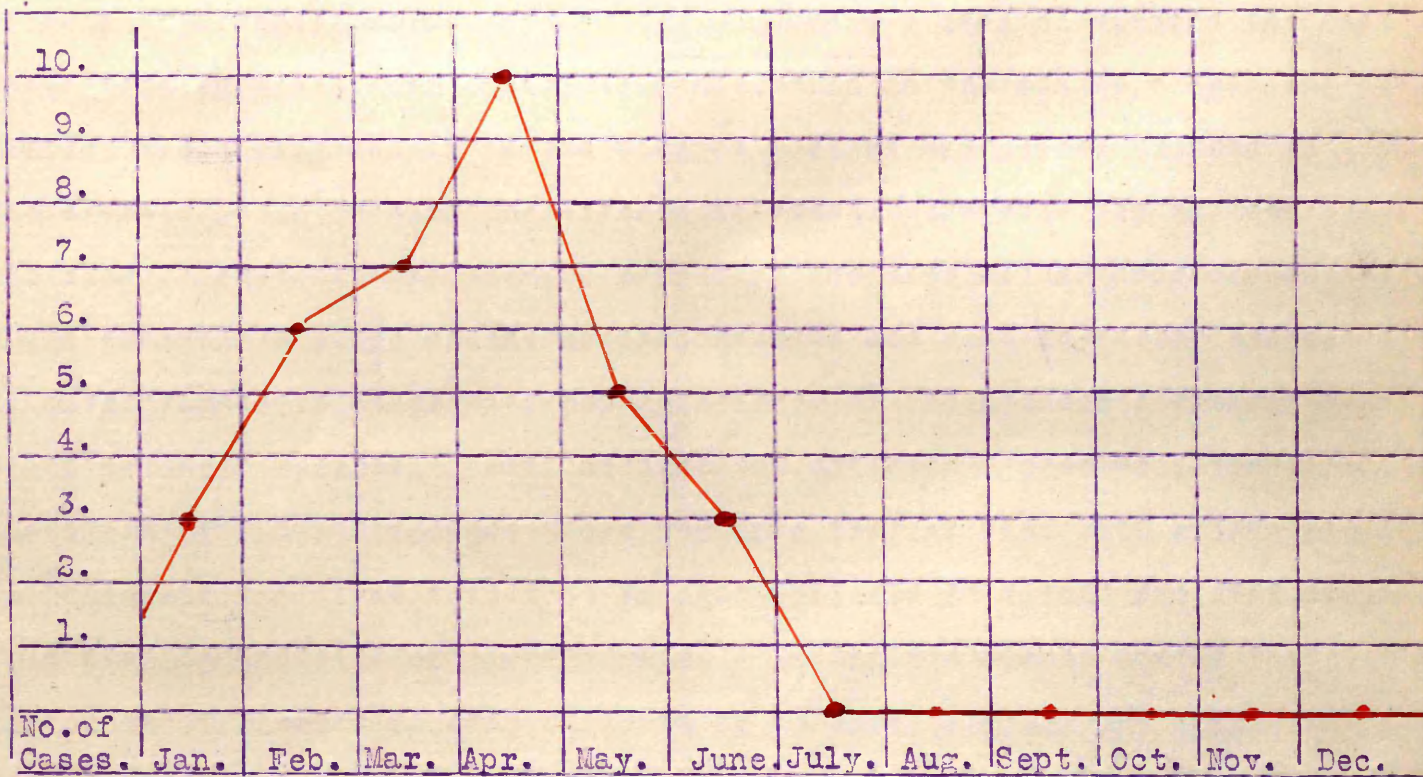
- (1) Investigation into the air space in the houses of rachitic children showed it to be defective.
- (2) In 75% of the rachitic children there was a history of the child not being taken out to the fresh air.
- (3) Of the children who developed rickets whilst under observation in almost every case the disease appeared in the winter or early spring

These facts would indicate that hygienic surroundings have a definite influence on the development of rickets.

The seasonal incidence of rickets is, of course, well known, but the value of this series lies in the fact that, by means of radiographs, the actual time of onset was observed. It was very remarkable that, although many children were observed and radiographed regularly, during the summer, autumn and early winter, the incidence of rickets was practically nil, and that, suddenly, in the beginning of the year the majority of the children, no matter what their diet was, developed evidence of the disease. In the cases where a negative radiograph had been obtained a few weeks previously the greatest incidence was in February and March. It may be attempted to explain this seasonal incidence from two completely different stand-points. 1. On dietetic grounds. 2. On hygienic grounds. It has been shown (13) that cow's milk contains less of the fat soluble A vitamin in the winter months when the cows are stall fed than in the summer months when they are at pasture. Consequently, although the milk supplied to the children who developed rickets under observation contained a sufficiency of fat it may be argued that it is not proved that it contained a sufficiency of the fat soluble A vitamin. But how is it possible, from

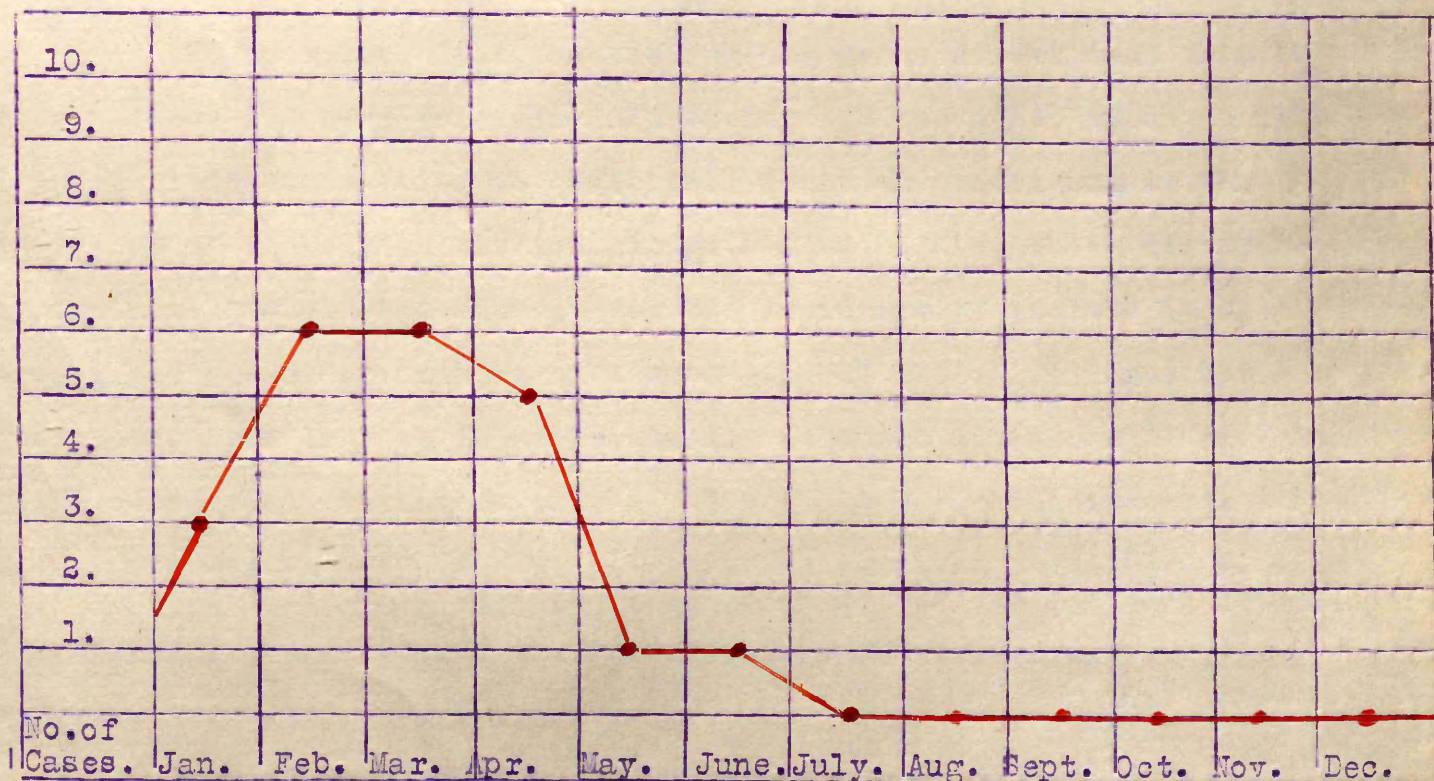
THE SEASONAL INCIDENCE OF RICKETS.

GRAPH TO SHOW MONTH OF RADIOGRAPHIC DEVELOPMENT OF RICKETS
IN CHILDREN ACTUALLY UNDER OBSERVATION.



N.B. Two of the cases developing in June were children in hospital after an acute illness.

SIMILAR GRAPH IN CASES WITH RADIOGRAPH NEGATIVE NOT MORE THAN
2 MONTHS PREVIOUSLY.



such a view point, to explain the clean cut class distribution of rickets? If the disease is due to a comparative lack of vitamin in cows' milk in the winter months then the child in the middle class family, whose milk supply is the same as that of his poorer brother in the slums, should develop the disease in exactly the same way as does the slum child. It may then be said that the diet of the poor class child contains a large amount of carbohydrate and that it is the excess of carbohydrate together with the deficiency of fat soluble A vitamin which produces rickets. But, amongst the children I observed, the incidence of rickets amongst those fed on a low fat diet with excess of carbohydrate was less than that amongst children on a full fat diet with only small quantities of carbohydrate. And in the summer months the incidence of rickets amongst children on an extremely low fat diet with very excessive amounts of carbohydrate was very small. Nor can it be because the better class child received more milk and, therefore, more vitamin, because the amount of milk supplied to the children under observation was ample. If the father of the child were unemployed, free milk was given by the Corporation.

Furthermore, Hess, by feeding one group of children on milk from pasture fed cows (vitamin sufficient) and the other group on milk from stall fed cows (vitamin deficient) found no difference in the incidence of rickets in the two groups⁽¹⁴⁾ And, again, these differences in cow's milk would not account for the incidence of rickets in the breast fed babies of mothers on a good general diet. It does not, therefore, seem logical to correlate the seasonal incidence of rickets with the seasonal variation of the fat soluble A vitamin in cow's milk. On the other hand, the hygienic theory seems to explain both the seasonal incidence and the tendency to spontaneous cure and, in addition, the class distribution.

The striking difference between the better class child and the slum child seems to be, as Findlay ⁽¹⁵⁾ has pointed out, the widely divergent hygienic conditions under which they exist in the winter time.

One has air space and sunlight and is taken out into the open daily. The other is, with four or five others, the occupant of a single apartment where light and fresh air are at a minimum. Only those who have spent considerable time in these rooms in the slums of a city like Glasgow can appreciate the intensity of the filth, darkness, and squalor amidst which these children are reared. The child exists in the same enervating atmosphere day and night, and his exercise and access to fresh air consist in being wrapped up in a shawl and taken out twice or thrice weekly for "messages", "if it is a good day". Hutchison's (16) results in India show the very close relationship of confinement and lack of sunlight and fresh air to the etiology of rickets, and the work of Hess (17) and of Powers, Park, Shipley and others (18) demonstrate the important influence of sunlight in preventing and curing rickets.

Muscle tone in rickets.

Attention has often been drawn to the striking loss of tone in the muscles in rickets, and opinion is divided as to whether the loss is primary or simply secondary to disease. Findlay (12) discusses the question and quotes Hagenbach, Burckhardt and Bing (19) who considered rickets to be a distinct and specific dystrophy. Recently Banu and Bourguignon (20) have corroborated the degenerative changes in the muscles of rachitic children previously described by Bing. On the other hand, Henoch, Hulbner and Zappert (21) thought the muscular weakness to be due to pain in the limbs. P.S. Henderson (22) working with the muscles of rachitic puppies found the creatin content to be definitely increased, and quotes Pikelhering (23) who correlated muscle tone with creatin (methyl-quanidin-acetic acid). She deduced from this that there is a profound change in the metabolism of the muscles in rickets. Recently Noel Paton (24) has suggested that an error in the metabolism of lecithin may be a causal factor in the failure of bone formation in rickets. He thinks that part of the excess of the methyl-quanidin ^{formed} from cholin liberated in the metabolism of lecithin may be linked to acetic acid to form creatin.

Clinically, the loss of muscle tone is striking, and it seems to me that the fact that the abdominal muscles share in this loss of tone and that there is often intestinal distension in the severe cases would tend to show that the loss of tone in rickets is an integral part of the disease and is not merely secondary to disease. The condition of the muscle tone of the limbs is a far better index for the progress of improvement than is the condition of the bones. It has already been shown that the radiographic improvement may be continuous whilst clinically there is very little change, and that, conversely, clinical improvement may be marked whilst the radiographs show little progress towards healing. The condition of the muscles is the real index to improvement; once the tone increases the child improves both in ability to walk and in general health, no matter what the radiographic appearance be. The response of the muscles to treatment by electricity and massage is striking. For the first few applications the limbs are undoubtedly sore and the child cries constantly; but within a few days the tenderness passes off and the child stands on his feet without complaint. The tenderness of the limbs in rickets is usually considered to be "bone tenderness", but the rapid disappearance under treatment by massage suggests to me that the tenderness is not in the bones but in the muscles. Bone tenderness, for example say a chronic osteitis, is certainly not lessened by vigorous rubbing; on the other hand muscle soreness, as after unaccustomed exercise, is at first increased by further exercise and then diminished. The condition of the patellar reflex seems to be of some interest in that it is seldom normal in a child with active rickets. In about 20% of the cases I examined it was either absent or only elicited with difficulty, and in 60% it was abnormally active, and then became normal again when the child commenced to walk.

Each of the points discussed above with reference to the muscles in rickets would probably alone be of little moment, but when we consider them together weight is certainly lent to the view that there is a considerable disturbance of the metabolism of the muscles in rickets. Is it possible, after all, that the changes in rickets are primarily in

the muscles and that the bone changes are secondary? If so, then all the conditions which tend to devitalize muscles would favour the onset of rickets and we have a feasible explanation of the mode of operation of bad hygienic conditions in producing rickets. For muscle tone depends, to a very great extent, on the stimuli it receives from exercise, moving air and sunlight. Diet, too, may influence it to a less extent. Leonard Hill (25) (26) has demonstrated the influence of fresh air on metabolism and every day the effects of fresh air and sunlight are being put on to a clearer physiological basis. If, then, we have confinement, an enervating and usually moist atmosphere, with lack of moving air and sunlight, we have most of the conditions leading to loss of muscle tone. These are the exact conditions which we find in the slum houses producing rachitic children in this country and which Hutchison (16) found in India in the better class houses where rickets was rife. Conversely, it has been shown that exercise, fresh air, sunlight and violet rays will prevent rickets, and that these same agents can be used to cure rickets. The fact that atrophic infants with flabby muscles do not usually develop rickets does not negative this, for in these cases growth is absent or is very deficient. The actual diminishing of the vitality of muscles would not "per se" produce rickets: there would need to be an intermediate step which at present is purely hypothetical. It might be an infection of low specific nature occurring in these devitalized muscles, but of this there is no proof. At anyrate, it is possible that further work of an experimental or histological nature on the musculature in rickets might throw some light on the etiology of the disease.

CONCLUSIONS.

The evidence in this investigation strongly opposes the theory that rickets is produced by a lack of fat in the diet, because:-

1. Children on a definitely fat sufficient diet developed rickets.
2. Children on a definitely fat deficient diet remained free from the disease.
3. A study of diet histories of a large number of rachitic children showed the diet to have been fat sufficient in 60% of the cases.
4. Cure of rickets was obtained without any alteration in diet and even when the amount of fat in the diet was definitely deficient.

The evidence, on the other hand, emphasizes the close connection between hygienic conditions and the development of rickets because of:-

1. The deficient air space in the houses occupied by rachitic children.
2. The deficient amount of time spent in the open air by these children.
3. The very marked seasonal incidence of the disease.

FINALLY.

1. In this investigation it has been shown that hygienic conditions play a more important part in the etiology of rickets than does diet.
2. Emphasis is laid on the condition of the musculature in rickets and support is given to the view that the disease is primarily of the muscles and not of the bones. Bad hygienic conditions act by depressing muscle activity.

I have much pleasure in recording my gratitude to Doctor Leonard Findlay for putting clinical material at my disposal and, more particularly, for many valuable suggestions and helpful criticisms. I have also to thank the Staff of the Radiographic Department of the Royal Hospital for Sick Children, Glasgow, for the large series of excellent radiographs taken by them. To Sister Elinor, of the Out-patient Department of the same Hospital, my thanks are due for collecting much of the clinical material used, and for her patience and enthusiasm in the massage treatment which she undertook.

Finally I have to thank the Medical Research Council by whom the expenses of this research were borne.

B I B L I O G R A P H Y.

1. Shipley, Park, McCollum, Simmonds and Parsons. Journ. Biol. Chem. Vol. LX. No.2.
Jan. 1921.
2. Park & Howlands. John Hopkins Hosp. Bul. Vol. XXXII, No. 369. Nov.1921.
3. Lawson Dick. "Rickets" 1922.
4. Burnett J. Brit. Journ. of Dis. of Child. Vol. XVIII. Sept.1921.
5. Miss Chick and others. Lancet, July 1st, 1922, p.7.
6. Hutchison H.S. Quart. Journ. of Med. April, 1920.
7. Schmorl. "Ergebnisse der innern medicin und kinderheilkunde".
Vierter band, 1909, p.403.
8. Shipley, Park, Simmonds & McCollum. Journ. of Biol. Chem. Vol. L. No.1. Jan.1922.
9. Leonard Findlay. Brit. Journ. of Dis. of Child.
10. Grove and Vines. B.M.J. May 20, 1922, p.791.
11. Leonard Findlay. Lancet, May 8th, 1915.
12. Miss Ferguson. Med. Research Committee. Spec. Rep. Series. No.20, 1918.
13. Drummond, Coward & Watson. Biochem.Journal 540 XV. 1921.
14. Hess and Unger. Amer. Journ. of Child. Dis. Vol. XXII, p.186, Aug.1921.
15. Findlay L. B.M.J. July 4th, 1908.
16. Hutchison H.S. Quart. Journ. of Med. Jan, 1922.
17. Hess and Unger. J. Amer. Med. Assoc. July, 2nd, 1921, Vol. 77, p.39.
18. Powers, Park, Shipley, McCollum and Simmonds. Jan. 31st,1922. Vol.78, p.159.
19. Hagenbach, Burckhardt and Bing. Med. Klinik 1907, No. I.
20. Banu and Bourguignon. Comptes. Rend. Socie. Biolog. 1921, p. 457, 798.
21. Henoch, Hulsner and Zappert. Charite Ann Berl, 1896. XXI, p.310 - 326.
Deutsche Klinik Berl Wien, VII, p.427 - 468 and(469-478)
22. Henderson P.S. Proc. of Phys. Soc. Journ. of Physiol, Oct.19th, 1918.
23. Pekelhering. Zeschr. P. Physiol Chem. 75 p.207.
24. Noel Paton. B.M.J. March, 11th, 1922. p.379.
25. Leonard Hill & Argyll Campbell. B.M.J. Feb. 25th, 1922, p.301.
26. Leonard Hill, Argyll Campbell & Hudson. B.M.J. March, 11th, 1922. p.385.

APPENDIX A.

DETAILS OF DIET OF CHILDREN DEVELOPING RICKETS UNDER OBSERVATION ON FAT SUFFICIENT DIET.

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
1.	Diet.	F.C. Glaxo.	F.C. Glaxo.	W.M. 18 Ozs.	W.M. 18 Ozs.	W.M. 22 Ozs.	W.M. 26 Ozs.	W.M. 30 Ozs.	W.M. 32 Ozs.	W.M. 35 Ozs.	W.M. 26.5 Ozs.	W.M. 35 Ozs.	W.M. 35 Ozs. & Porr.	do.	do.				
Mary	Fat in Gms.					20.7.	23.4.	27.0.	28.8.	31.5.	23.85.	31.5.	31.5.	31.5.	31.5.				
Hay.	Wt. in Kilos.					3.5.	4.5.	5.5.	6.0.	6.1.	6.2.	6.5.	7.4.	7.6.	8.0.				
	Gms. of fat per Kilo.					5.9.	5.2.	4.9.	4.8.	5.1.	3.8.	4.8.	4.2.	4.1.	3.9.				
	Month.					May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.				
	X Rays.						-ve.		-ve.				-ve.		+ve.				
Admitted to Hospital at 4 months. Dismissed at 5 months.																{ Observed from 4 months. Rickets at 14 months.			

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
2.	Diet.	Breast.	F.C. Glaxo.	BCM 25 Ozs.	W.M. 25 Ozs.	W.M. 25 Ozs.	W.M. 30 Ozs.	W.M. 31 Ozs.	W.M. 35 Ozs.	W.M. 30 Ozs. & Porr.	W.M. 30. Ozs. & Porr.	do. & Milk.	do.	Diet 1.					
	Fat in Gms.			21.6.	22.5.	22.5.	27.0.	27.9.	31.5.	31.5.	31.5.	31.5.	31.5.						
ANNIE	Wt. in Kilos.			3.9.	4.3.	5.4.	6.2.	6.8.	7.2.	7.8.	8.3.	8.5.	8.8.						
CHISHOLM.	Gms. of fat per Kilo.			5.4.	5.2.	4.1.	4.3.	4.1.	4.4.	4.0.	3.8.	3.7.	3.6.						
	Month.			Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.					
	X Rays.				-ve.			-ve.		-ve.				+ve.					
Admitted to Hospital at 2 months. Dismissed at 4 months.																{ Observed from 2 months. Rickets at 13 months.			

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
3.	Diet.	Breast.	F.C. Glaxo.	Sis. L. Food.	W.M. 27 Ozs.	W.M. 30 Ozs.	W.M. 30 Ozs.	W.M. 30 Ozs.	W.M. 32 Ozs.	W.M. 35 Ozs.	W.M. 35 Ozs. & Porr.	do.	do.	Diet 1. 2 Pts. Milk.	Butter. Gravy.				
David.	Fat in Gms.				24.3.	27.0.	27.0.	27.0.	28.8.	31.5.	31.5.	31.5.	31.5.						
Wark.	Wt. in Kilos.				4.0.	5.0.	5.2.	5.4.	6.1.	6.5.	7.3.	7.8.	8.0.						
	Gms. of fat per Kilo.				6.0.	5.4.	5.1.	5.0.	4.7.	4.8.	4.3.	4.0.	3.9.						
	Month.				Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.					
	X Rays.						-			-				+ve.					
Admitted to Hospital at 3 months. Dismissed at 5 months.																{ Observed from 3 months. Rickets at 13 months.			

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
4.	Diet. Glaxo.	Sis. L. Food.	do.	Pep. Milk 25 oz.	Pep. Milk 29 oz.	W.M. 33 Oz.	W.M. 35 Ozs.	W.M. 35 Oz.	W.M. 35 Oz.	W.M. 35 oz. & Porr.	do.	do.	Diet 1 Butter	Milk 1 Pt. Gravy.					
Agnes	Fat in Gms.			22.6.	26.1.	29.7.	31.5.	31.5.	31.5.	31.5.	31.5.	31.5.							
Barley	Wt. in Kilos.			3.1.	3.7.	4.4.	5.0.	5.7.	6.6.	7.4.	8.0.	8.2.	8.4.	8.9.					
	Gms. of fat per Kilo.			7.2.	7.0.	6.7.	6.3.	5.5.	4.8.	4.25.	3.9.	3.8.							
	Month.			March.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.				
	X Rays.									-		-		+ ve					

Admitted to Hospital at 2 months.
Sent to Country Branch at 5 months.
Dismissed at 8½ months.

{ Observed from 3 months.
Rickets at 14 months.

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
5.	Diet. Breast.	Breast. L. Food.	do.	W.M. 24 oz.	W.M. 24 oz.	W.M. 32 oz.	W.M. 30 oz.	W.M. 33 oz.	W.M. 35 oz.	W.M. 35 oz.	W.M. 35 oz.	Diet 1 Butter	and milk daily.						
Chas.	Fat in Gms.			21.6.	21.6.	28.8.	27.0.	29.7.	31.5.	31.5.	31.5.								
Mc.	Wt. in Kilos.			4.2.	4.9.	5.4.	6.0.	6.7.	7.2.	7.8.	8.0.	8.0.							
Guigan	Gms. of fat per Kilo.			5.1.	4.4.	5.3.	4.5.	4.4.	4.3.	4.0.	3.9.								
	Month.			June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.							
	X Rays.			-	-	-	-	-	-	-	-	+ ve.							

Admitted to Hospital at 4 months.
Dismissed at 4½ months.

{ Observed from 4 months.
Rickets at 13 months.

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
6.	Diet. Breast.	Sis. L. Food.	W.M. 16 oz.	W.M. 16 oz.	W.M. 16 oz.	Sis. L. Food & W.M. 24 oz.	B.C.M. 30 oz.	W.M. 35 oz.	do.	do.	do.	do.	do.	do.	do.	Diet 1.			
John	Fat in Gms.			14.4.	14.4.	21.7.	17.7.	27.0.	31.5.	31.5.	31.5.	31.5.	31.5.	31.5.	31.5.	31.5.			
Hill.	Wt. in Kilos.			3.7.	4.0.	4.1.	4.2.	4.5.	4.7.	5.1.	5.5.	5.6.	5.8.	5.9.	6.0.				
	Gms. of fat per Kilo.			4.0.	3.6.	5.2.	4.25.	6.0.	6.7.	6.1.	5.7.	5.6.	5.4.	5.3.	5.2.				
	Month.			Oct.	Nov.	Dec.	Jan.	Feb.	March.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.		
	X Rays.										?	+ ve.			Healing.				

Came under observation at 3 months.
Admitted to Hospital at 5 months.
Dismissed from Hospital at 9 months.

{ Observed from 3 months.
Rickets at 1 year.
Healing on same diet without treatment.

[illegible]

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
8.	Diet.	Breast	do.	do.	do.	do.	do.	do.	In Fever Hospital with Diptheria.			Allenbury's Food No. 2.			W.M. 33 Ozs.	W.M. 35 Ozs.	W.M. 35 Ozs.	W.M. 35 Ozs. & Diet.	
	Fat in Gms.														29.7.	31.5.	31.5.	31.5.	
	Wt. in Kilos.														6.3.	7.1.	8.0.	3.2.	
	Gms. of fat per Kilo.														4.7.	4.4.	3.9.	3.8.	
	Month.														Feb.	Mar.	Apr.	May.	
	X Rays.																	+	

Admitted to Hospital for Diptheria at 7 months.
Dismissed at 10 months.
Admitted to Hospital, clinically no rickets at 13 months.
Clinically rickets at 17 months.

{ Observed from 13 months.
{ Rickets at 17 months.

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
9. PHYLLIS MYLEON	Diet.	Allen- bury No.1.	Beng- or's Food.	W.M. 25 Ozs.	W.M. 25 Ozs.	W.M. 25 Ozs.													
	Fat in Gms.			22.5	22.5	22.5													
	Wt.in Kilos.			3.5	3.9	4.7													
	Gms.of fat per Kilo.			6.4	5.7	4.8													
	Month.			Feb.	Mar.	Apr.													
	X Rays.					fr.													
	Admitted to Hospital at 2 months, Dismissed at 4 months.										(Observed from 2 months. (Rickets at 5 months.								

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
10.	Diet.	Breast.	Allen-bury No.1.	Bray's Food.	do.	do.	W.M. 30 Ozs.	W.M. 30 Ozs.	W.M. 30 Ozs.	W.M. 30 Ozs.	W.M. 35 Ozs.	do.	do.	do.	do.	do.			
James	Fat in Gms.						27.0.	27.0.	27.0.	28.8.	31.5.	31.5.	31.5.	31.5.	31.5.	31.5.			
Coyle.	Wt.in Kilos.						4.1.	5.3.	6.0.	7.0.	7.7.	8.0.	8.2.	8.6.	9.0.	9.5.			
	Gms.of fat per Kilo.						6.6.	5.1.	4.5.	4.1.	4.1.	3.9.	3.8.	3.7.	3.5.	3.3.			
	Month.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	
	X Rays.															-		-	

General diet consisted of 2 pints milk, butter, gravy, soup, bread.
Radiograph *tr* at 1.11/12 yrs.

(Observed from 5 months.
(Rickets at 1.11/12 yrs. (April)

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
11.	Diet.	W.M. 24 Ozs.	W.M. 24 Ozs.	Sis. L. Food.	do.	do.	do.	do.	do.	1% fat 30 Ozs. then W.M. 18 Ozs.	W.M. 18 Ozs.	W.M. & Whey.	W.M. 35 Ozs.	W.M. 35 Ozs.	W.M. 2 Pts.	W.M. 2 Pts.	W.M. 2 1/2 Pts. & Butter.	do.	do.
Alfred	Fat in Gms.									12.6.	16.2.	22.0.	31.5.	31.5.	36.0.	36.0.	45.0.	45.0.	45.0.
Quinn.	Wt.in Kilos.									4.36.	4.6.	4.9.	5.0.	5.34.	6.0.				
	Gms.of fat per Kilo.									2.9.	3.5.	4.5.	6.3.	5.9.	6.0.				
	Month.									May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
	X Rays.									<i>tr</i>	<i>tr</i>	<i>tr</i>		-				?	<i>tr</i>

Note:- Rickets occurred first on a fat poor diet, healed, and then recurred on a fat rich diet.

Admitted to Hospital at 8 months.
Dismissed at 13 months.

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
12.	Diet.	Breast.	Breast & BCM 12 Oz.	Breast & BCM 12 Oz.	W.M. 30 Ozs.	W.M. 33 Ozs.	W.M. 30 Ozs.	W.M. 31 Ozs.	W.M. 35 Ozs.	W.M. 35 Ozs.									
Alex.	Fat in Gms.				27.0.	29.7.	27.0.	27.9.	31.5.	31.5.									
Gay.	Wt.in Kilos.		3.9.	4.3.	5.0.	5.8.	6.6.	6.6.	7.6.	8.0.									
	Gms.of fat per Kilo.				5.5.	5.1.	4.0.	4.2.	4.1.	3.9.									
	Month.		Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.									
	X Rays.							?		<i>tr</i>									

Admitted to Hospital at 1 month.
Dismissed at 4 months.

Operated on at $\frac{1}{12}$ for pyloric stenosis.
Throve well afterwards
- no vomiting.

(Observed from $\frac{1}{12}$.
(Rickets at $\frac{9}{12}$.

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
13.	Diet.	Breast.	Breast.	Breast.	F.C.	do.	do.	W.M.	W.M.	W.M.									
					Glaxo.			36	36	36									
								Ozs.	Ozs.	Ozs.									
James	Fat in																		
	Gms.				22.5.	25.0.	27.5.	32.4.	32.4.	32.4.									
Murray	Wt.in																		
	Kilos.							4.3.	5.0.	5.3.									
	Gms.of																		
	fat per							7.5.	6.4.	5.9.									
	Kilo.																		
	Month.							Jan.	Feb.	March.									
	X Rays.									+									

(Observed from 6/12.
Rickets at 9/12.

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
14.	Diet.	Breast.	do.	do.	do.	do.	do.	W.M.	W.M.	W.M.	W.M.								
								30	30	30	32.5								
								Ozs.	Ozs.	Ozs.	Ozs.								
Arch.	Fat in																		
	Gms.							27.0.	27.0.	27.0.	29.15.								
Holmes	Wt.in																		
	Kilos.							6.0.	6.2.	6.3.	6.5.								
	Gms.of																		
	fat per							4.5.	4.3.	4.2.	4.4.								
	Kilo.																		
	Month.							Jan.	Feb.	Mar.	April.								
	X Rays.										+								

(Observed from 6/12.
Rickets at 10/12.

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
15.	Diet.	Breast.	do.	do.	do.	do.	do.	do.	W.M.	W.M.	W.M.	W.M.	W.M.	W.M.					
									25	25	30	32.5.	35	35					
									Ozs.	Ozs.	Ozs.	Ozs.	Ozs.	Ozs.					
James	Fat in																		
	Gms.								27.5.	27.6.	27.0.	29.25.	31.5.	31.5.					
Cochrane	Wt.in																		
	Kilos.								6.0.	6.8.	7.3.	7.7.	8.0.	8.3.					
	Fat per																		
	Kilo.								3.6.	3.3.	3.7.	3.8.	3.9.	3.7.					
	Month.								Nov.	Dec.	Jan.	Feb.	Mar.	Apr.					
	X Rays.													+					

(Observed from 7/12.
Rickets at 1.1/12.

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
16.	Diet.	Breast	W.M. 18 Ozs.	Nestle's Milk.	Pep. Milk. 12 Ozs.	1 1/2 fat 34 Ozs.	1 1/2 fat 28 Ozs.	W.M. 28 Ozs.	W.M. 28 Ozs.	W.M. 26 Ozs.	W.M. 35 Ozs.	W.M. 35 Ozs.	Diet 1.						
	Fat in Gms.				16.2.	7.2.	12.6.	25.2.	25.2.	23.4.	31.5.	31.5.							
	Wt.in Kilos.				2.7.	3.3.	4.0.	4.6.	5.5.	6.4.	7.5.	8.6.							
	Gms.of fat per Kilo.				6.0.	2.5.	3.1.	5.4.	4.6.	3.6.	4.2.	3.7.							
	Month.				Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.			
	X Rays.															+			
Diet 1 consisted of milk 1 1/2 pints, butter, soup, and gravy daily.														(Observed from 3 months. (Rickets at 1.3/12 yrs. (Slight deficiency of fat during 4th & 6th months)					

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
17.	Diet.	Breast	do.	do.	W.M. 18 Ozs.	W.M. 18 Ozs.	W.M. 25 Ozs.	W.M. 27 Ozs.	W.M. 30 Ozs.	W.M. 32.5 Ozs.	W.M. 35 Ozs.	W.M. 35 Ozs.	Diet 1.						
	Fat in Gms.					19.8.	22.5.	24.3.	27.0.	29.25.	31.5.	31.5.							
	Wt.in Kilos.					3.0.	3.8.	4.4.	5.2.	5.6.	5.8.	6.6.							
	Gms.of fat per Kilo.					6.0.	6.0.	5.5.	5.2.	5.3.	5.4.	4.7.							
	Month.					Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April.
	X Rays.							+	-		-	-		-					+
Diet 1 contained 1 pint milk, margarine soup, gravy.														(Observed from 4/12. (Rickets at 7/12 and at 1.6/12.					

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
18.	Diet.	W.M. 12 Ozs.	W.M. 12 Ozs.	Savory & Moore's Food.	do.	do.	W.M. 25 Ozs.	W.M. 33 Ozs.	W.M. 35 Ozs.	W.M. 26 Ozs.	W.M. 35 Ozs.	W.M. 35 Ozs.	W.M. 35 Ozs.	W.M. 35 Ozs.	W.M. 35 Ozs.	Diet 1.			
	Fat in Gms.							29.7.	31.5.	23.4.	31.5.	27.5.	27.6.	27.5.	27.6.				
	Wt.in Kilos.							4.6.	4.8.	5.2.	5.4.	5.6.	5.9.	6.3.	7.0.				
	Gms.of fat per Kilo.							6.4.	6.5.	4.5.	5.8.	5.6.	5.4.	4.9.	4.5.				
	Month.							Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.			
	X Rays.															+			
Diet 1 contained 1 pint milk, margarine , soup and gravy.														(Observed from 6 months. (Rickets at 1.3/12 yrs.					

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
19.	Breast	W.M.	W.M.	W.M.	W.M.	W.M.	W.M.	W.M.	W.M.	W.M.	W.M.	W.M.	W.M.	Diet					
	Diet.	&	18	21	25	28	30	32.5	35	32	35	35	1.						
	W.M.	Cream.	Ozs.	Ozs.	Ozs.	Ozs.	Ozs.	Ozs.	Ozs.	Ozs.	Ozs.	Ozs.	Ozs.						
	Fat in			16.2.	18.9.	22.5.	25.2.	27.0.	29.25.	31.5.	28.8.	31.5.	31.5.						
	Gms.																		
	Wt. in			2.4.	2.7.	3.4.	4.3.	5.3.	6.0.	7.0.	7.3.	8.0.	9.0.						
	Kilos.																		
JANE CONNELLY	Gms. of			6.9.	7.0.	6.6.	5.9.	5.0.	4.8.	4.5.	3.9.	3.9.	3.5.						
	fat per																		
	Kilo.																		
	Month.			Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	
	X Rays.							-	-	-		-		?				two	

Diet 1 contained 1 pint milk, butter, gravy and soup daily.

{ Observed from 2 months.
Rickets at 1.5/12.

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
20.	Diet.	Breast.	do.	do.	W.M. 24 Ozs.	W.M. 30 Ozs.	W.M. 30 Ozs.	W.M. 35 Ozs.	W.M. 33 Ozs.	W.M. 30 Ozs.	W.M. 34 Ozs.	W.M. 35 Ozs.	W.M. 35 Ozs.						
	Fat in Gms.							31.5.	29.7.	27.0.	31.5.	31.5.	31.5.	31.5.					
	Wt. in Kilos.							4.5.	4.8.	5.42.	6.0.		6.9.						
	Gms. of fat per Kilo.							7.0.	6.1.	4.9.	5.2.		4.5.						
	Month.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.					
	X Rays.										-		+						

JOHN ROBERTSON

There were clinical signs of rickets at 10 months, but the radiograph was negative. Was not under direct observation during April and May.

Admitted to Hospital at 6 months. Dismissed from Hospital at 9 months. Epilepsy, and removed from town at 10 months. Returned at 13 months.

{ Observed from 6 mths
Rickets at 13 months

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
21.	Diet.	Breast.	do.	do.	do.	do.	do.	do.	do.	do.	do.	Diet 1.							
	Fat in Gms.																		
	Wt. in Kilos.																		
	Gms. of fat per Kilo.																		
	Month.																		
	X Rays.																		

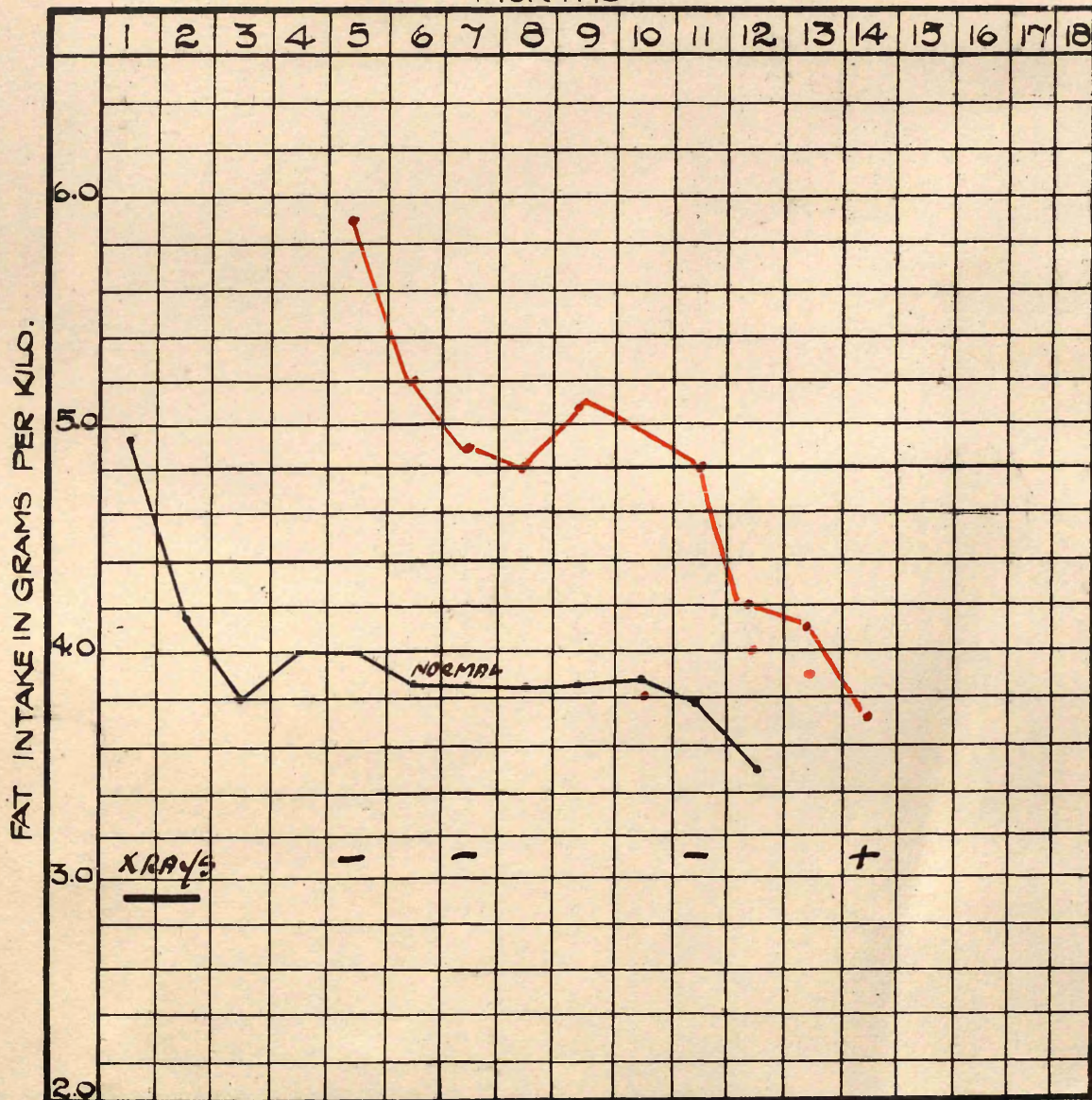
8

This child was seen at 1.12 with rickets. Radiographs became normal and then rickets recurred at 2.5/12 yrs. (March) on a diet containing milk, margarine, soup and gravy.

APPENDIX B.

I. MARY HAY.

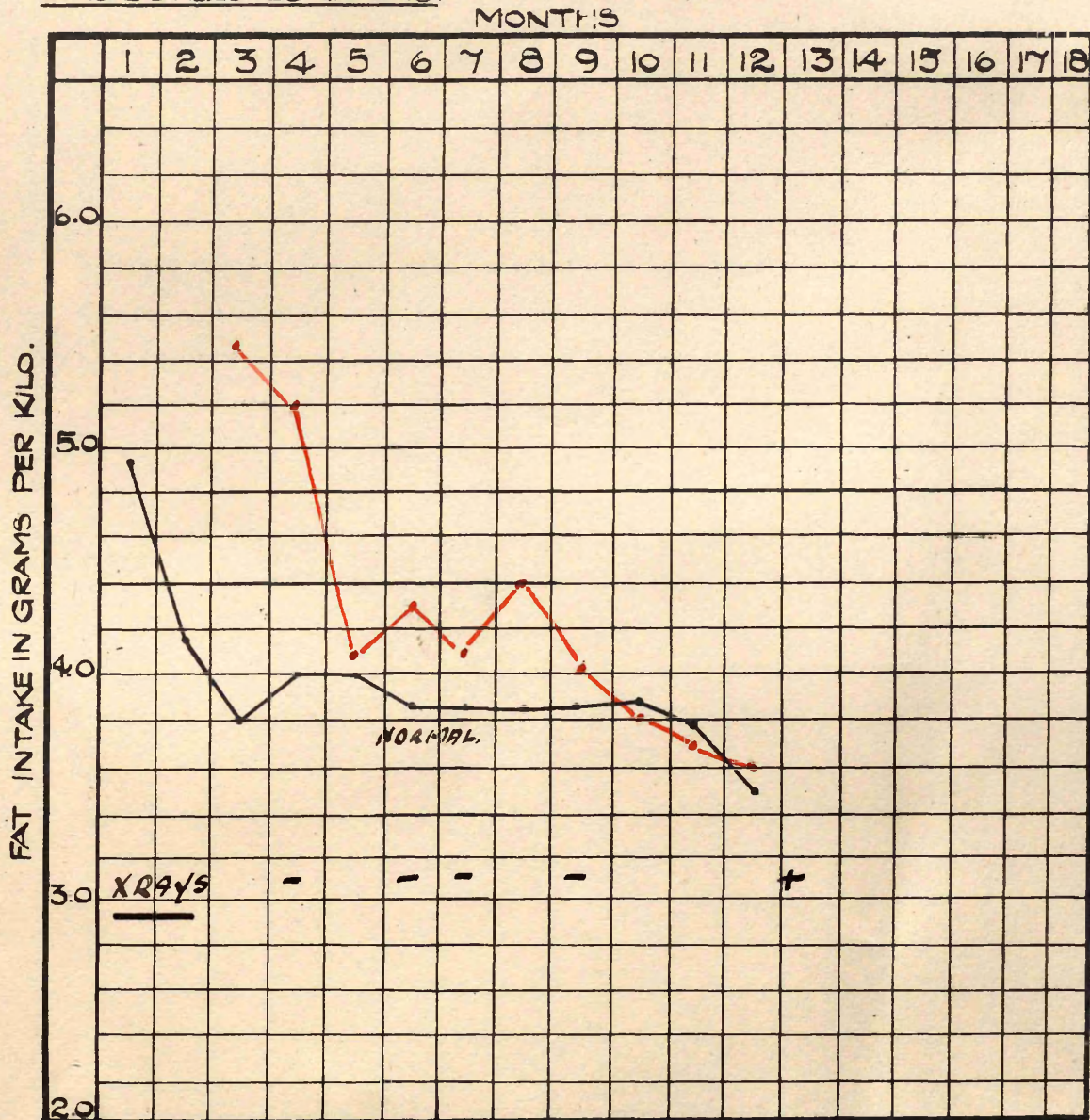
CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER
KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD
WHO DEVELOPED RICKETS ON A FAT SUFFICIENT DIET.
 MONTHS



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

2. ANNIE CHISHOLM

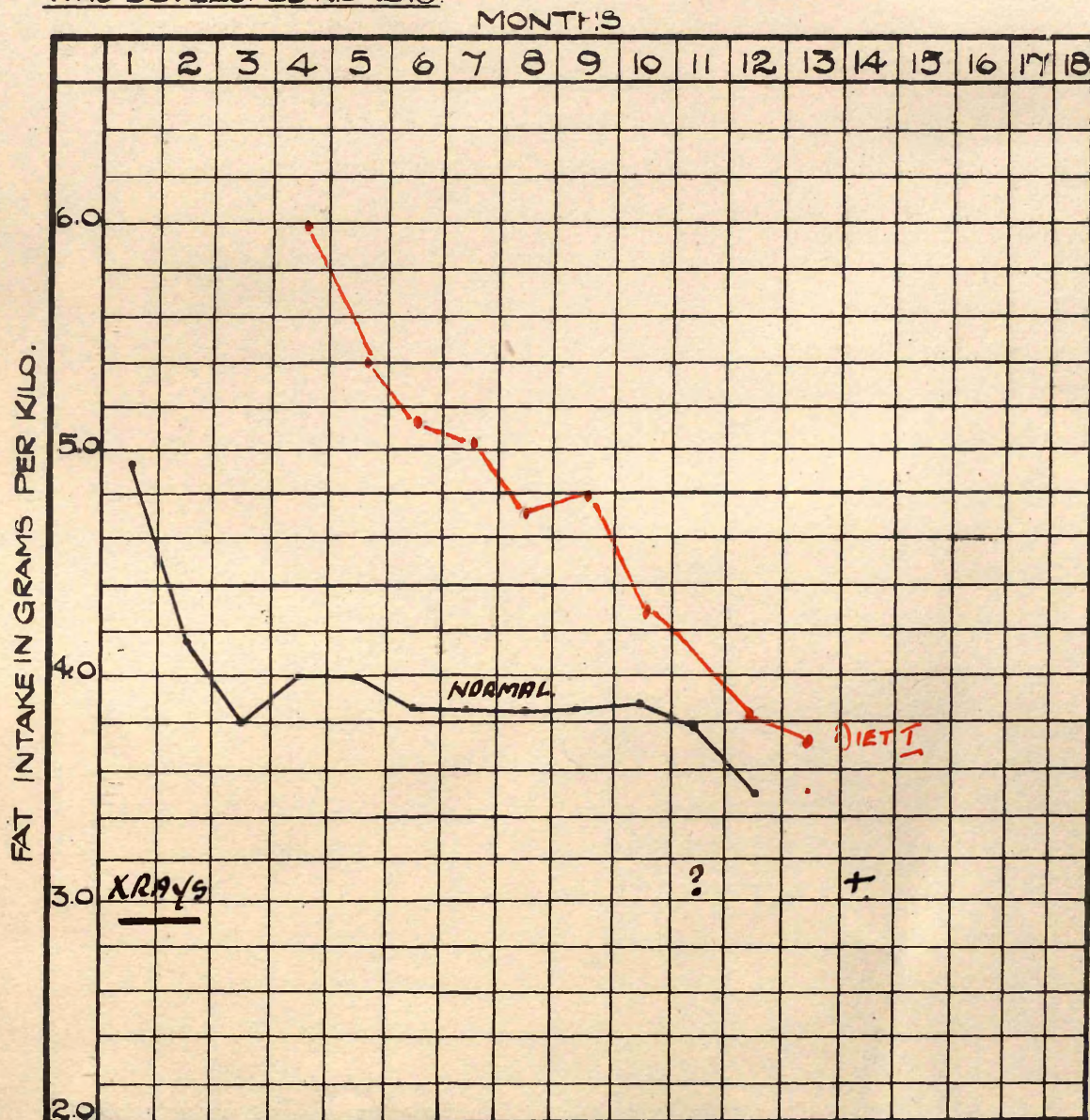
CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER
KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD
WHO DEVELOPED RICKETS.



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

3. DAVID WARK

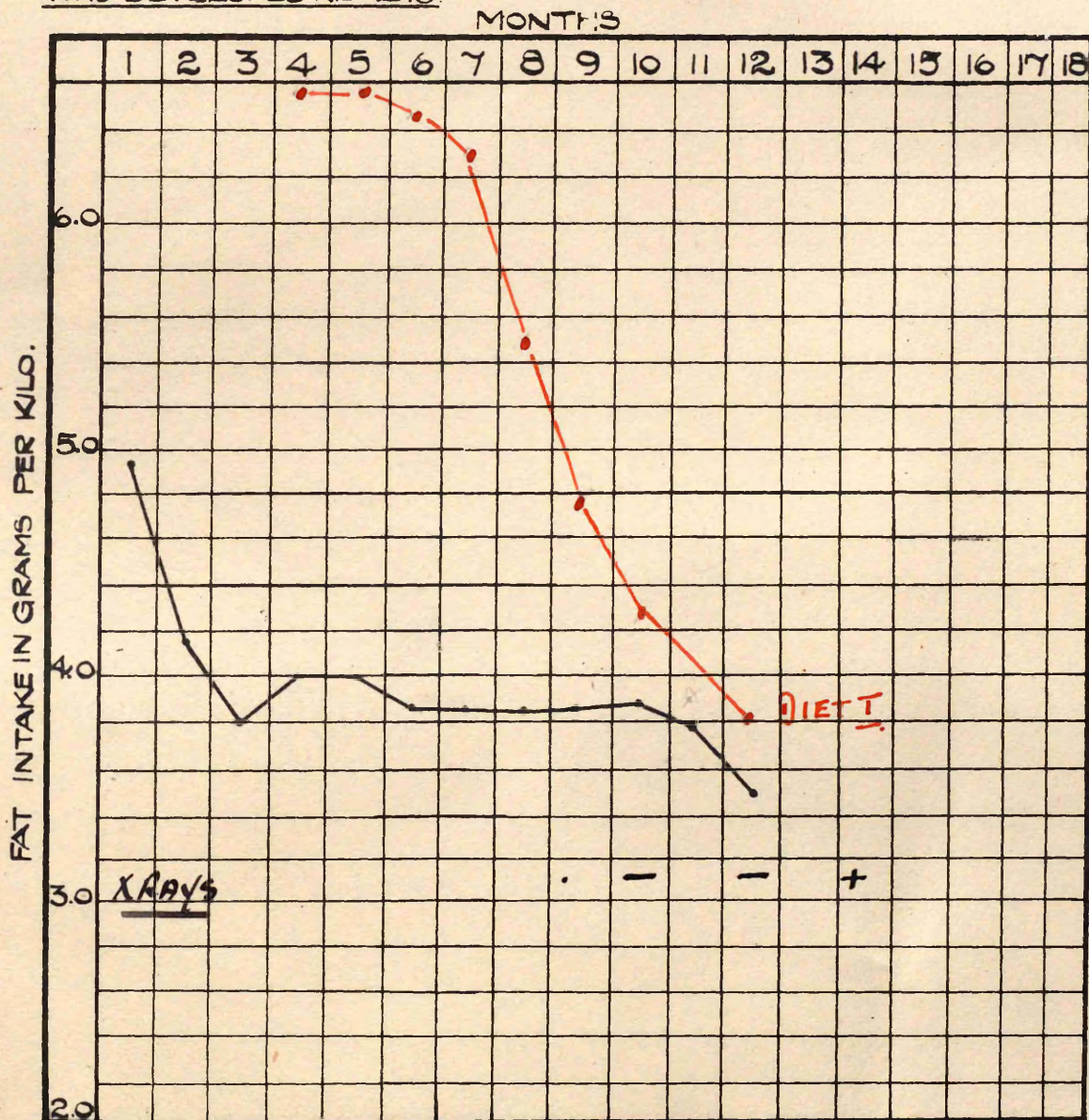
CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD WHO DEVELOPED RICKETS.



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

4 AGNES HARLEY

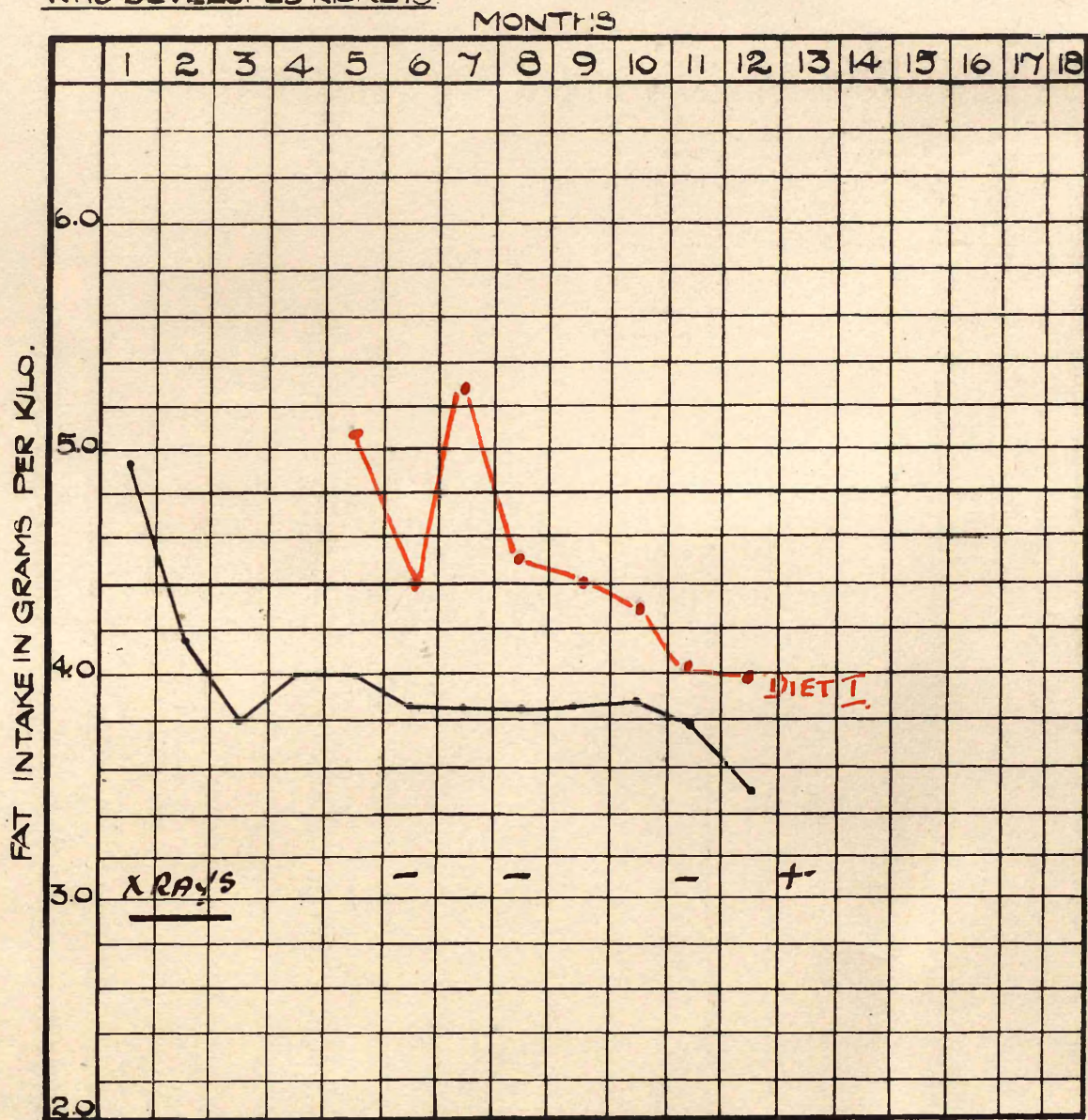
CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD WHO DEVELOPED RICKETS.



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

S. CHARLES McGUIRAN.

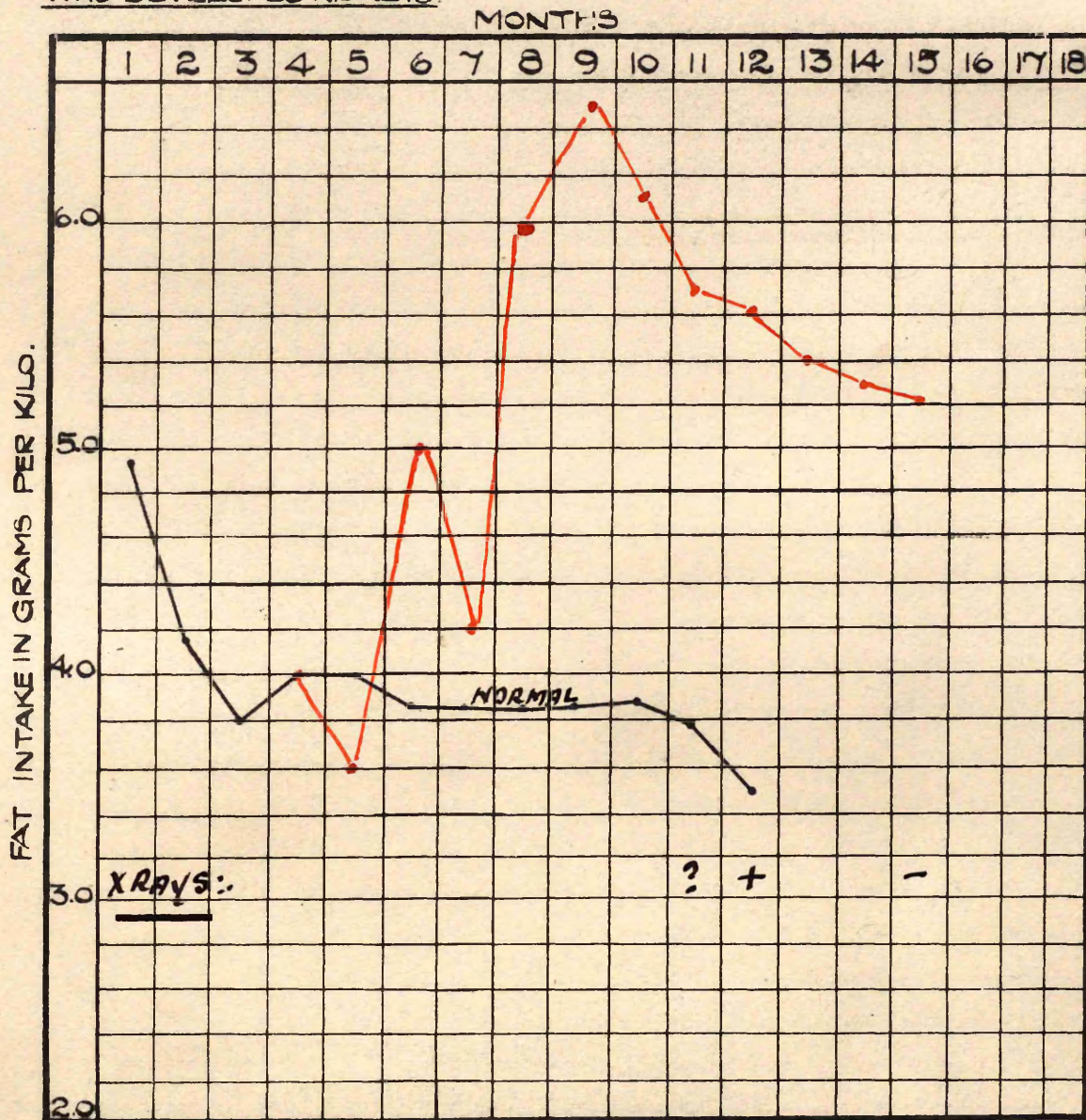
CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER
KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD
WHO DEVELOPED RICKETS



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

G. JOHN HILL

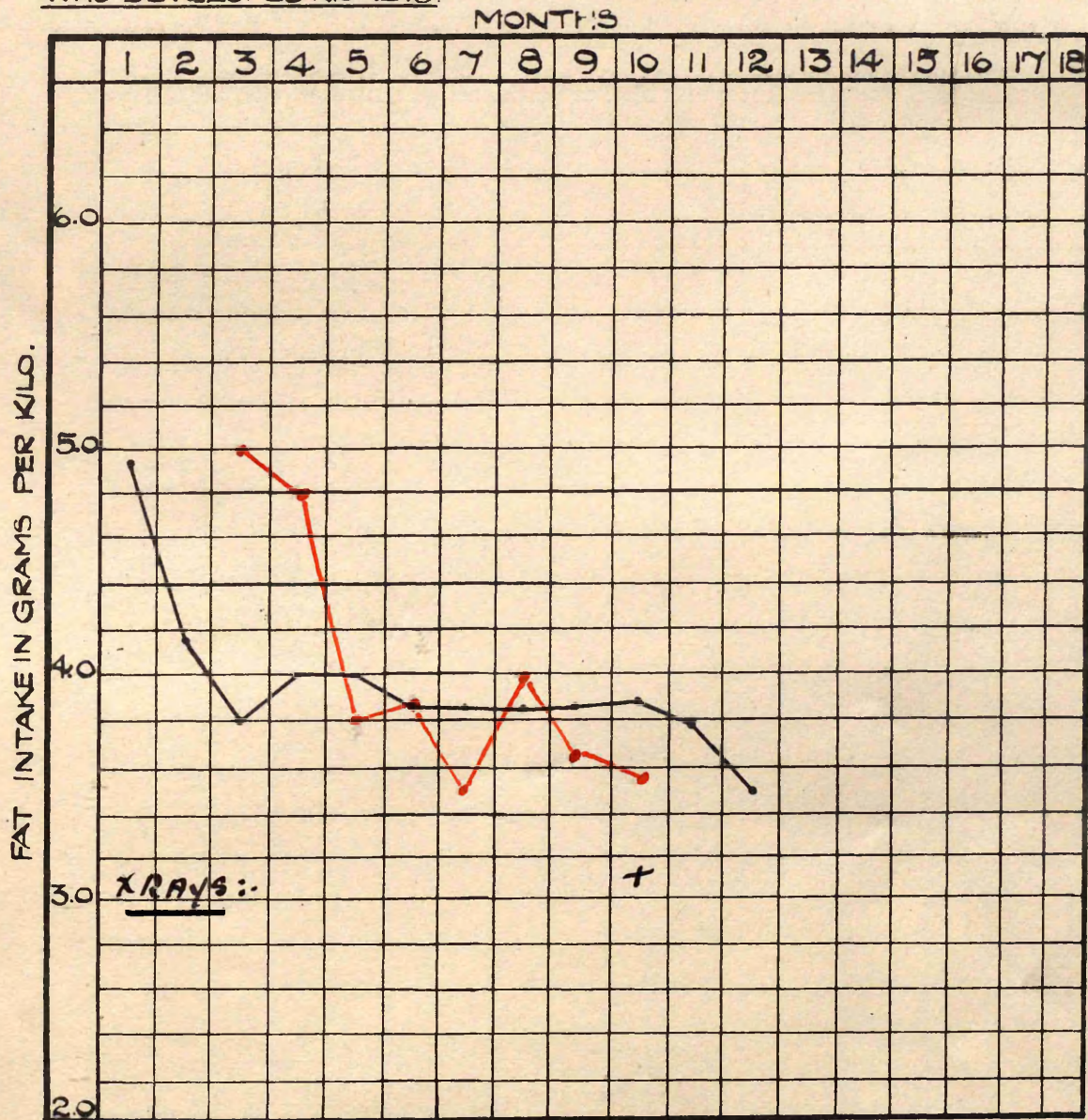
CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD WHO DEVELOPED RICKETS.



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

Y. JOHN HAMILTON

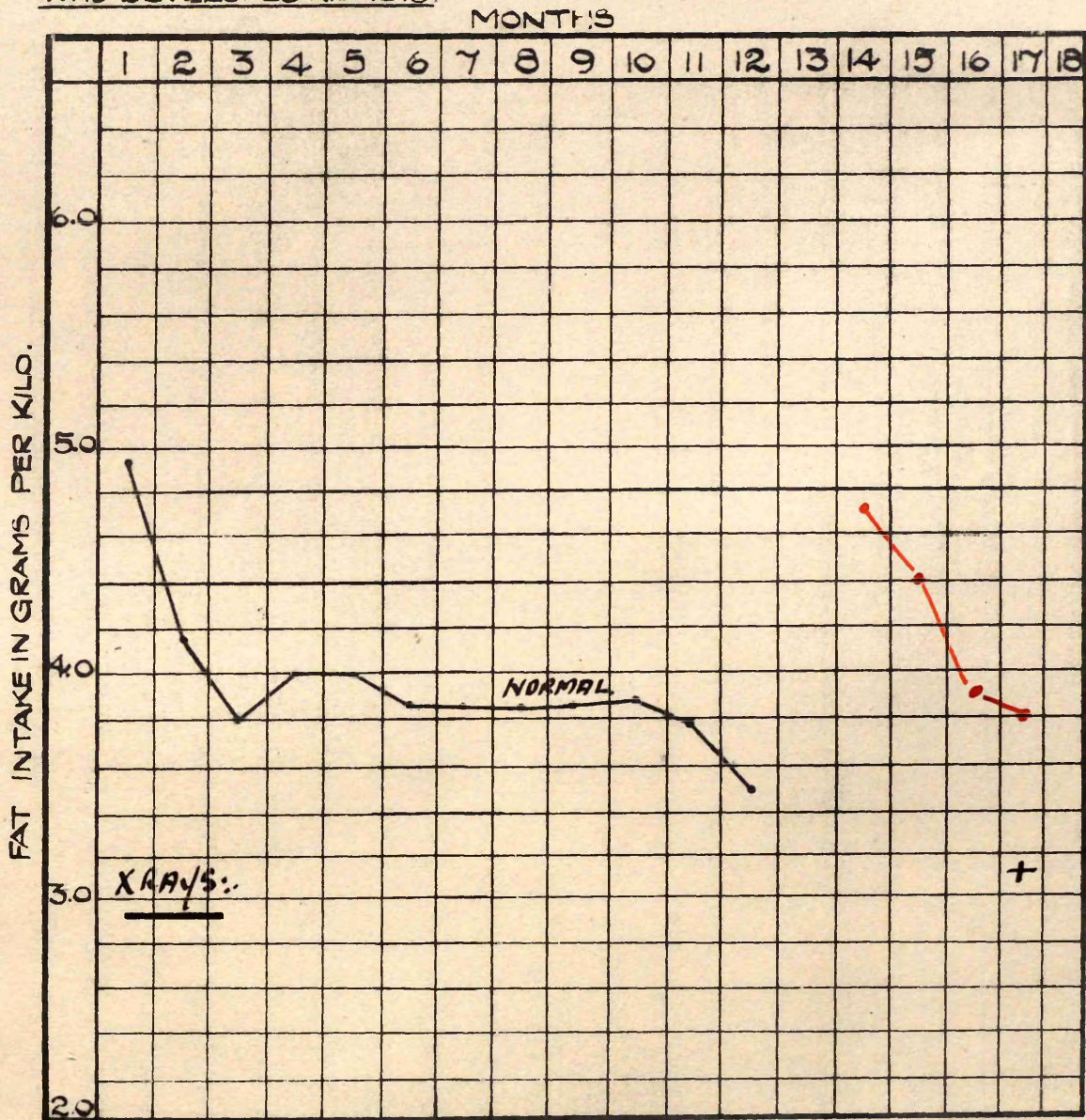
CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD WHO DEVELOPED RICKETS.



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

8. PATRICK CROSSAN

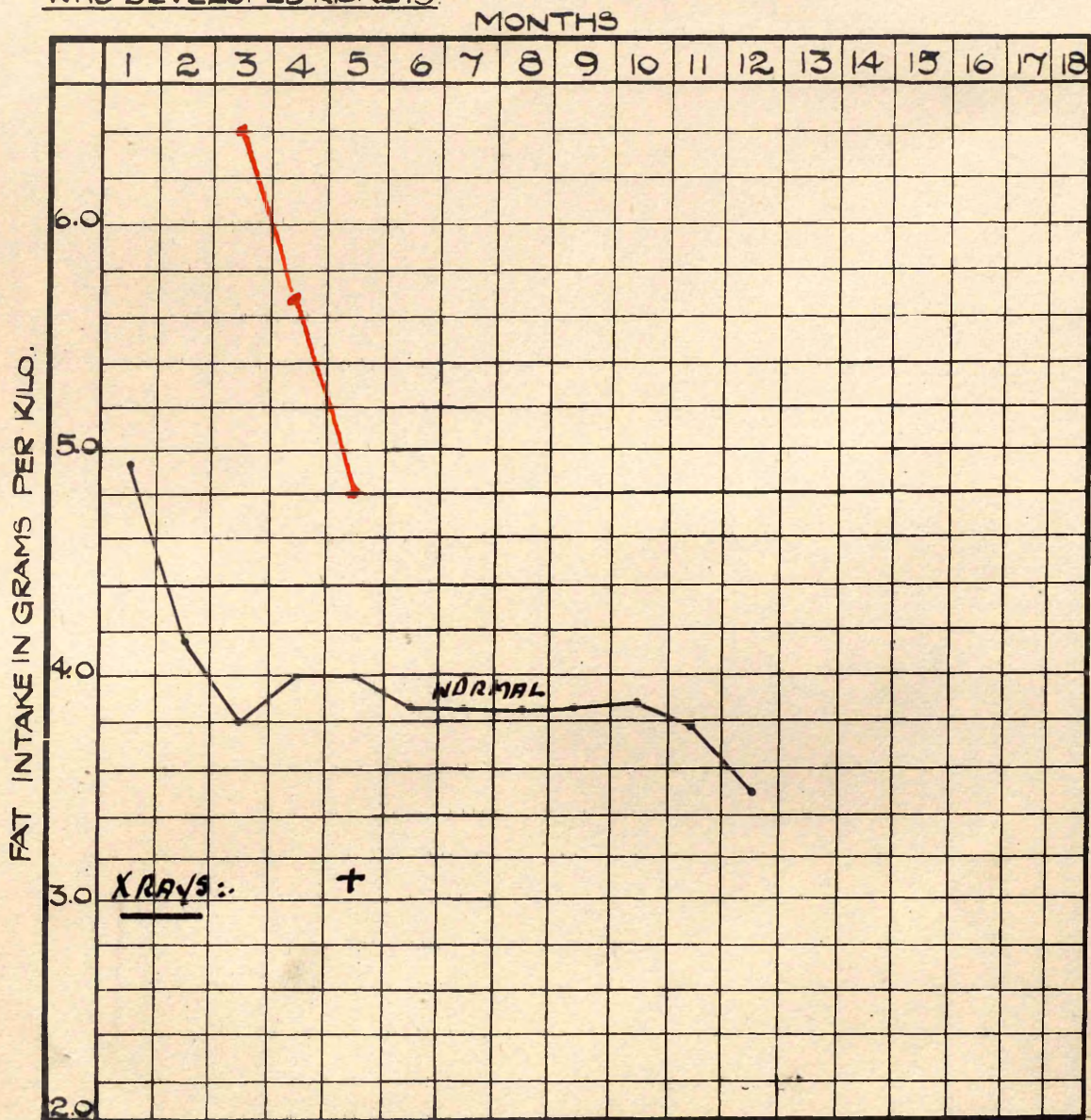
CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD WHO DEVELOPED RICKETS.



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

G. PHYLLIS McLEARN

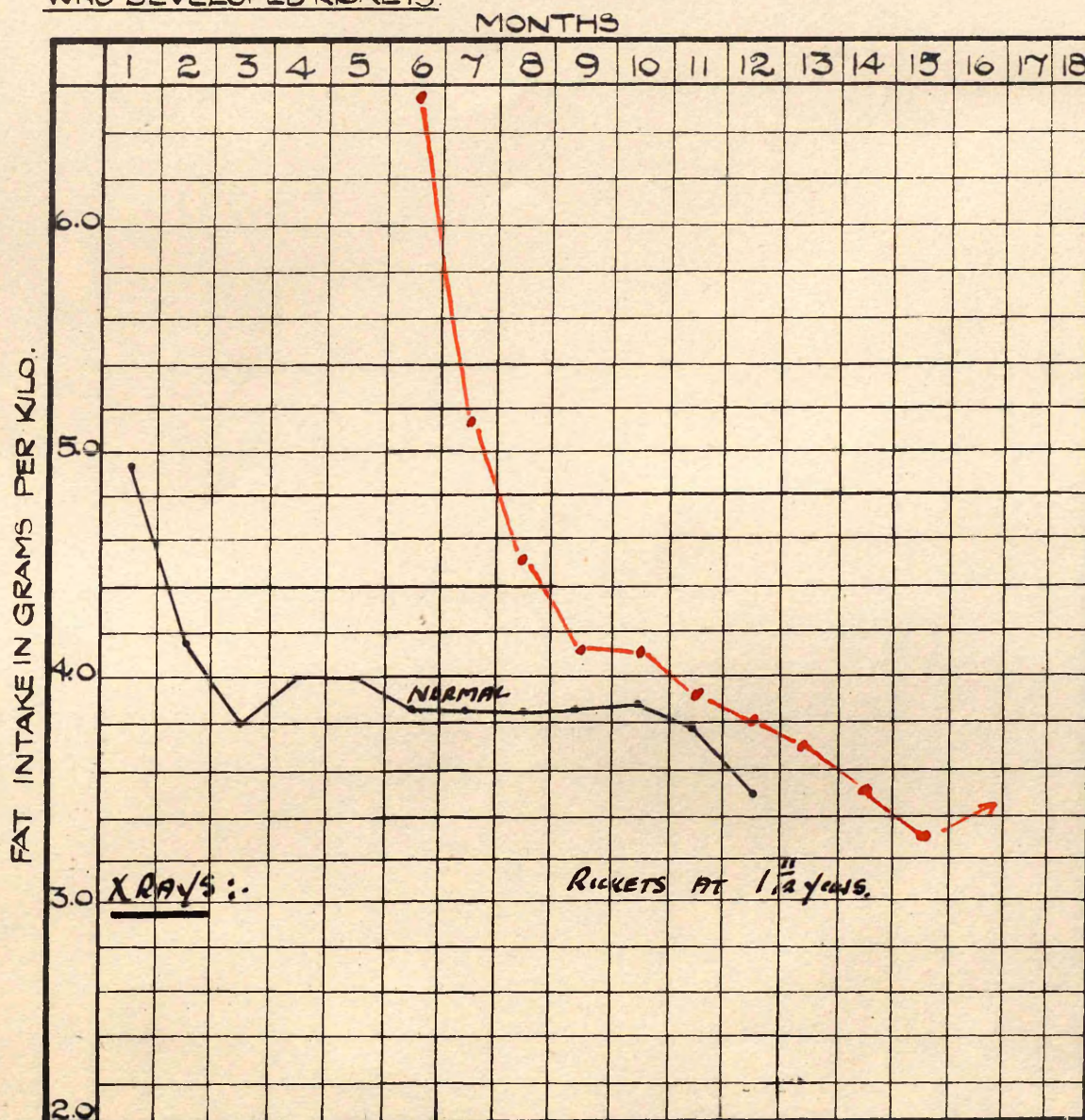
CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD WHO DEVELOPED RICKETS.



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

10. JAMES COYLE

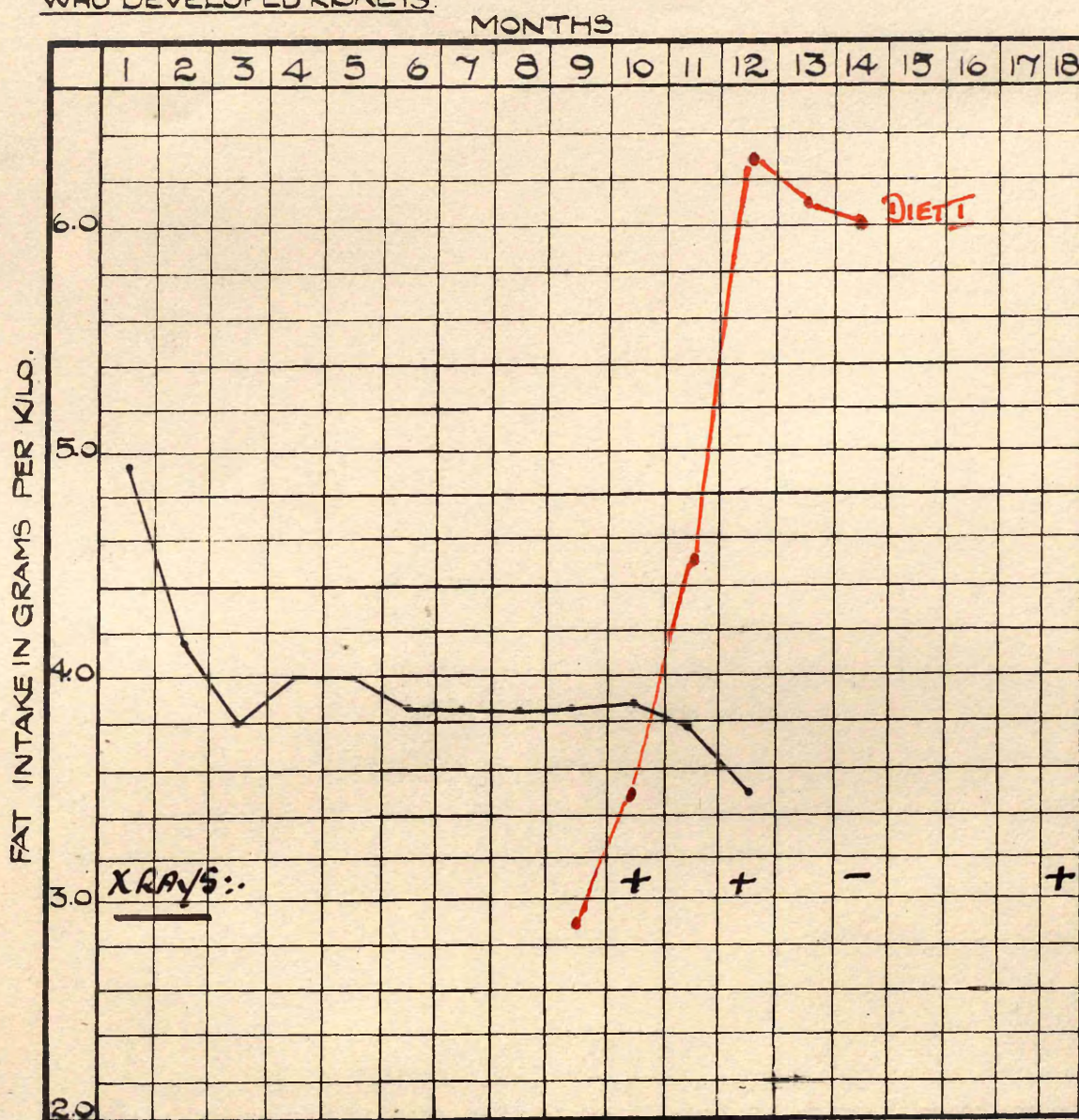
CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER
KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD
WHO DEVELOPED RICKETS.



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

11. ALFRED QUINN.

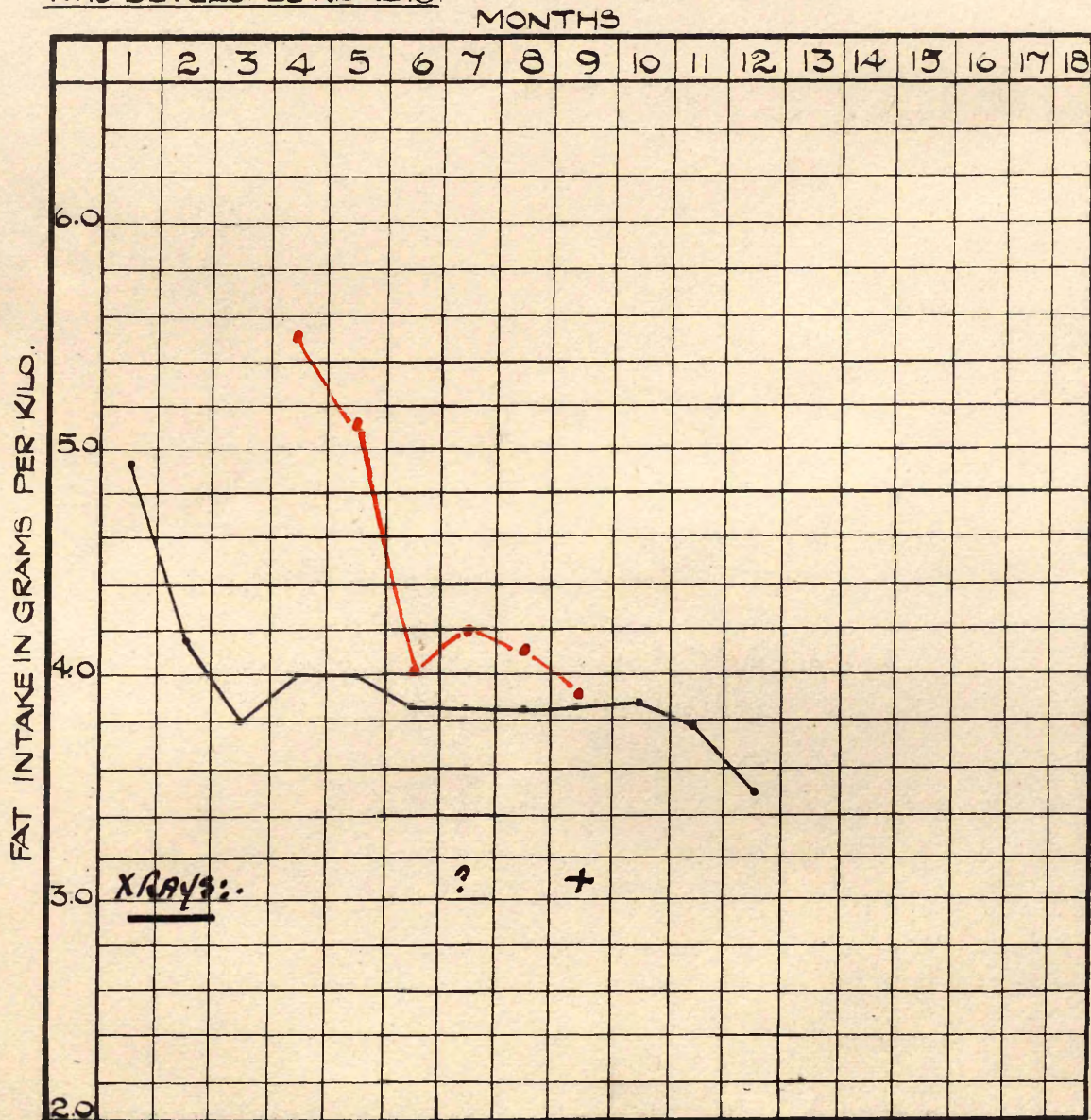
CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD WHO DEVELOPED RICKETS.



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

12 ALEX GAY.

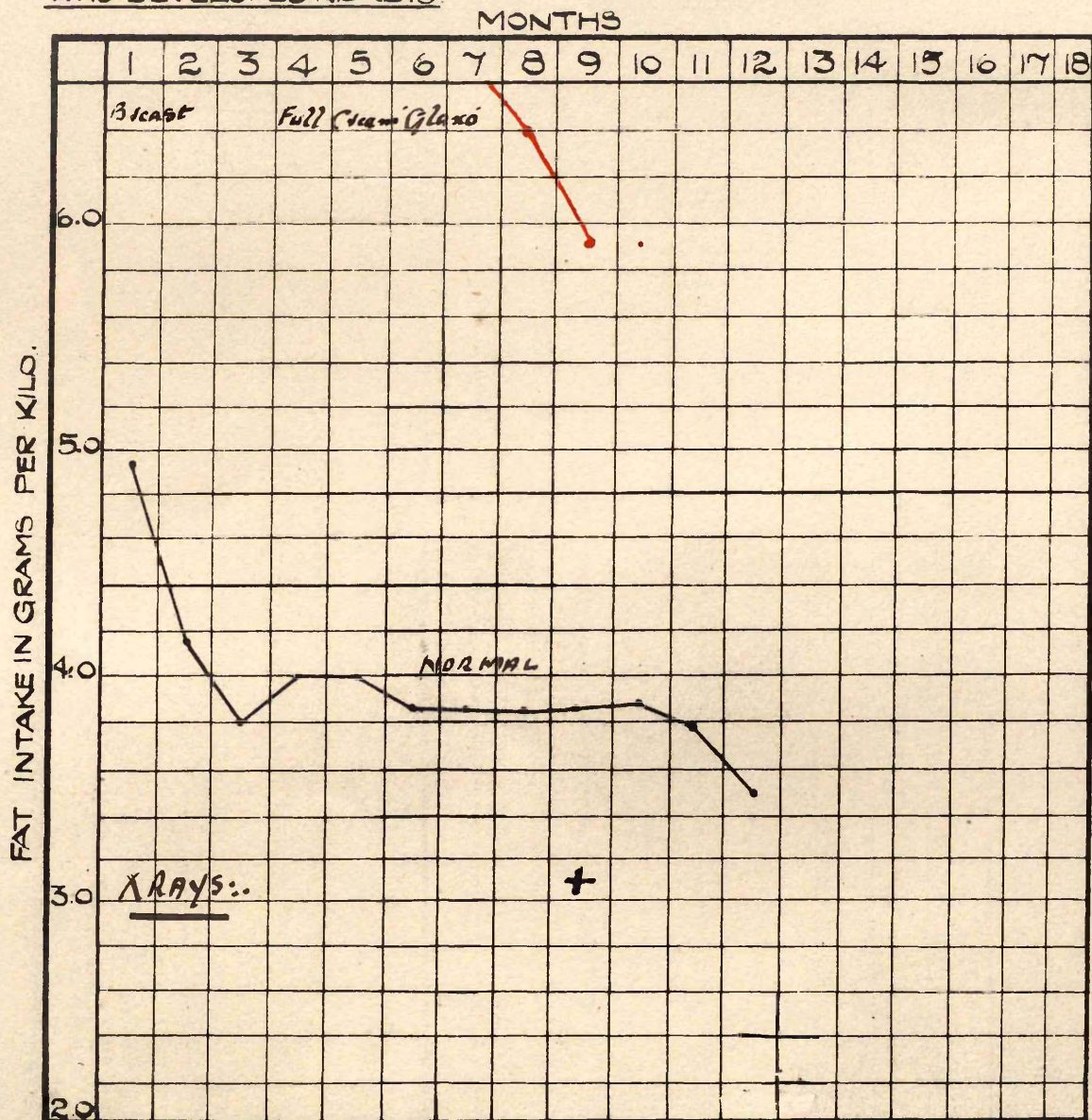
CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD WHO DEVELOPED RICKETS.



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

13 JAMES MURRAY

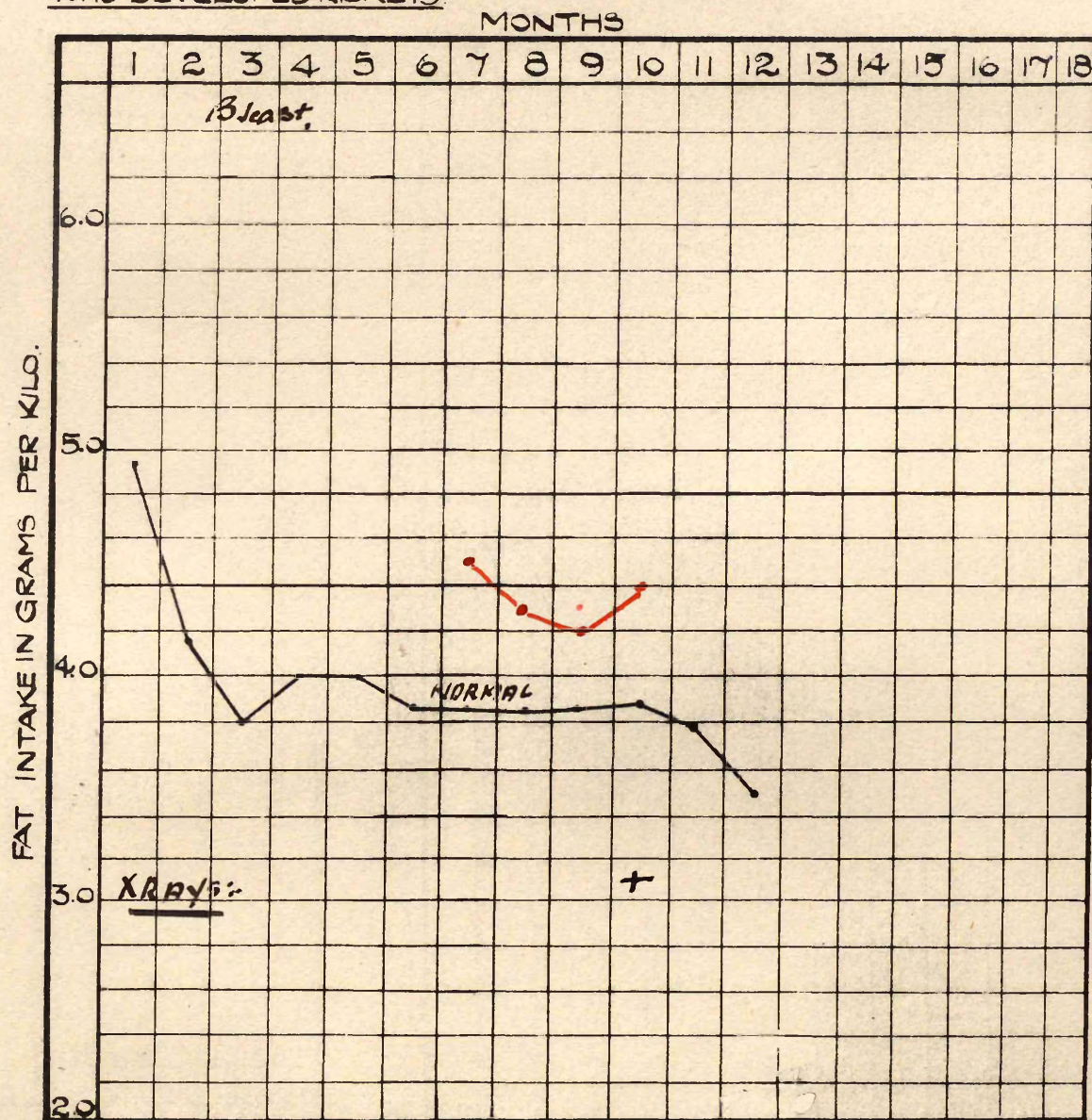
CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD WHO DEVELOPED RICKETS



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

14. ARCHIBALD HOLMES

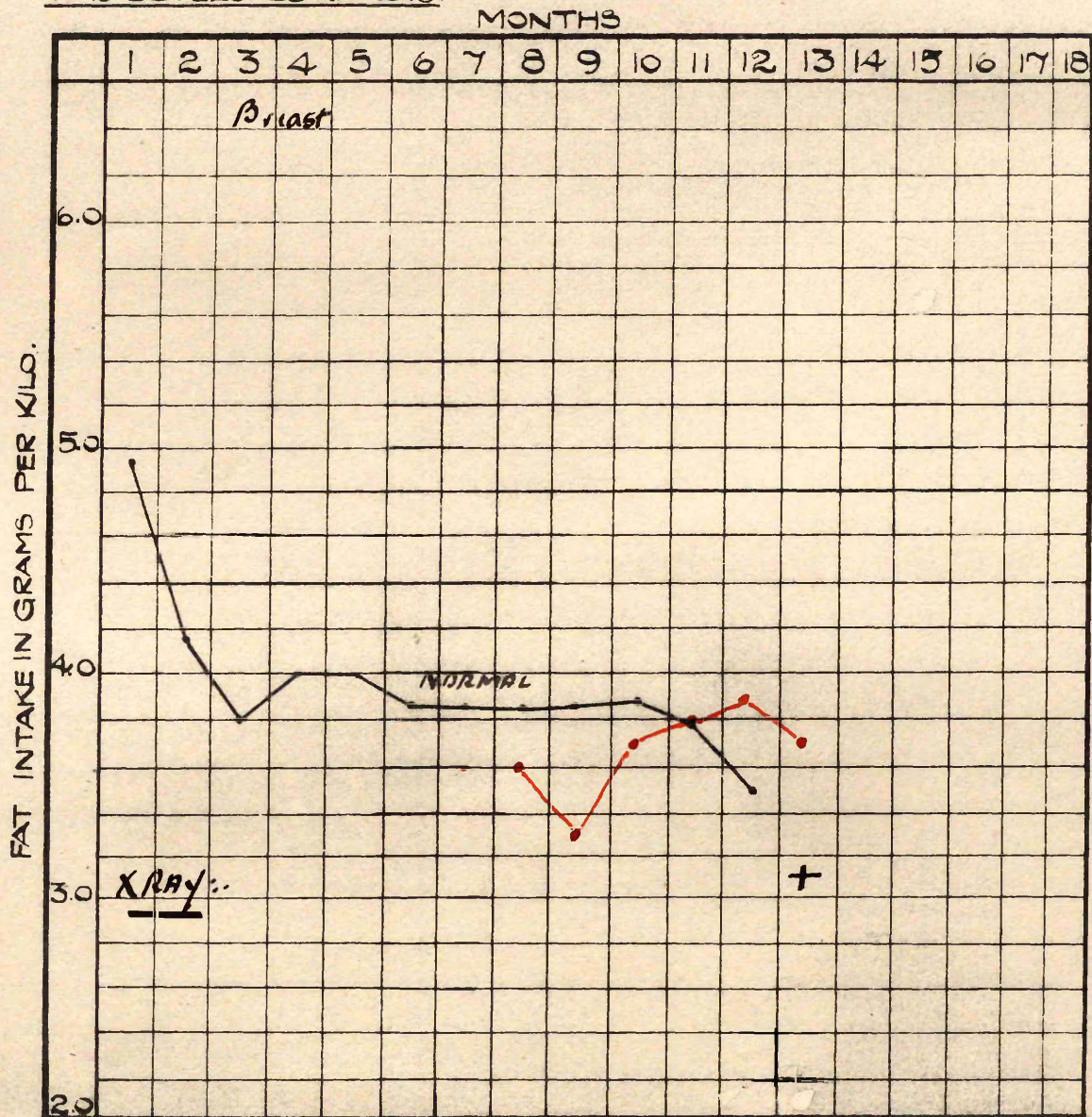
CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER KILLO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD WHO DEVELOPED RICKETS



4.86/4.16/3.8/4.0/4.0/3.86/3.84/3.86/3.87/3.88/3.8/3.5

15. JAMES COCHRANE

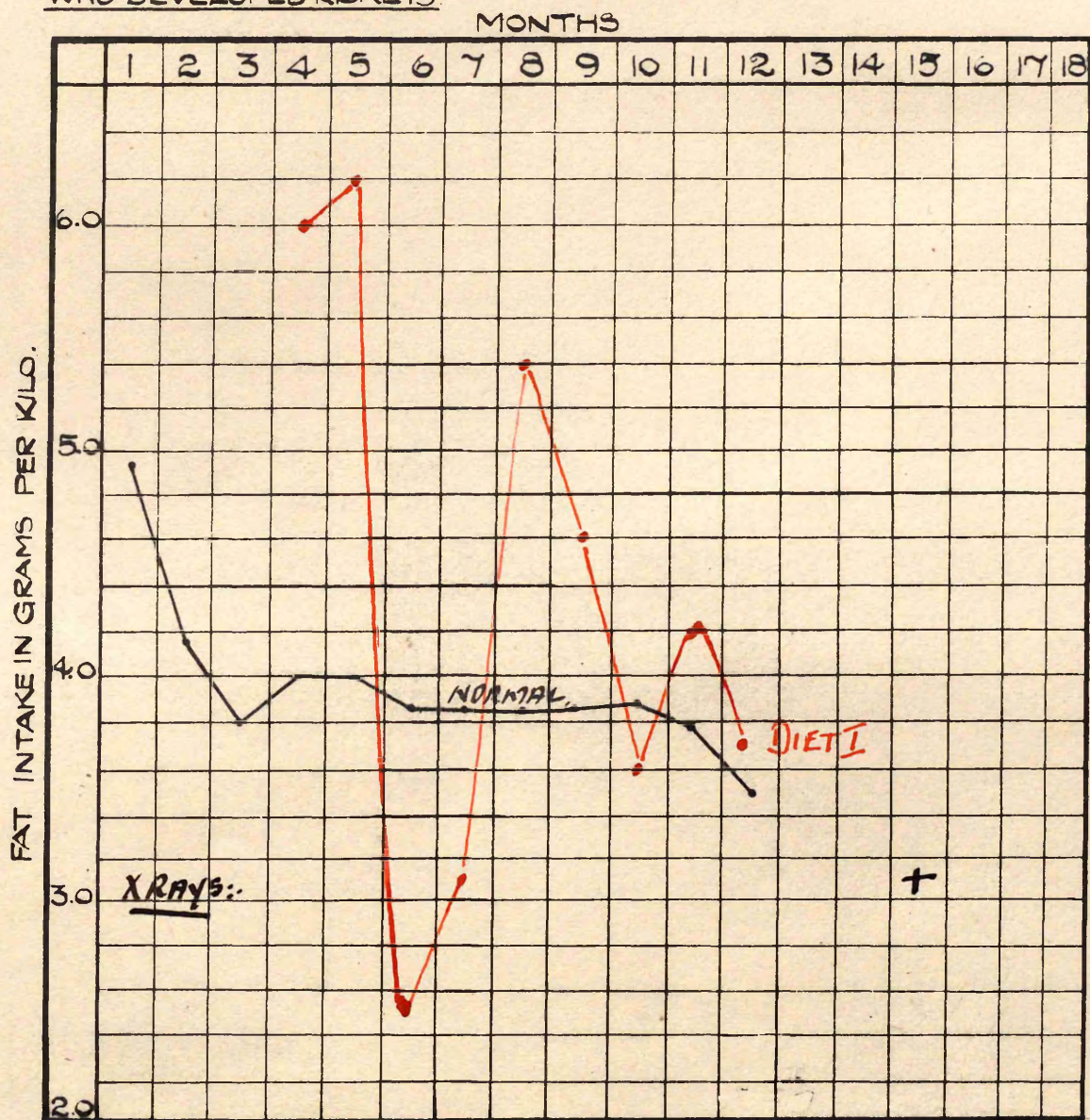
CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD WHO DEVELOPED RICKETS



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

16. JOHN McILWRAITH.

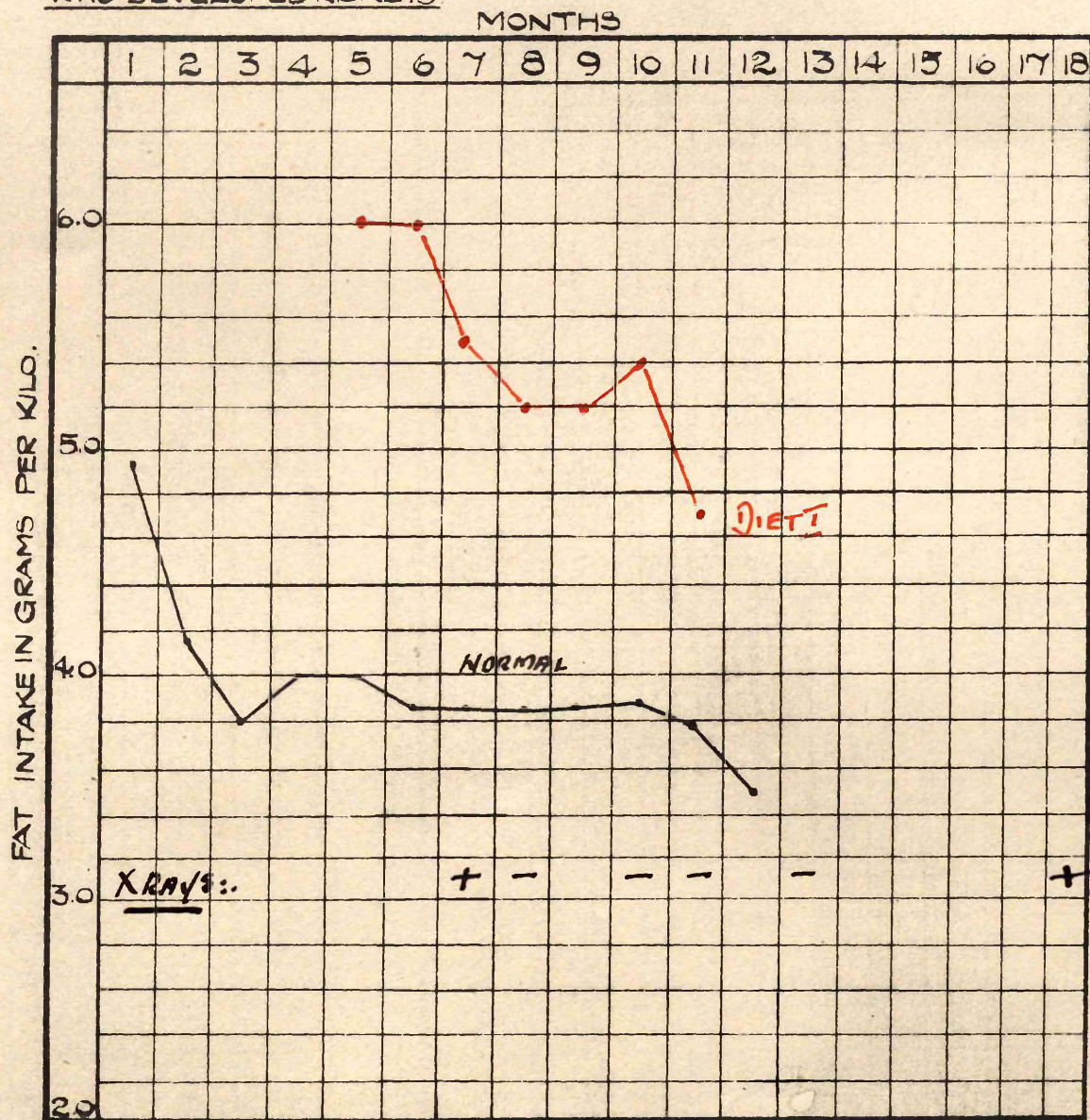
CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD WHO DEVELOPED RICKETS.



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

17. ANDREW HAYLOR

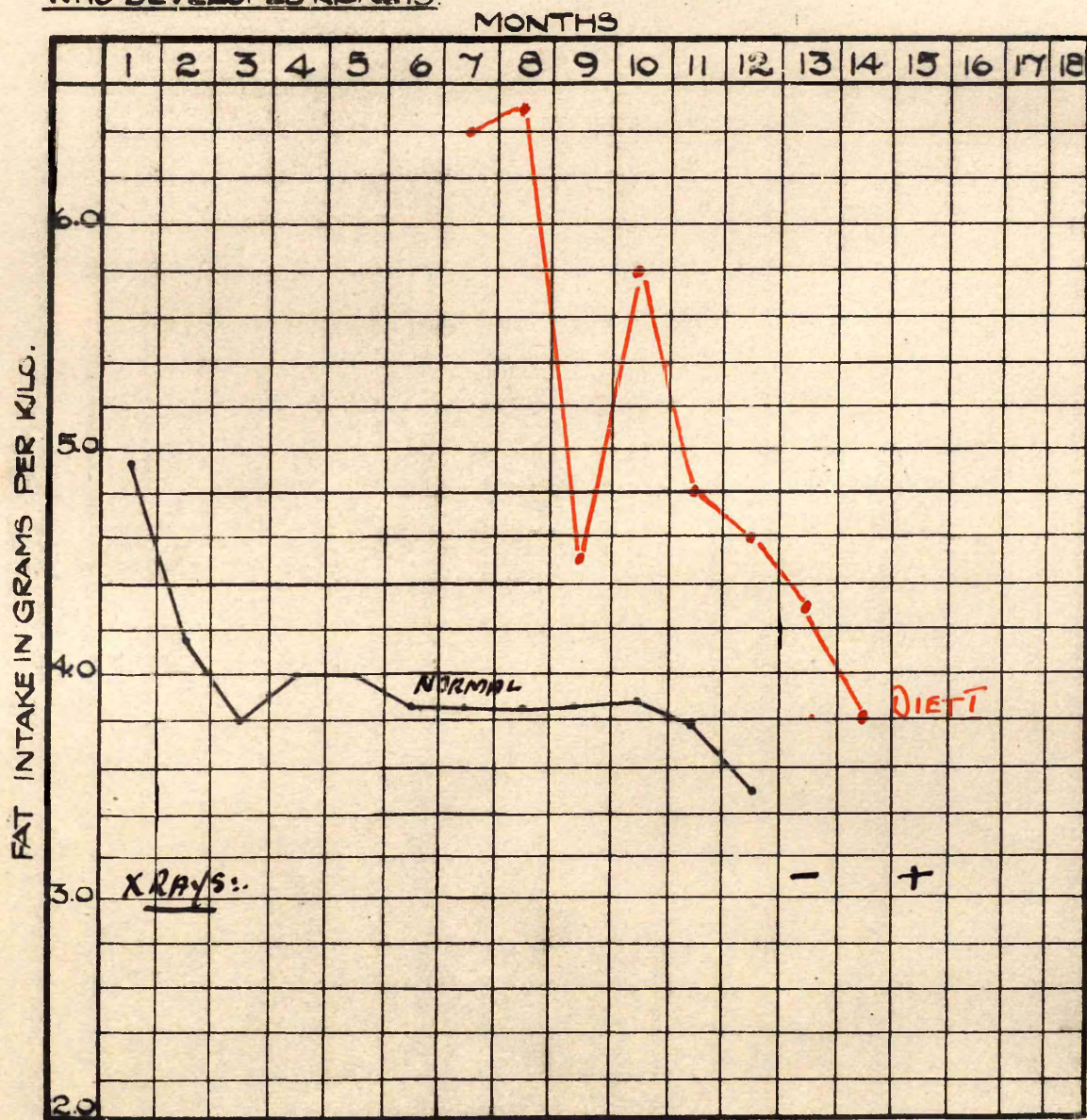
CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD WHO DEVELOPED RICKETS



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

18. HARRY DICK.

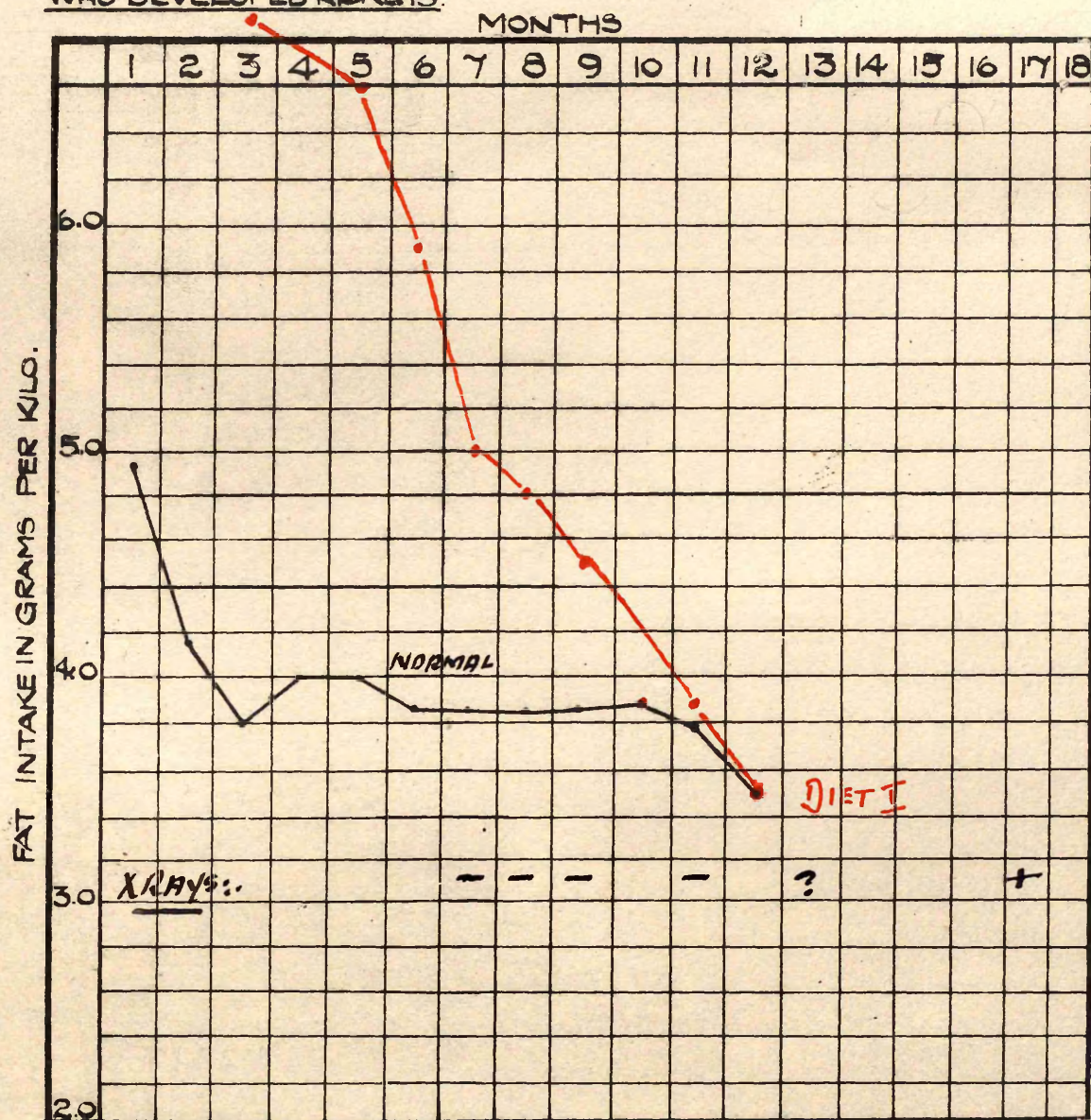
CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD WHO DEVELOPED RICKETS.



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

19. JANE CONNELLY

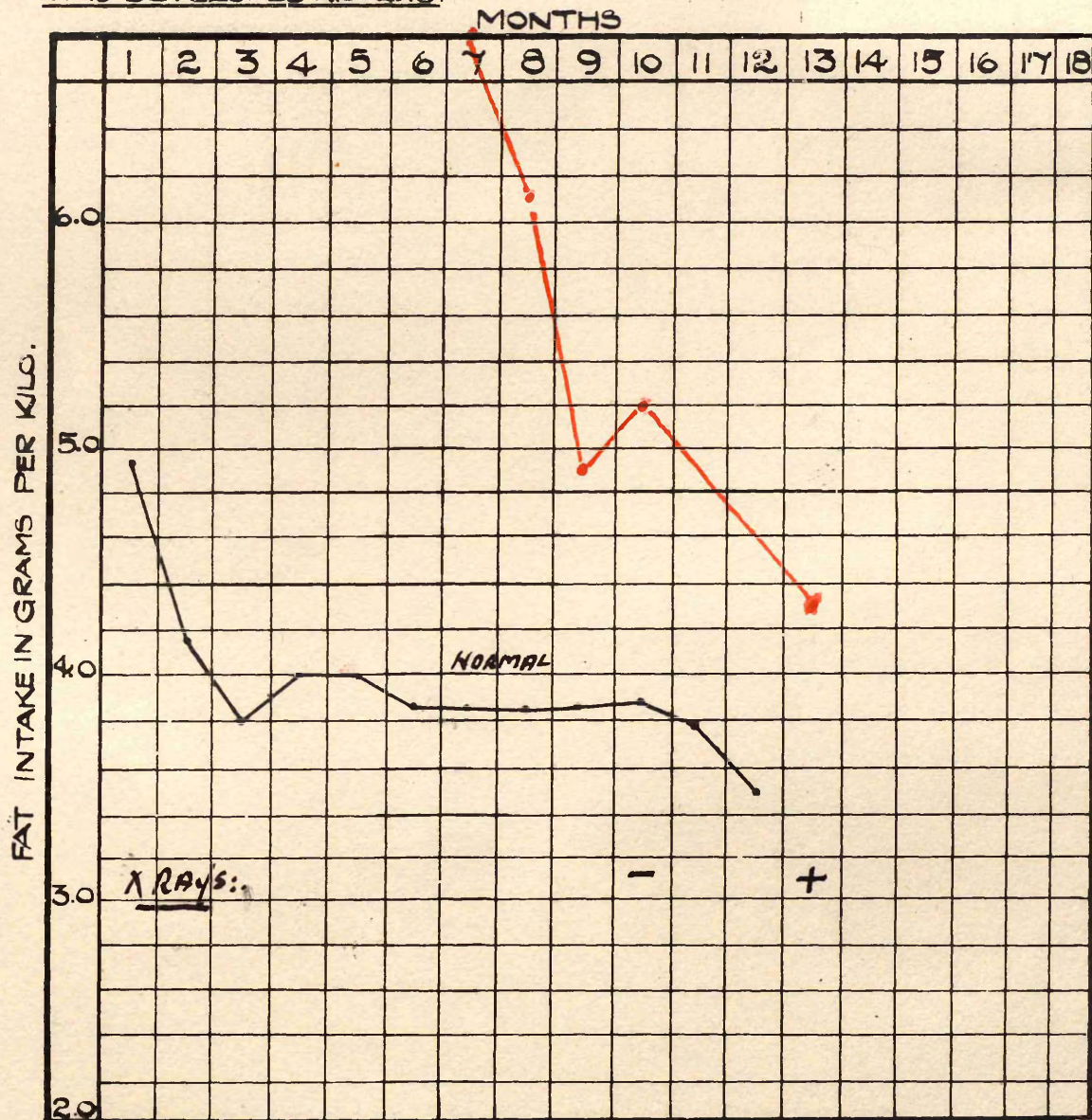
CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER
KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD
WHO DEVELOPED RICKETS.



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

20. JOHN ROBERTSON

CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD WHO DEVELOPED RICKETS.



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

APPENDIX C.
DETAILS OF DIET OF CHILDREN UNDER OBSERVATION ON FAT DEFICIENT DIET.

Note:- In column of daily intake of carbohydrate -

S = Cane sugar.
S.L. = Sister Laura's Food.

A. WINTER.

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1.	Diet.	Breast.	Glaxo.	Glaxo.	W.M. 20 oz.	W.M. 20 oz.	W.M. 20 oz.	W.M. 24 oz.	W.M. 24 Oz. 1.5% 48 oz.	1.5% 42 oz.	1.5% 35 oz.	1.5% 35 oz.	W.M. 22.5 oz.	Diet 1.		
Mary Angus.									S. 8. 12.12.	S.18. SL.3.	S.15. SL.7.5.	S. 17.5.				
	Fat in Gms.								21.6. 18.9.	18.9.	15.75.	15.75	20.25.			
	Wt.in Kilos.								5.4.	6.0.	6.2.	6.8.	6.8.			
	Gms.of fat per Kilo.								3.7.	3.15.	2.5.	2.3.	2.9.			
	Month.								Nov.	Dec.	Jan.	Feb.	March.	Apr.	May.	June.
	X Rays.								-		-	-	-			-

{ Observed from 7½ to 12 months on poor fat diet.
Negative for rickets at 12 months and at 15 months.

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
2.	Diet.	Breast.	Breast.	1.5% 24 Oz.	1.5% 28 Oz.	1.5% 28 Oz.	1.5% 42 Oz.	1.5% 40 Oz.	1.5% 48 Oz.	1.5% 48 Oz.	W.M. 30 Oz.					
David Rose.				S.16.	S.14.	S.7.	S.L.7.	S.14. SL.7.	S.14. SL.7.	S.14. SL.7.	S.12. SL.6.					
	Fat in Gms.			10.8.	12.6.	12.6.	18.9.	18.0.	21.6.	21.6.	27.0.					
	Wt.in Kilos.			5.0.	5.3.	6.0.	6.7.	7.0.	7.5.	8.0.	9.0.					
	Gms.of fat per Kilo.			2.1.	2.4.	2.1.	2.8.	2.6.	2.8.	2.7.	3.0.					
	Month.			Feb.	March.	Apr.	May.	June.	July.	Aug.	Sept.					
	X Rays.			-		+		Heal- ing.		Heal- ing.	Heal- ing.					

{ Observed from 2 months to 9 months on poor fat diet.
Rickets at 4½ months. Healing progressed during the summer on poor diet.

MODERATELY
SEVERE
(Slight).

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
3.	Diet.	Glaxo.	Glaxo.	W.M. 24 Oz.	W.M. 24 Oz.	W.M. 24 Oz.	1.5% 35 Oz.	1.5% 35 Oz.		1.5% 35 Oz.	W.M. 35 Oz.	W.M. 35 Oz.	W.M. 35 Oz.	Diet 1.	with 2 Pts.	W.M.
Thomas Canning							S.16.	S.15.		S.15.	S.7.	S.7.	S.7.			
	Fat in Gms.						15.75.	15.75.		15.75.	15.75.					
	Wt.in Kilos.						4.4.	4.3.		4.9.	5.3.					
	Fat per Kilo.						3.6.	3.6.		3.2.	3.0.					
	Month.						Oct.	Nov.	Dec.	Jan.	Feb.	March.	Apr.	May.	June.	
	X Rays.								-	-					+	

{ Observed during 6th, 7th and 9th month on fat poor diet. In Fever Hospital at 8 months.
(Negative for rickets at 9 months but positive at 13 mths. (Moderately severe)

(Observed from 8 months on fat poor diet.
(Rickets at 1 year. (Severe)

{ Observed from 4 months on poor fat diet.
{ Rickets at 11 months.

{Fontanelle almost closed.
{6 teeth.

(No sign of rickets at 10 months.

(Severe).

(Observed from 2 months on poor fat diet.
(Negative for rickets at 6 months.

Died of Bronchopneumonia at 7 months.
Clinically negative for rickets.

This child was observed in hospital.

She had congenital obliteration of the bile ducts, and fat absorption was therefore very low.

(Observed from 8 to 14 months, on poor fat diet.
{ Negative for rickets at 14 months, but slight rickets
{ at 16 months. (Slight).

Diet 1. 1 pint milk,
margarine, gravy.

AT 10 MONTHS { 7 teeth at ~~10 months~~.
Fontanelle well closed.

Is strong on feet. No sign of rickets.

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
13.	Diet.	Breast.	do.	do.	do.	do.	do.	do.	do.	1% fat 35 oz.	1% fat 35 oz.	1% fat 35 oz.				
Thomas Wyllie.	Carbo- hydrate.									S.12.	S.12.	S.12.				
	Fat in Gms.									10.5.	10.5.	10.5.				
	Weight.									5.0.	5.8.	6.2.				
	Fat per Kilo.									2.1.	1.8.	1.7.				
	Month.									Feb.	March.	April.				
	X Rays.												+			
(Observed from 8 to 11 months, on fat poor diet. (Rickets at 11 months.																
Clinically negative at 8 months. Clinically positive for rickets at 12 months. (Slight)																
Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
14.	Diet.	Breast.	Allen- bury No.1.	W.M. 18½ oz.	W.M. 27 oz.	W.M. 27 oz.	W.M. 30 oz.	W.M. 20 oz.	W.M. 30 oz.	W.M. 25 oz.	W.M. 25 oz.	W.M. 25 oz.	W.M. 25 oz.	W.M. 25 oz.		
Mathew Maxwell.	Carbo- hydrate.							S.5.	S.10.	S.10.	S.10.	S.10.	S.10.	S.10.		
	Fat in Gms.							18.0.	27.0.	22.5.	22.5.	22.5.	22.5.	22.5.		
	Weight.							5.5.	5.8.	6.3.	7.0.	7.3.	7.4.	7.8.		
	Fat per Kilo.							3.3.	4.6.	3.6.	3.2.	3.0.	3.0.	2.9.		
	Month.							Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.		
	X Rays.								-					+		
(On fat poor diet during 7th month and from 8th month onwards. (Rickets at 12 months.																
(Slight). No clinical sign at 12 months. Clinical signs present at 13 months.																
Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
15.	Diet.	S.L. Food & W.M.	S.L. Food & W.M.	W.M. 24 oz.	1% fat 24 oz.	1% 26 oz.		W.M. 30 oz.	W.M. 27 oz.	W.M. 32 oz.	W.M. 35 oz.	W.M. 35 oz.				
Eliza- beth. Davies.	Carbo- hydrate.				S½.	S½.										
	Fat in Gms.			21.6.	7.2.	7.8.	10.0.	27.0.	24.3.	28.8.	31.5.	31.5.				
	Weight.			2.2.	2.5.	3.2.	3.9.	4.5.	5.3.	5.9.	6.2.	6.7.	7.0.			
	Fat per Kilo.			10.0.	3.0.	2.4.	2.5.	6.0.	4.6.	4.8.	5.1.	4.7.	4.5.			
	Month.				Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.			
	X Rays.							+								
(Observed from 3 months to 6 months on fat poor diet. (Rickets at 6 months.																
Admitted to Hospital at 3 months. To Country Branch at 5 months. Dismissed at 7 months. (Slight).																

[illegible]

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1. Francis Muir.	Diet.	Breast.				1% fat.	1% fat.	1% fat.	W.M.	W.M.	W.M.	Diet				
	Carbo- hydrate.					24 oz.	24 oz.	24 oz.	24 oz.	35 oz.	35 oz.	1.				
	Fat in Gms.					S.15.	S.15.	S.15.								
	Wt. in Kilos.					7.2.	7.2.	7.2.								
	Fat per Kilo.					4.0.	4.7.	5.3.								
						1.8.	1.5.	1.4.								
	Month.				July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.			
X Rays.							-	-						-		

(Observed from 4 months to 7 months on fat poor diet.
 (Negative for rickets at 7 months, 8 months, and 13 months.

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
2. Edward Farmer.	Diet.	Breast.	Breast.	Nestles.	Nestles.	1.5% fat	1.5% fat	1.5% fat	1.5% fat	1.5% fat	1.5% fat					
						35 oz.	35 oz.	35 oz.	42 oz.	42 oz.	49 oz.					
	Carbo- hydrate.					S.14.	S.21.	S.21.	S.18.	S.21.	S.21.					
	Fat in Gms.					15.75.	15.75.	15.75.	18.9.	18.9.	22.05.					
	Wt. in Kilos.					5.7.	6.4.	7.0.	7.6.	8.0.	8.4.					
	Fat per Kilo.					2.8.	2.4.	2.3.	2.5.	2.4.	2.7.					
	Month.			Feb.	March.	April.	May.	June.	July.	Aug.	Sept.					
X Rays.						-				-	-					

Observed from 4 months.
 Neg. at 10 months.

Clinically negative at 10 months,
 and 4 teeth. Fontanelle well closed.
 Walks with support.

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
3. Mathew Shannon.	Diet.	Breast.	Glaxo F.C.	1.5% fat.	1.5% fat.	1.5% fat.	1.5% fat.	1.5% fat.	1.5% fat.	1.5% fat.						
				28 oz.	28 oz.	30 oz.	39 oz.	42 oz.	42 oz.	45 oz.						
	Carbo- hydrate.			S.14.	S.17.5.	S.12.	S.15.	S.15.	S.15.	S.12.						
				SL.7.	SL.7.	SL.7.	SL.7.	SL.7.	SL.7.	SL.6.						
	Fat in Gms.			12.6.	12.6.	13.5.	17.55.	18.9.	18.9.	20.25.						
	Wt. in Kilos.			4.3.	5.1.	6.0.	6.5.	7.0.	7.5.	8.0.						
	Fat per Kilo.			3.0.	2.6.	2.25.	2.7.	2.7.	2.5.	2.5.						
Month.				March.	April.	May.	June.	July.	Aug.	Sept.						
X Rays.						-				?						

Observed from 3 months,
 Radiograph doubtful at 9 months.

4 teeth. Fontanelle well closed. Stands strongly
 at 9 months. No clinical evidence
 of rickets.

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
4.	Diet.	Breast.	do.	do.	do.	do.	do.	do.	do.	do.	1.5% fat 35 oz.	1.5% 35 oz.	1.5% 40 oz.			
Margaret Mc- Monigal.	Carbo- hydrate.										S.12.5. S.L.5.	S.12.5. S.L.5.	S.12.5. S.L.5.			
	Fat in Gms.										15.75.	15.75.	18.0.			
	Weight.										7.2.	7.6.	8.0.			
	Fat per Kilo.										2.2.	2.0.	2.2.			
	Month.										March.	April.	May.	June.	July.	Aug.
	X Rays.										-			-		-

Observed from 9 months.

Neg. at 10, 12, & 14 months.

Note:- Had Olei Phosphorati m q daily during April.
and May.

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
5.	Diet.	Breast.	do.	do.	1.5% fat 26 oz.	1.5% 30 oz.	1.5% 39 oz.	1.5% 44 oz.	1.5% 48 oz.	1.5% 48 oz.	W.M. 30 oz.					
Thelma Winning.	Carbo- hydrate.				S.12. SL.6.	S.12. SL.6.	S.15. SL.3.	S.15. SL.3.	S.15. SL.3.	S.15. SL.3.	S.15. SL.3.					
	Fat in Gms.				11.7.	13.5.	17.5.	19.8.	21.6.	21.6.	27.					
	Weight.				5.0.	5.3.	6.2.	6.7.	7.1.	7.7.	8.4.					
	Fat per Kilo.				2.3.	2.5.	2.8.	2.9.	3.0.	2.8.	3.2.					
	Month.				March.	April.	May.	June.	July.	Aug.	Sept.					
	X Rays.				-	-	-				-					

Observed from 3 months.

Clinically negative at 10 months. 6 teeth.
Stands strongly.

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
6.	Diet.	Breast.	Breast.	Nestles Milk.	do.	do.	1.5% fat 35 oz.	1.5% 37 oz.	1.5% 42 oz.	1.5% 36 oz.	48					
John SUNTERS	Carbo- hydrate.						S.14. SL3.5.	S14. SL3.5.	S14. SL3.5.	S14. SL3.5.	S14. SL3.5.					
	Fat in Gms.						15.75.	16.65.	18.9.	16.2.	22.6.					
	Weight.						6.3.	7.4.	8.0.	8.6.	8.8.					
	Fat per Kilo.						2.5.	2.25.	2.4.	1.9.	2.6.					
	Month.						May.	June.	July.	Aug.	Sept.					
	X Rays.						-				-					

Observed from 5 months.
Radiograph doubtful at 10 months.
*negative
doubtful*Clinically negative. 2 teeth at 9 months.
Fontanelle well closed.

[illegible][illegible]

Name.	Month.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
9.	Diet.	Breast.	Nestle.	1.5% fat 36 oz.	1.5% 32 oz.	1.5% 36 oz.	1.5% 36 oz.	1.5% 36 oz.								
Robert				S.12.	S.12.	S.15.	S.15.	S.15.								
William-	Fat in			16.2.	14.4.	16.2.	16.2.	16.2.								
son.	Gms.			4.9.	5.7.	6.5.	7.1.	8.0.								
	Wt. in			3.3.	2.5.	2.5.	2.2.	2.0.								
	Kilos.															
	Gms. of															
	fat per															
	Kilo.															
	Month.			May.	June.	July.	Aug.	Sept.								
	X Rays.			-			-		-							

Observed from 3 months.

Neg. at 7 months.

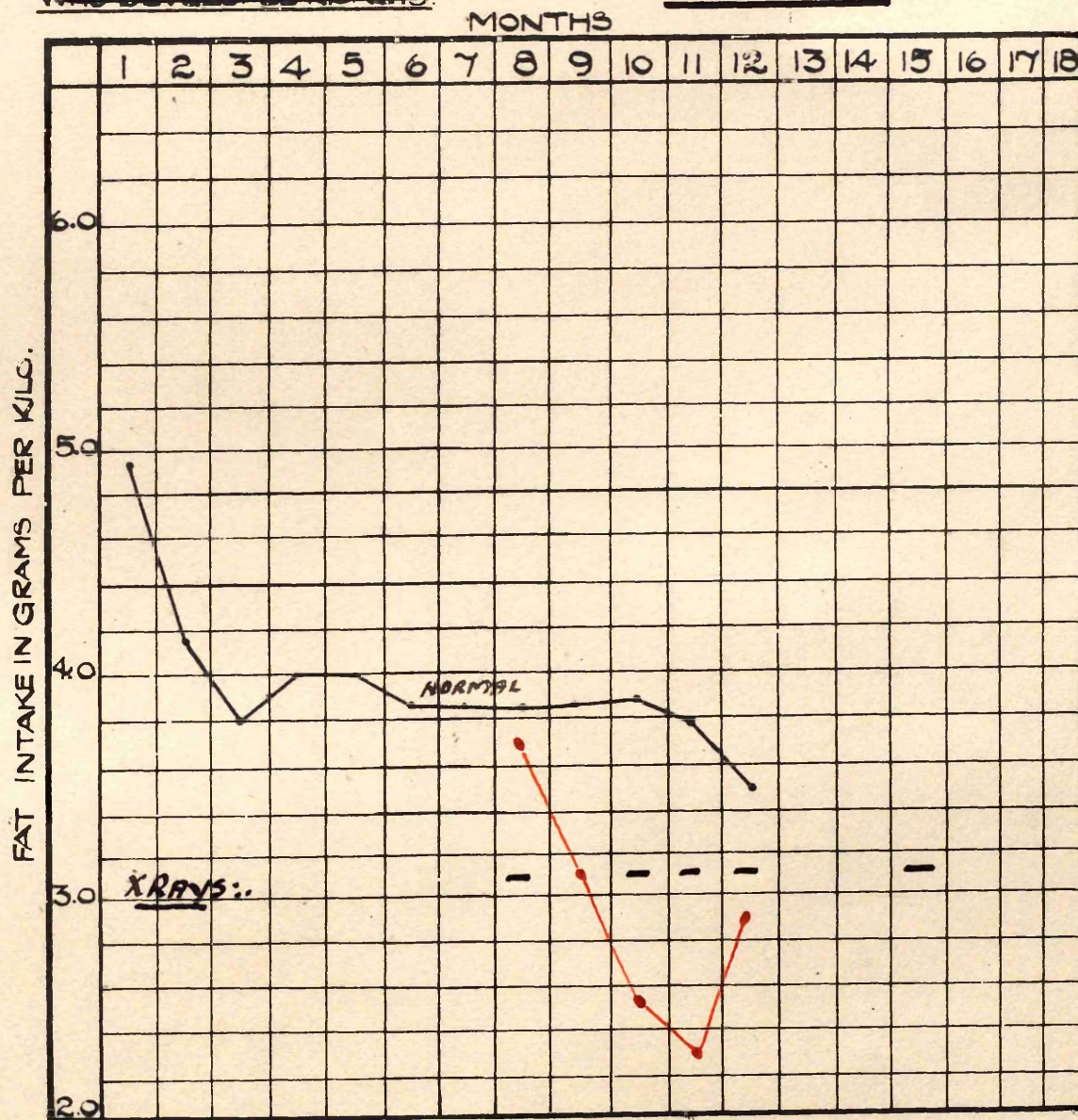
At 7 months - 6 teeth, Fontanelle well closed. Stands strongly.

APPENDIX 1

WINTER SERIES

CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER KILO. OF ACTUAL BODY WEIGHT WITH THE OBSERVED IN A CHILD WHO DEVELOPED RICKETS. ON FAT POOR DIET

I. MRAY ANGLIS

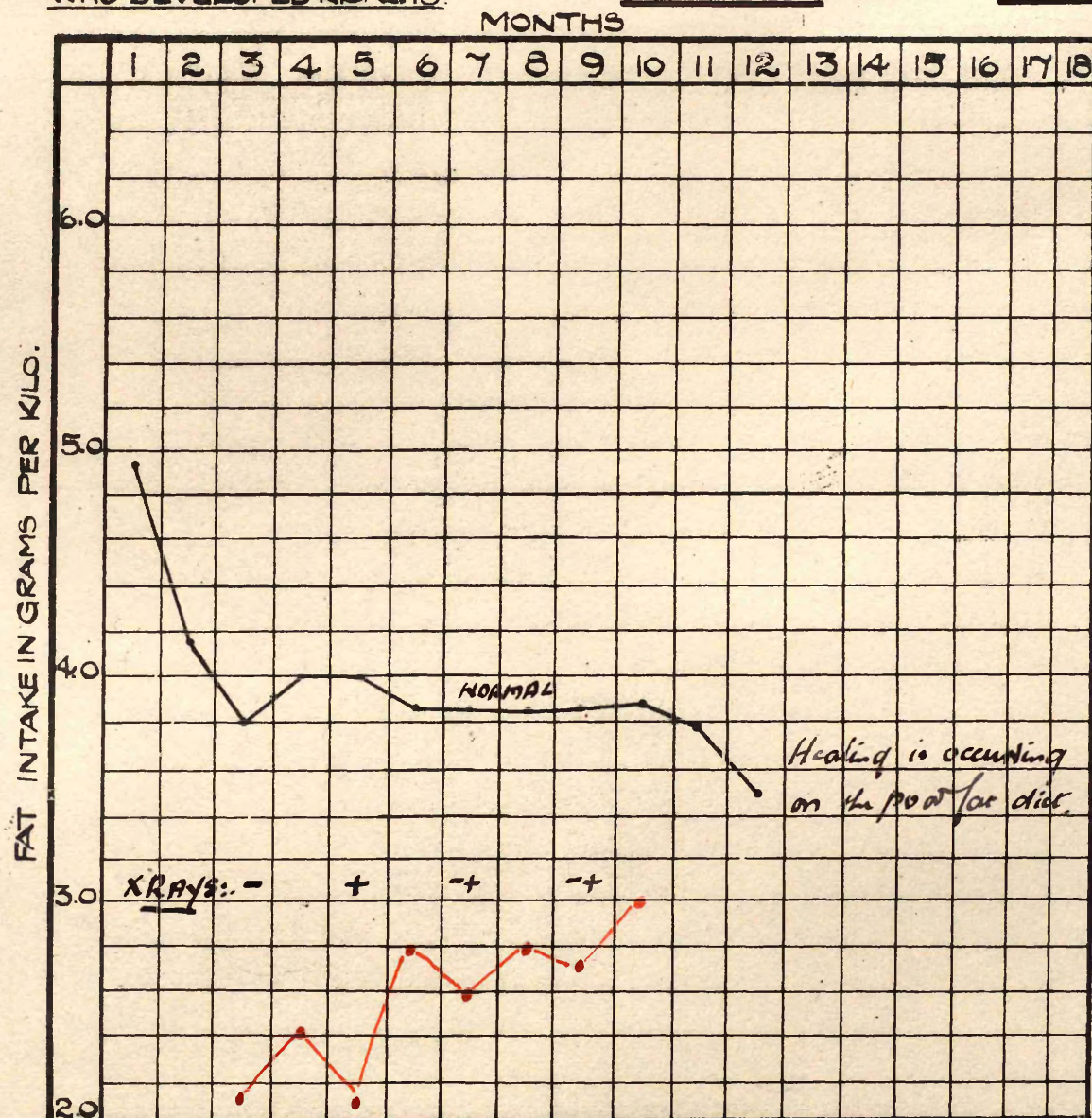


4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER
KILO OF ACTUAL BODY WEIGHT WITH THE OBSERVED IN A CHILD
WHO DEVELOPED RICKETS.

ON FAT POOR DIET.

2. BAYIO ROSE

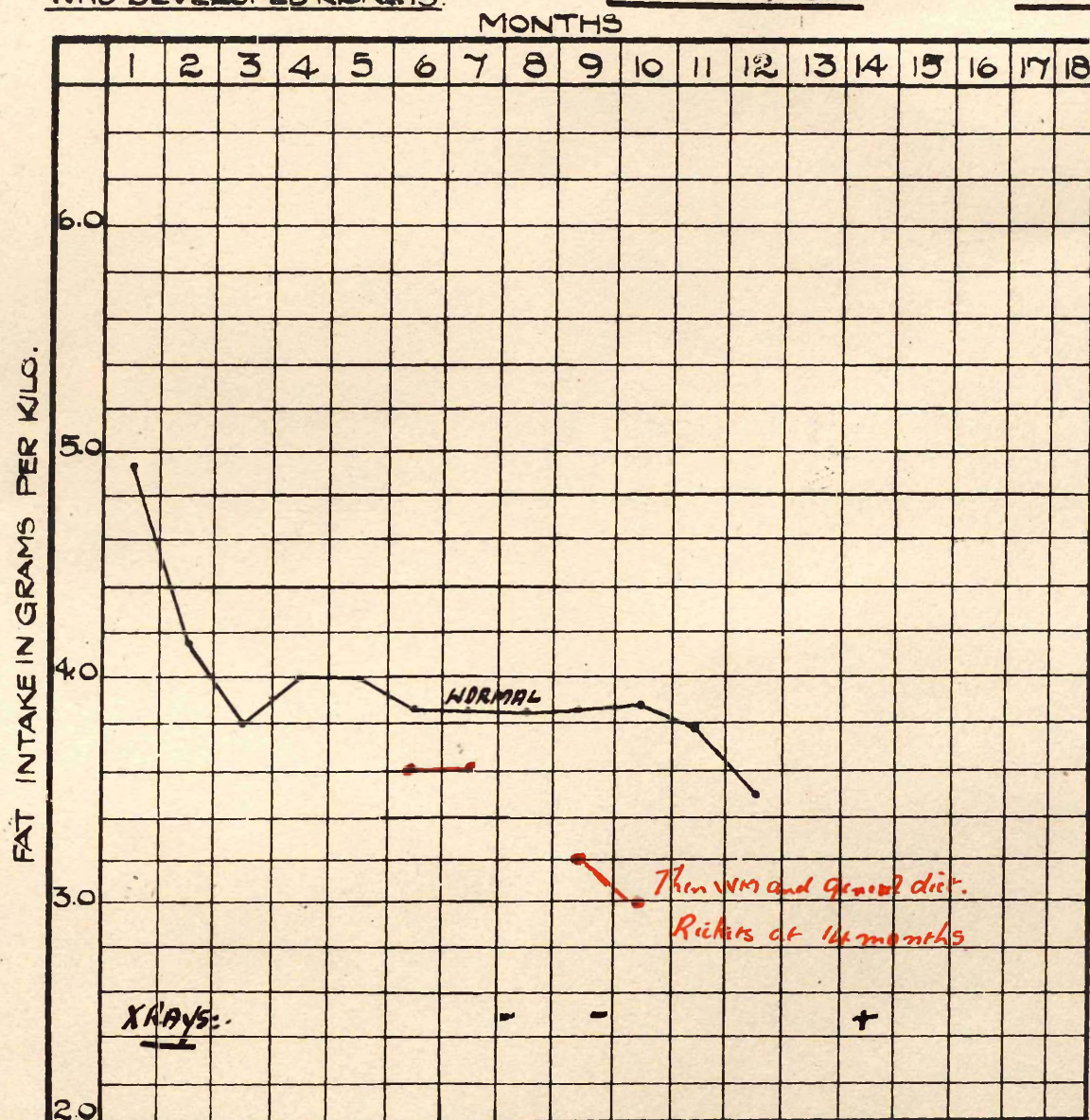


4.86/4.16/3.8/4.0/4.0/3.86/3.84/3.86/3.87/3.88/3.8/3.5

CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER
KILO OF ACTUAL BODY WEIGHT WITH THE OBSERVED IN A CHILD
WHO DEVELOPED RICKETS.

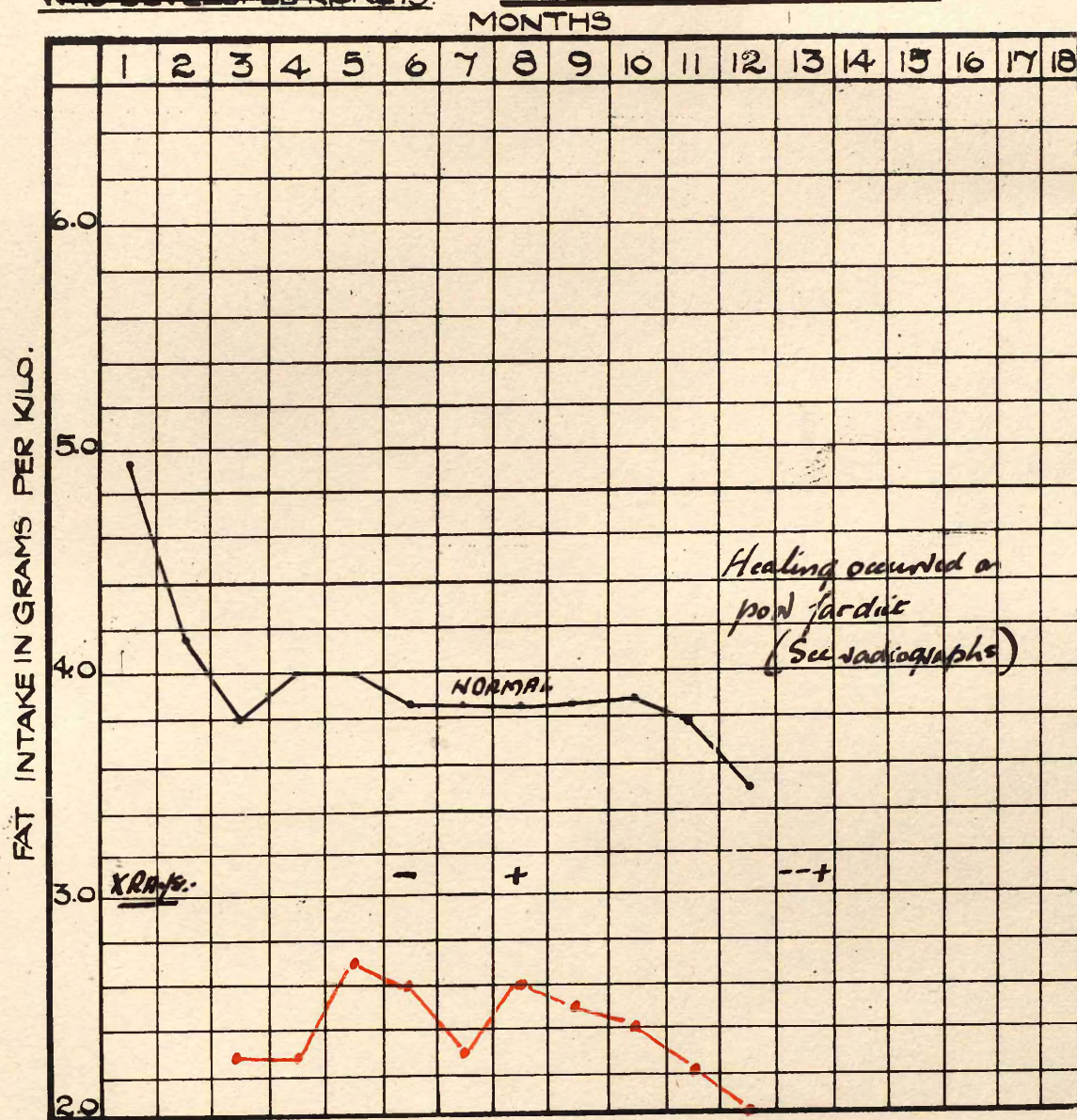
ON FAT POOR DIET.

S. THOMAS CANNING



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD WHO DEVELOPED RICKETS. ON POOR FAT DIET. 4. ELIZ. CONNELLY.



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER
 KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD
 WHO DEVELOPED RICKETS. ON POOR FAT DIET. S. JAMES DOUGLAS.

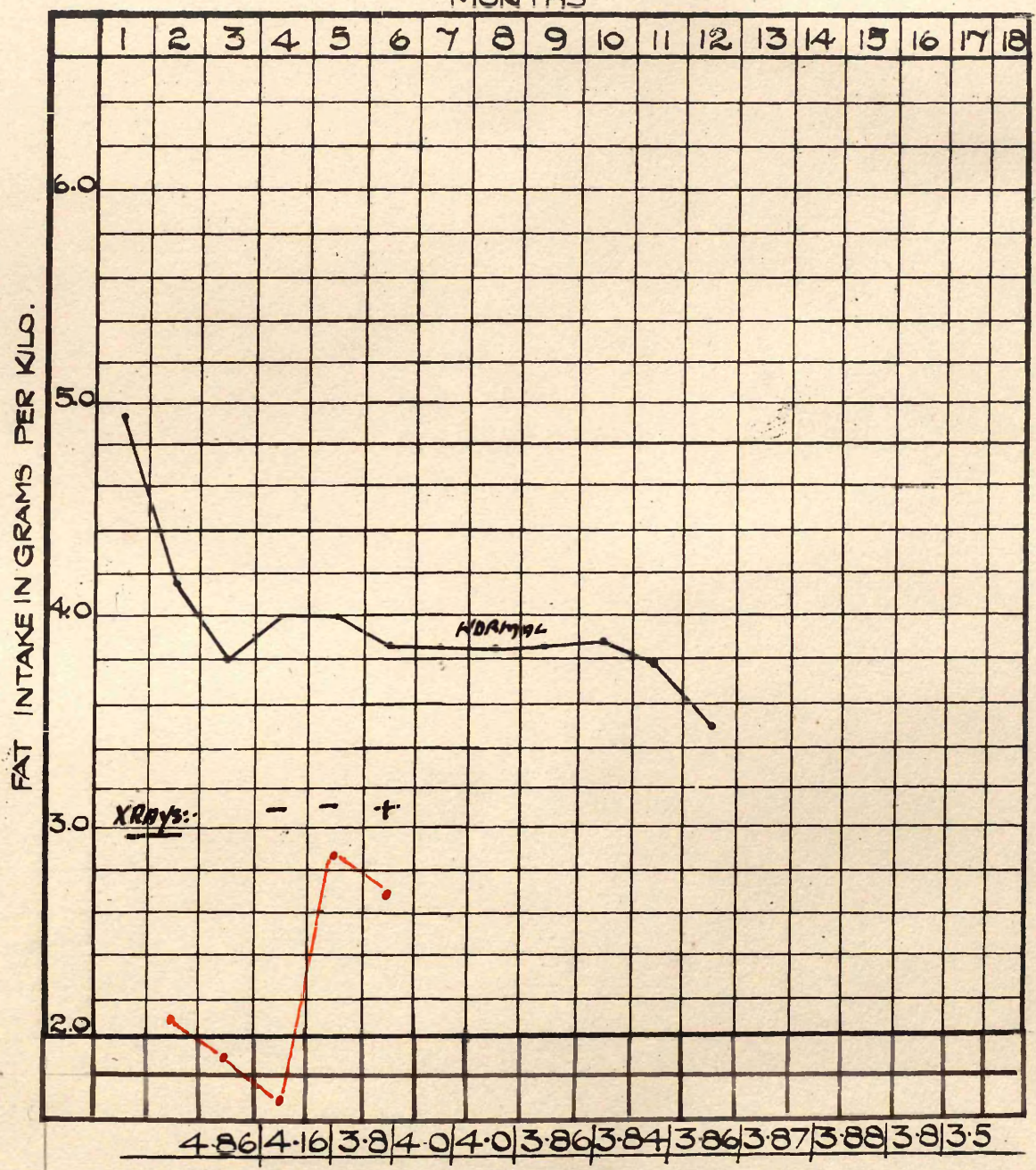
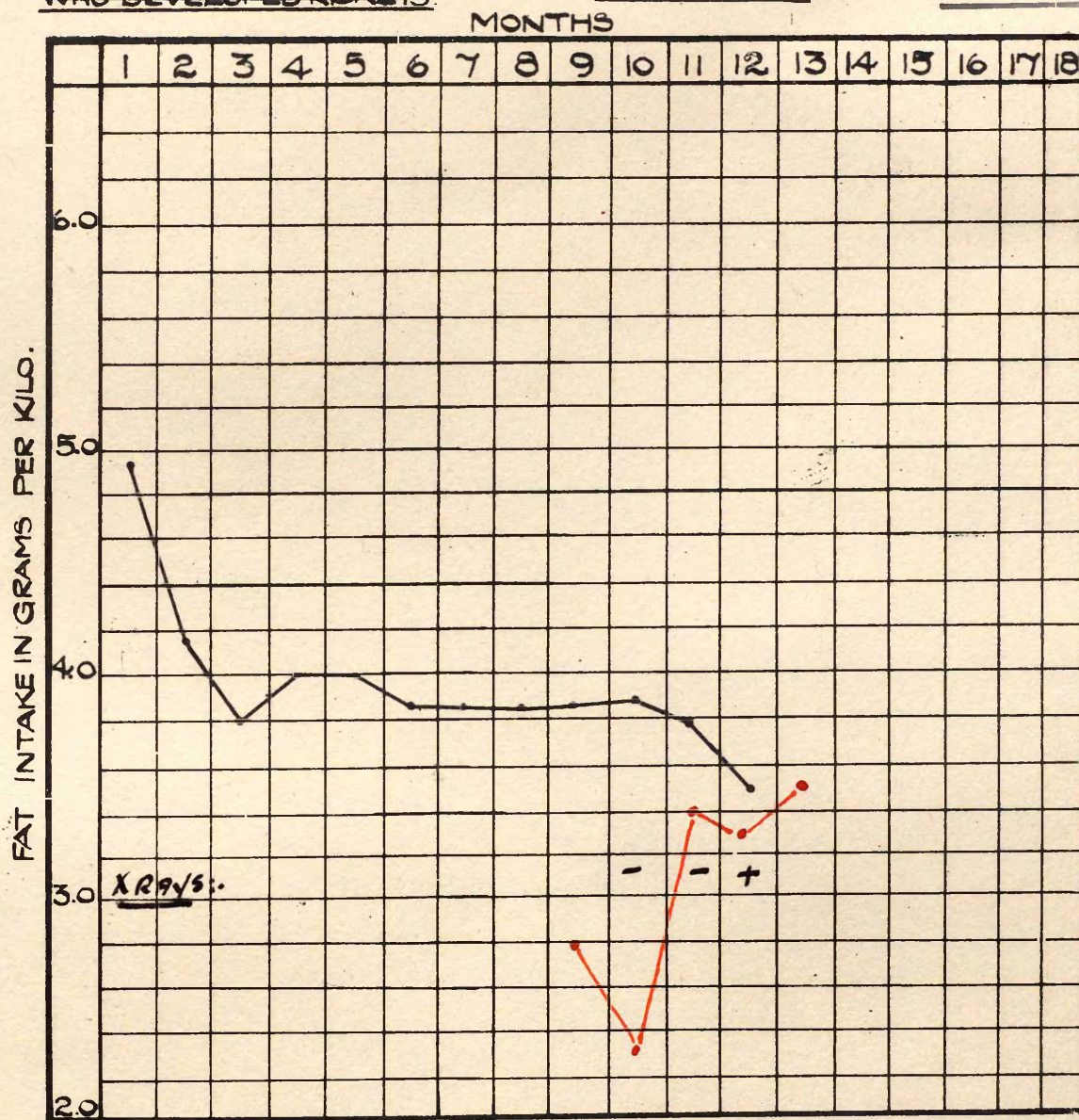


CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER KILO OF ACTUAL BODY WEIGHT WITH THE OBSERVED IN A CHILD WHO DEVELOPED RICKETS ON POOR FAT DIET. G. JAMES DONNACHIE

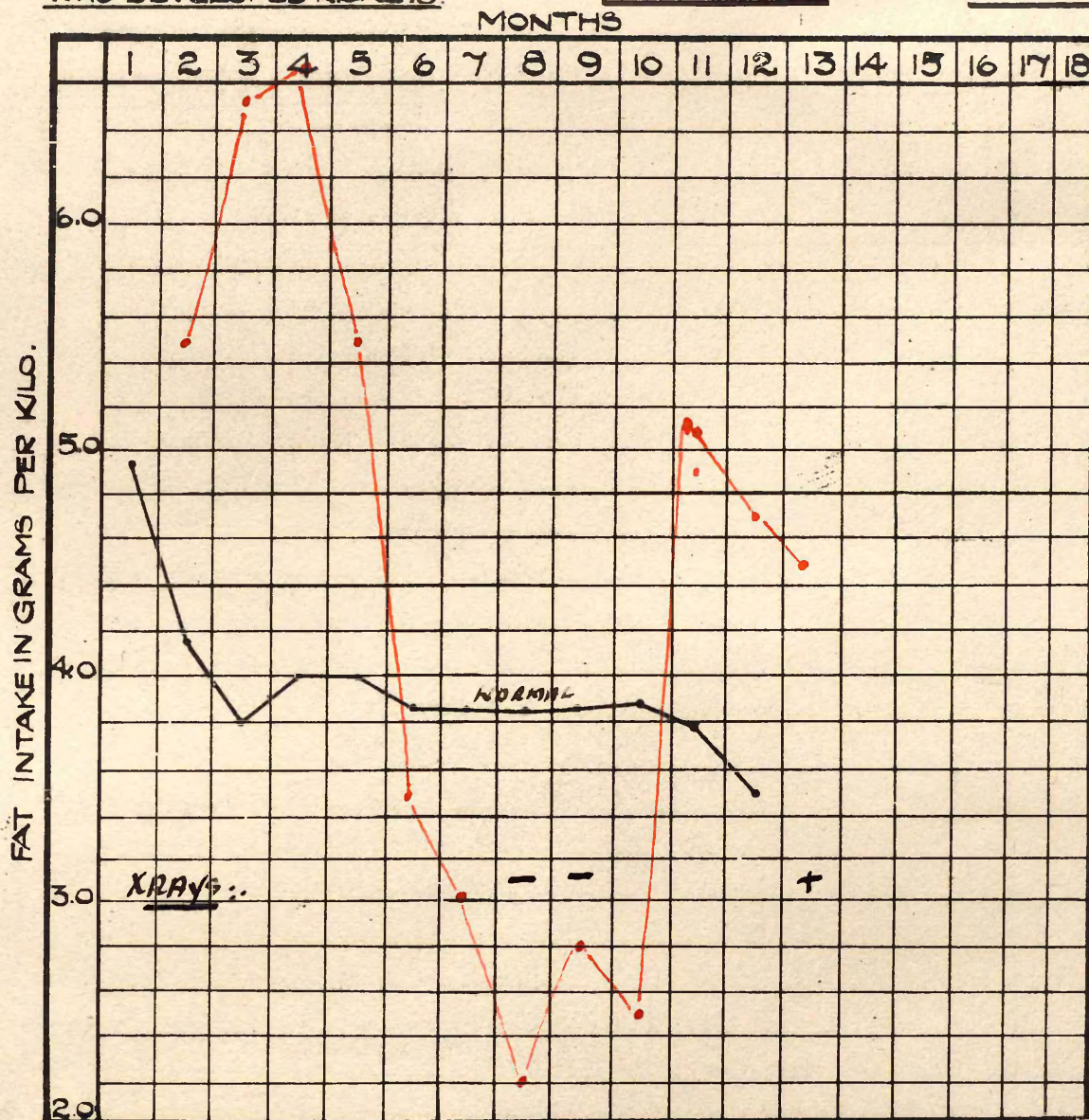


4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER
KILO OF ACTUAL BODY WEIGHT WITH THE OBSERVED IN A CHILD
WHO DEVELOPED RICKETS.

ON POOR FAT DIET

Y. ELIZ. DUNLOP



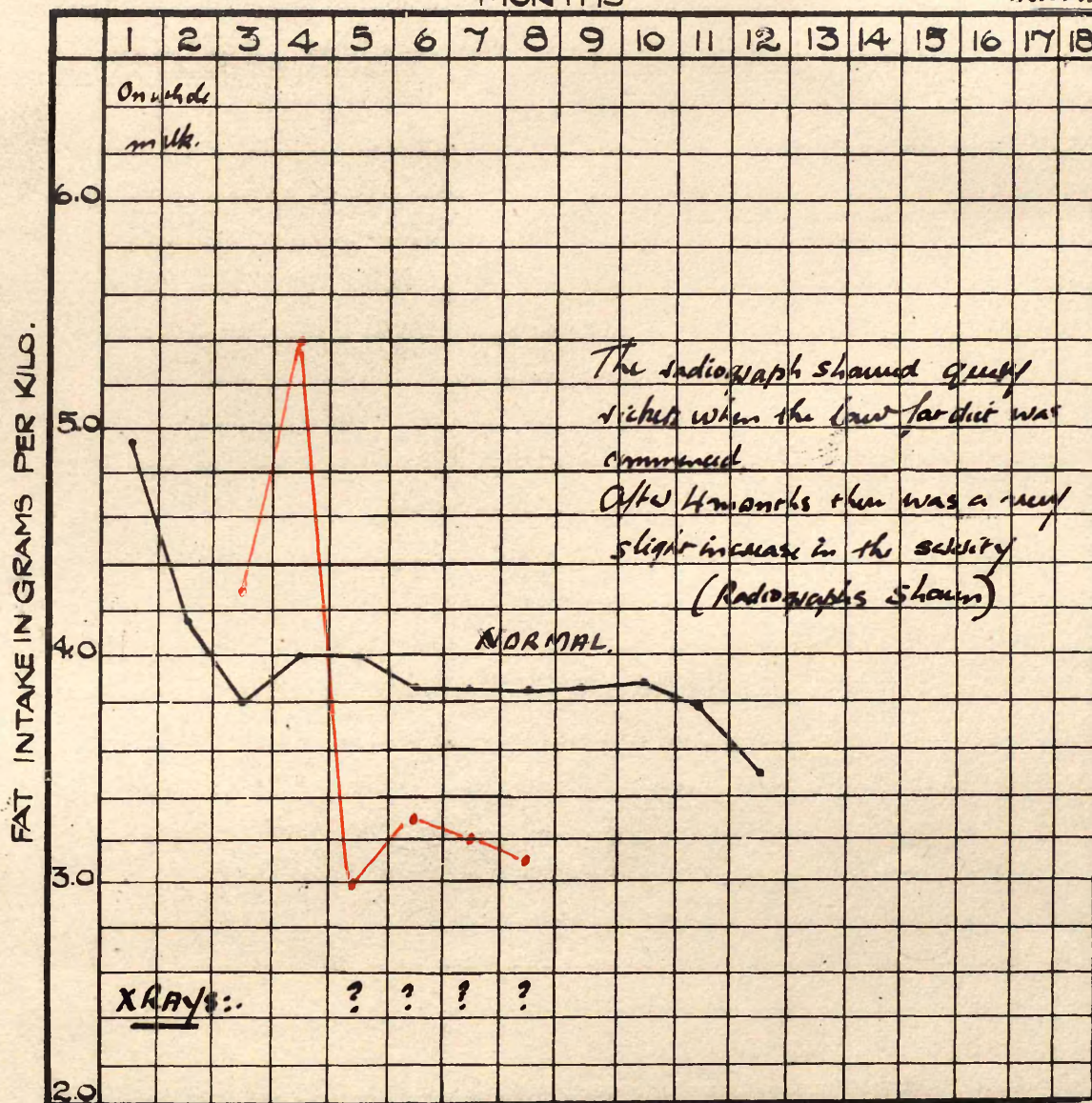
4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER
KILO OF ACTUAL BODY WEIGHT WITH THE OBSERVED IN A CHILD
WHO DEVELOPED RICKETS

ON POOR FAT DIET

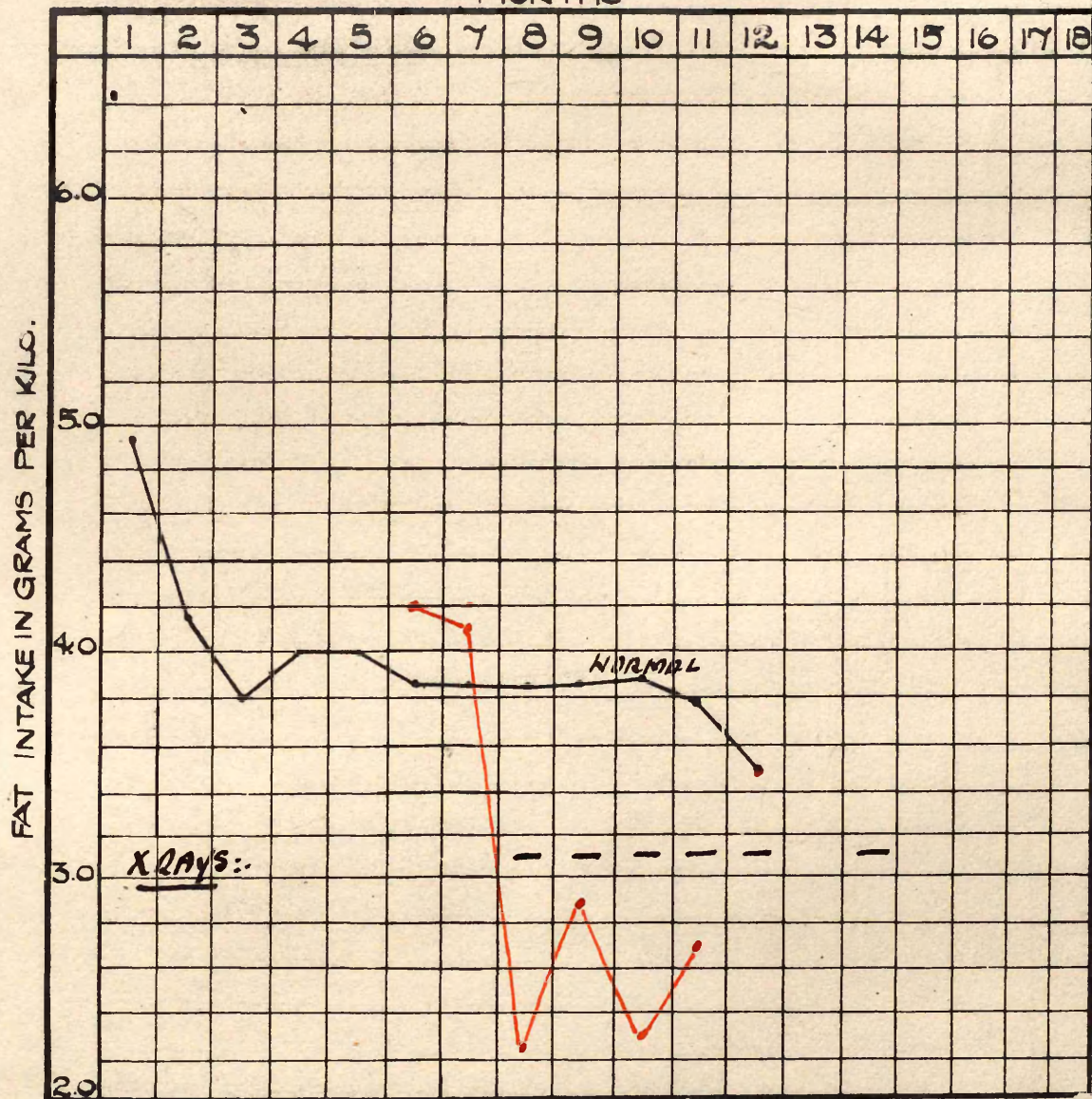
S. MARGARET
HOLLINGSWORTH.

MONTHS



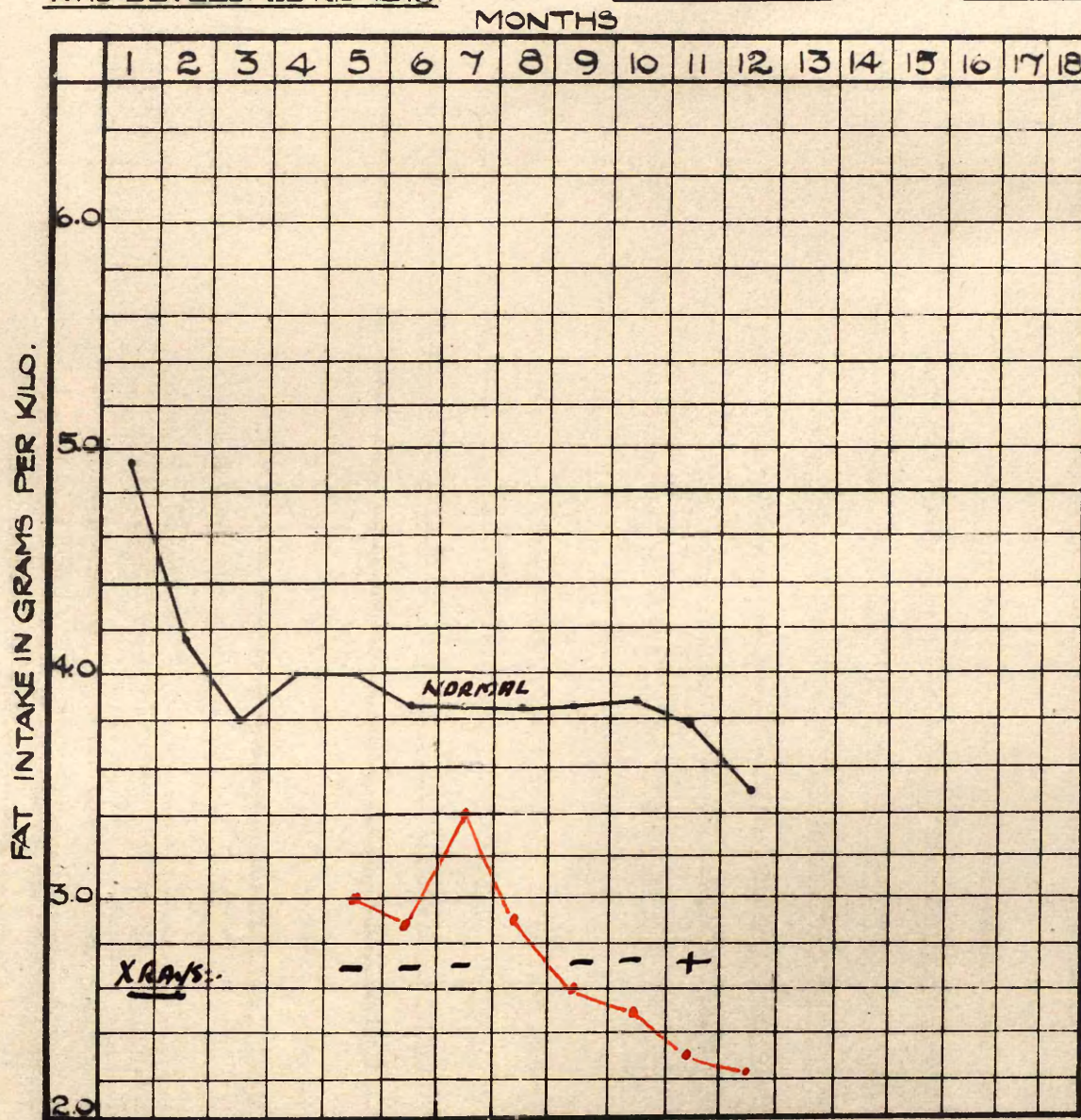
4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER
KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD
~~WHO DEVELOPED RICKETS~~ ON POOR FAT DIET. 9. ALEX. LIODELL



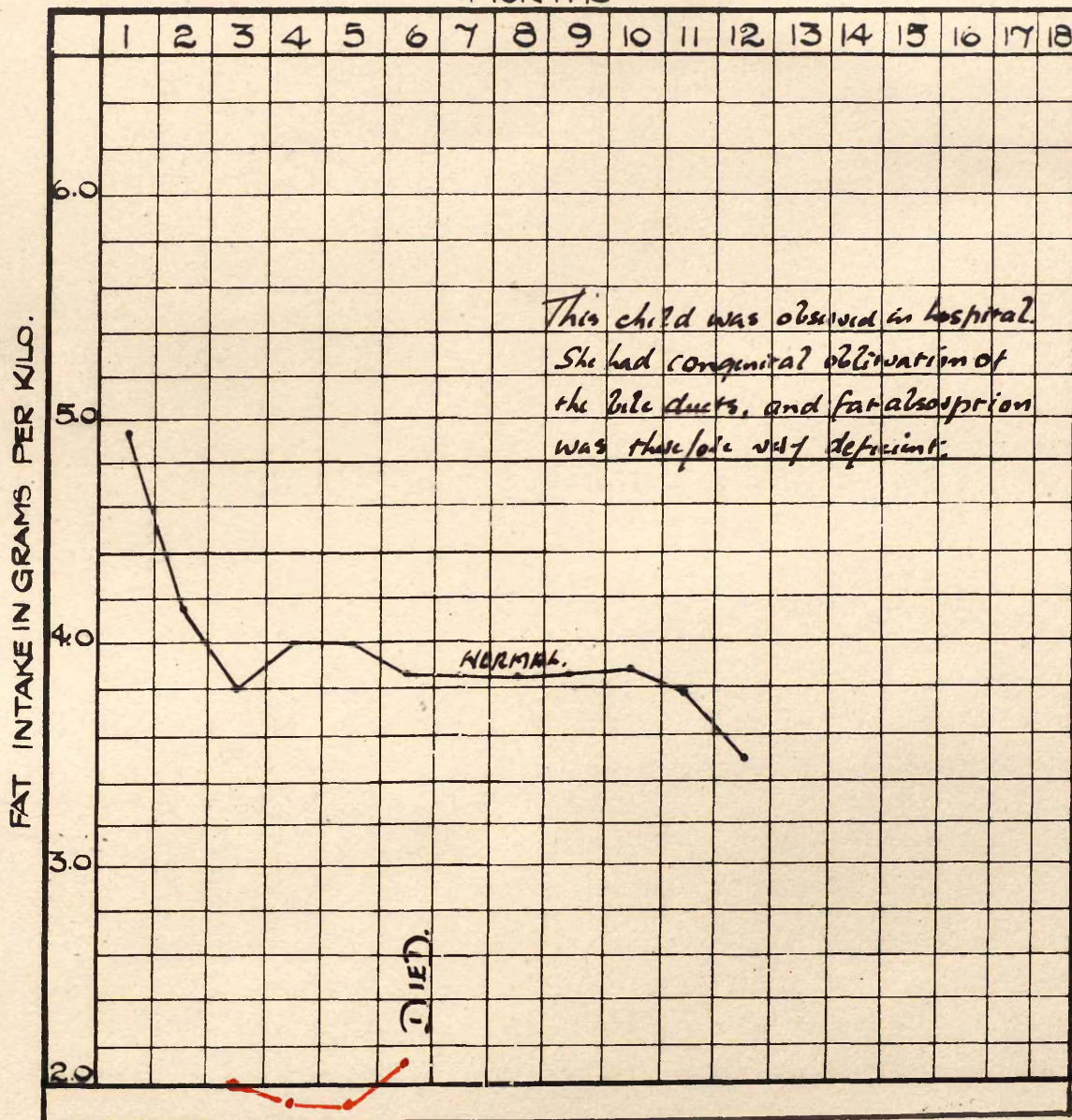
4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER
KILO OF ACTUAL BODY WEIGHT WITH ~~THE~~ OBSERVED IN A CHILD
WHO DEVELOPED RICKETS ON POOR FAT DIET. 10 THOMAS SMALL



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

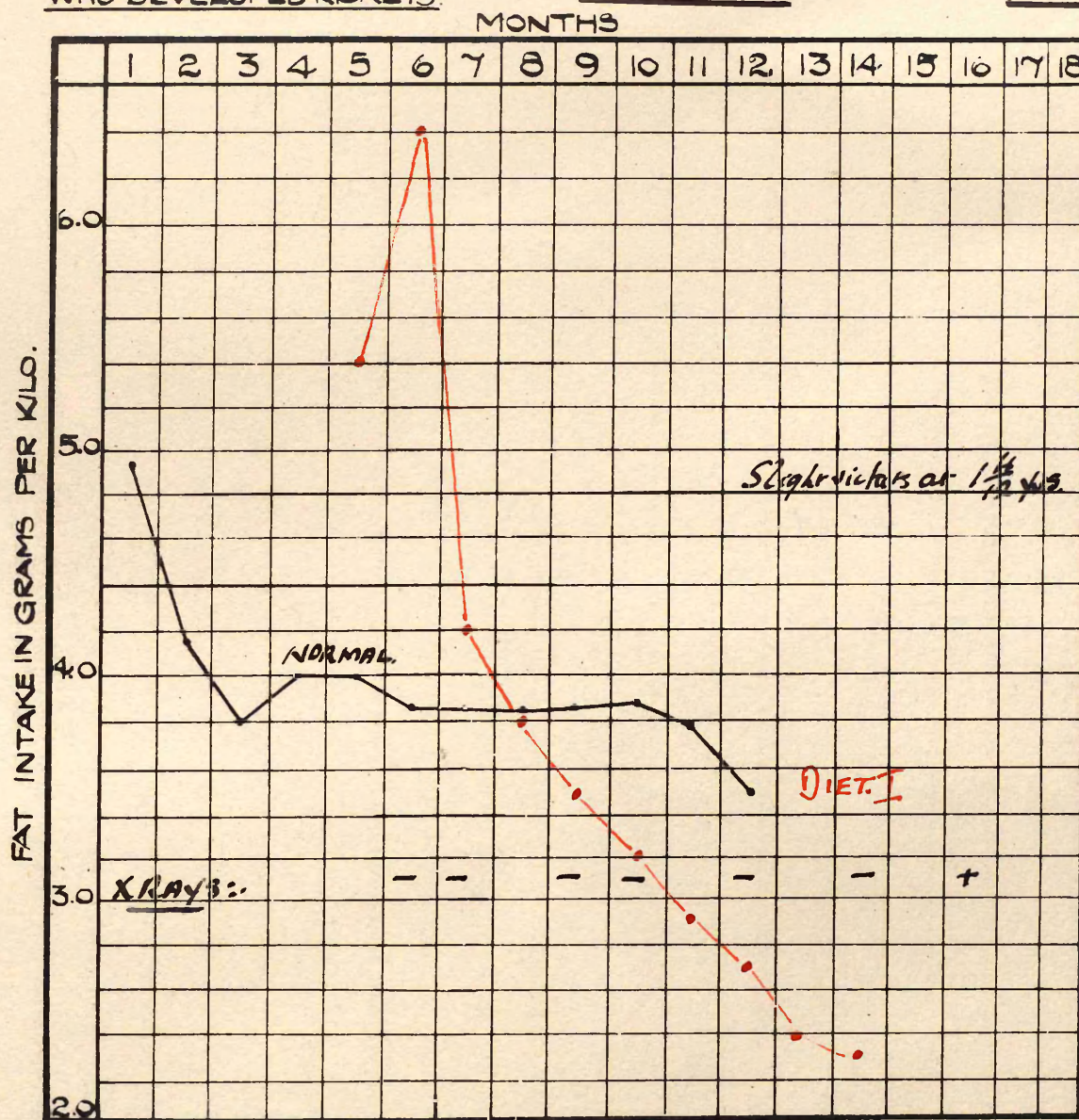
CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD WHO DEVELOPED RICKETS. ON POOR FAT DIET. IL JEAN SYME



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

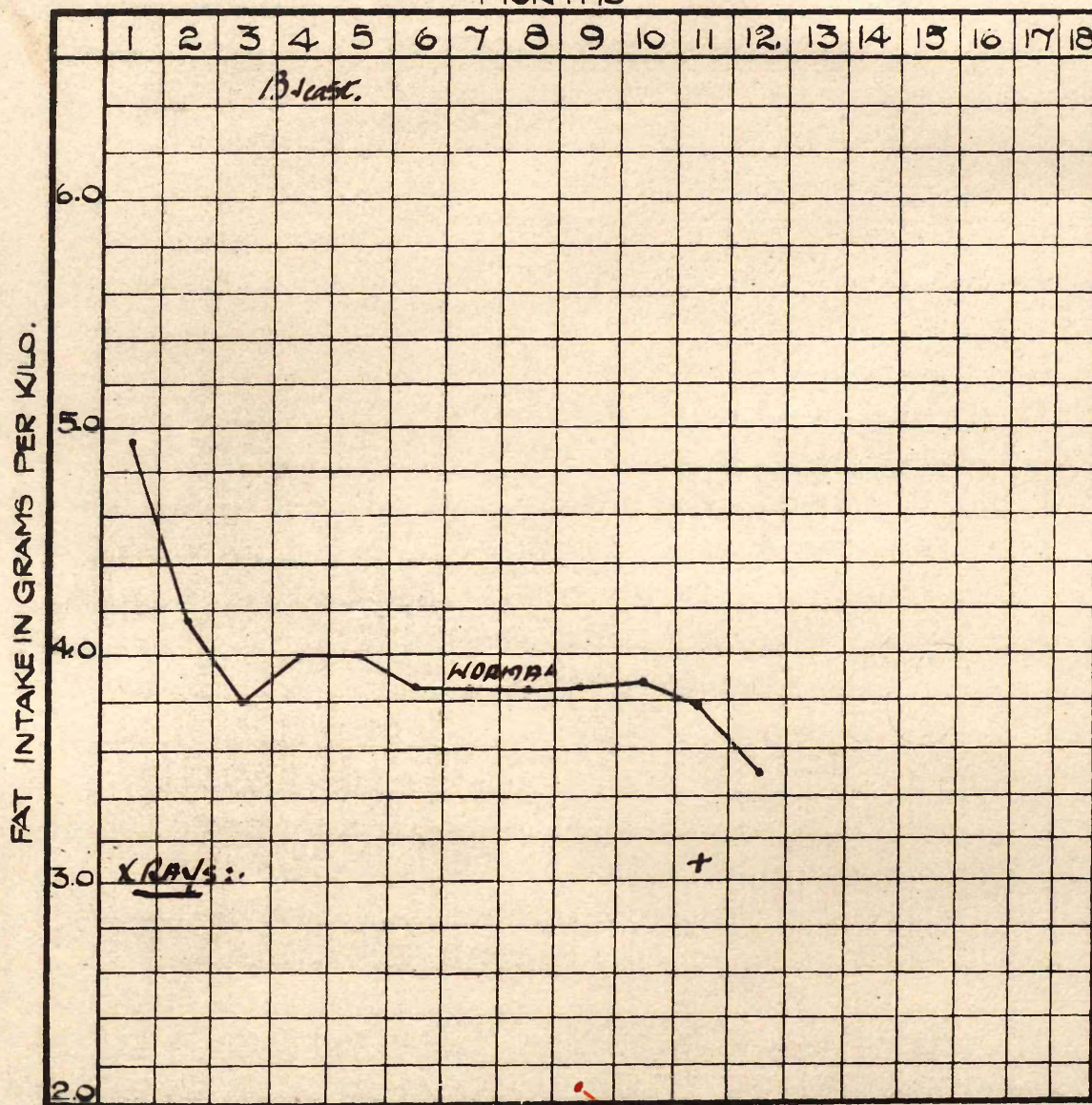
CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER
KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD
WHO DEVELOPED RICKETS. ON POOR FAT DIET.

M. JAN. WEDGEMOOD



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

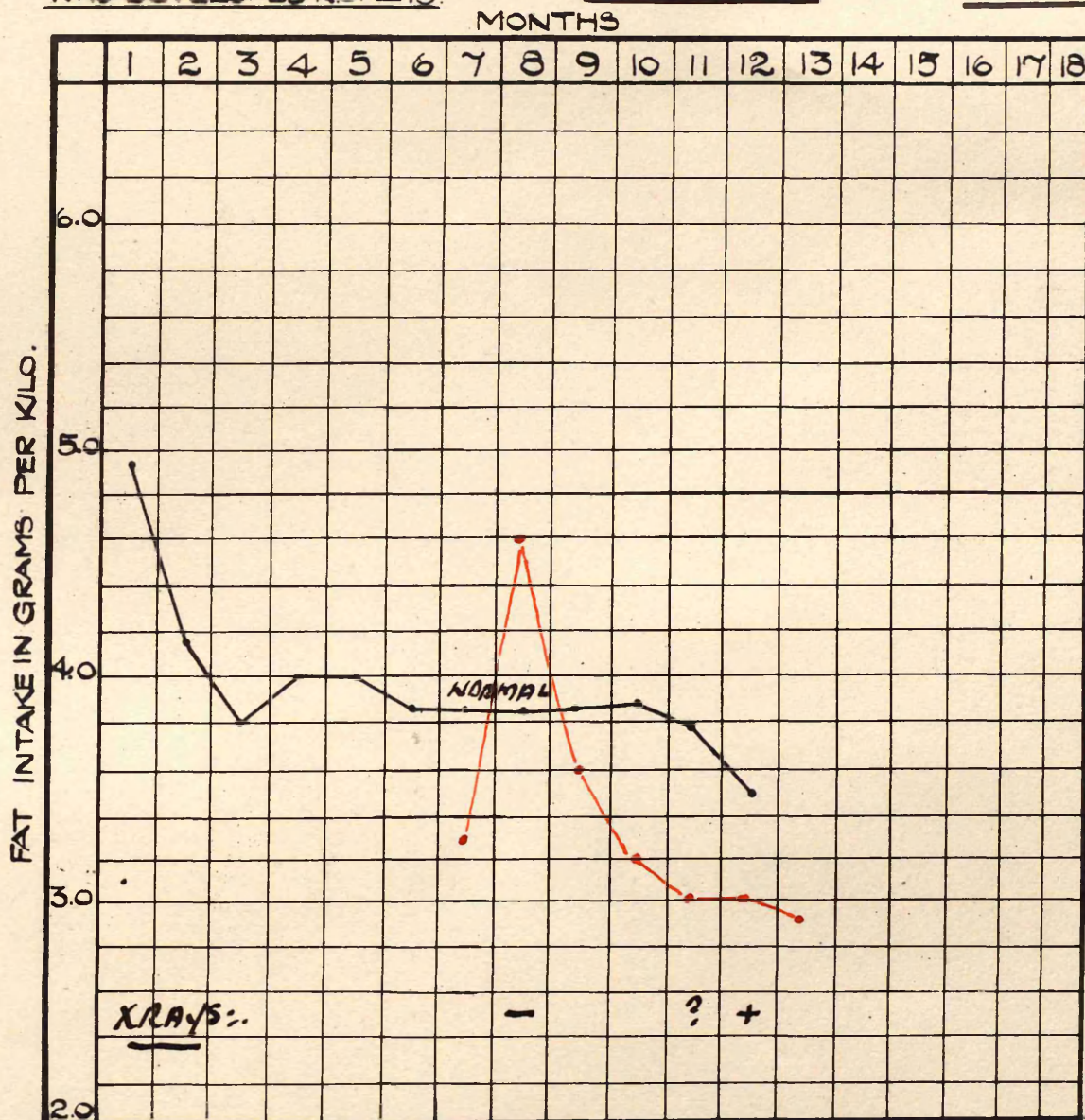
CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD WHO DEVELOPED RICKETS ON POOR FAT DIET 13. THOMAS WYLLIE



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

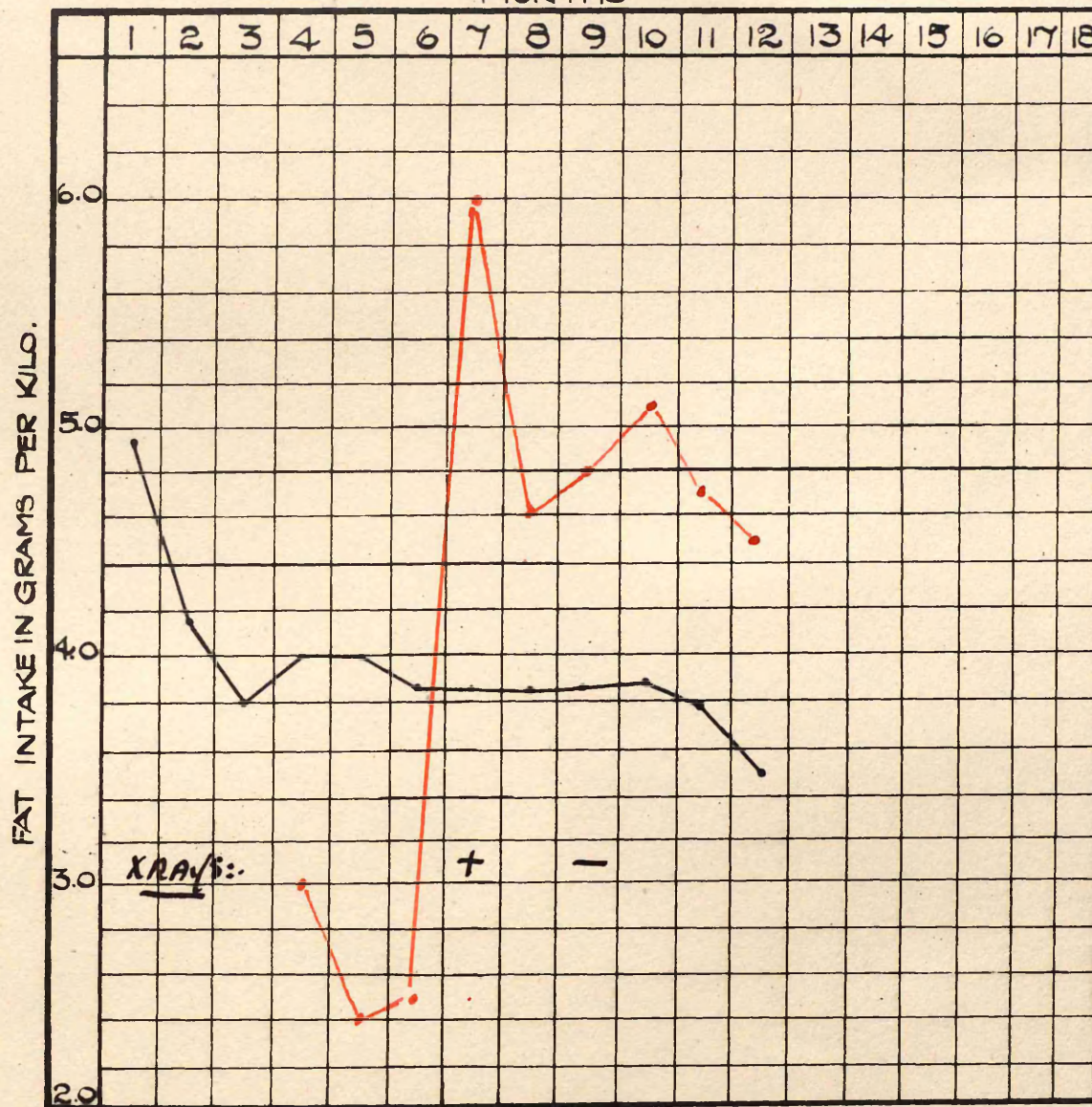
1.8
1.7

CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER
KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD
~~WHO DEVELOPED RICKETS~~ ON POOR FAT DIET IN MATTHEW MAXWELL



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

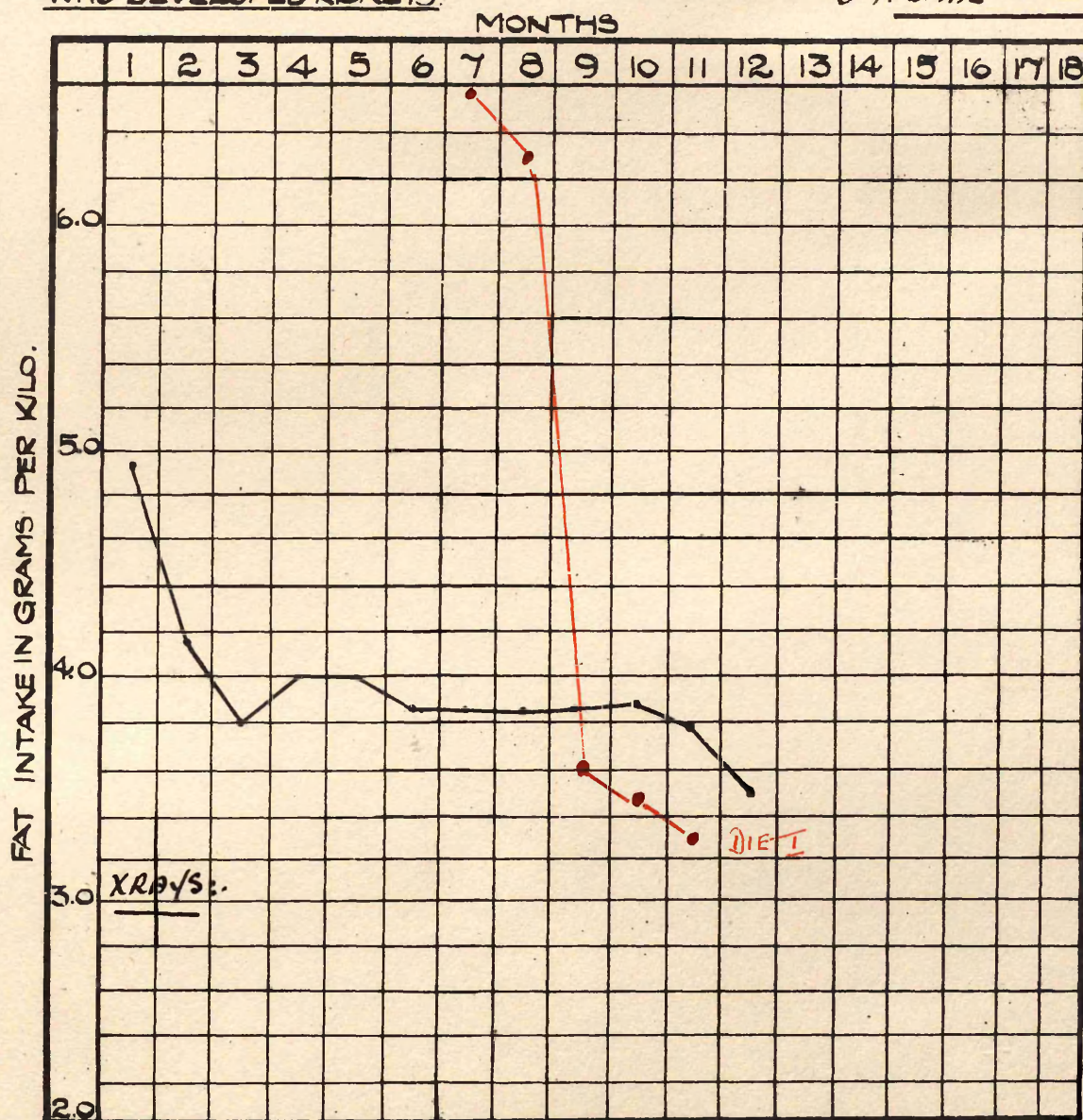
CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER
KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD
~~WHO DEVELOPED RICKETS~~ ON POOR FAT DIET. 15. ELIZ DAVIES



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER KILO OF ACTUAL BODY WEIGHT WITH THE OBSERVED IN A CHILD WHO DEVELOPED RICKETS.

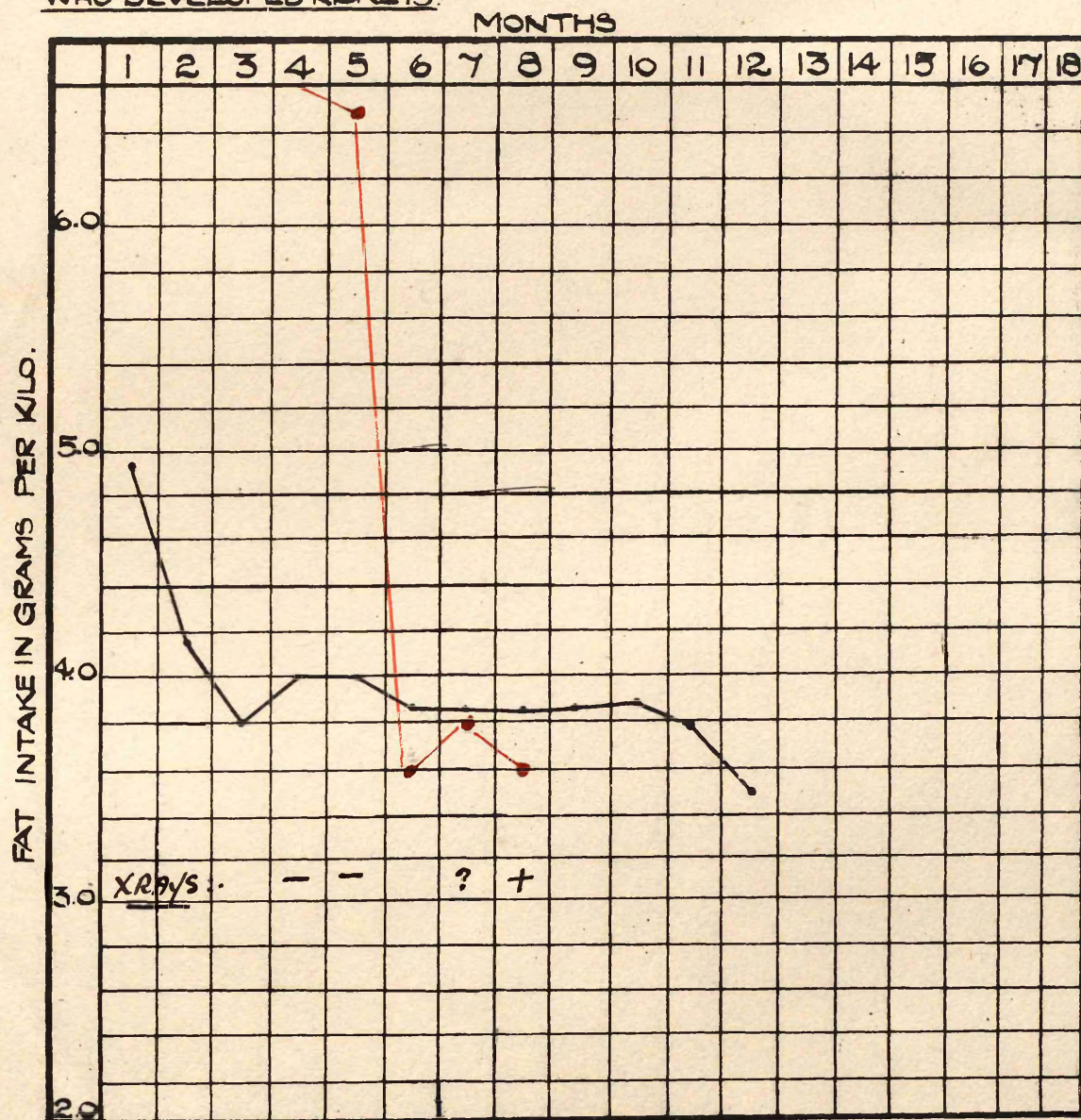
16. THOMAS WILLIS



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.8 | 3.87 | 3.88 | 3.8 | 3.5

14. JOSEPHINE McCANN

CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER
KILO OF ACTUAL BODY WEIGHT WITH THE OBSERVED IN A CHILD
WHO DEVELOPED RICKETS.



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.8 | 3.87 | 3.88 | 3.8 | 3.5

SUMMER CASES

CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD WHO DEVELOPED RICKET.

ON POOR FAT DIET.

I. FRANCES MUIR

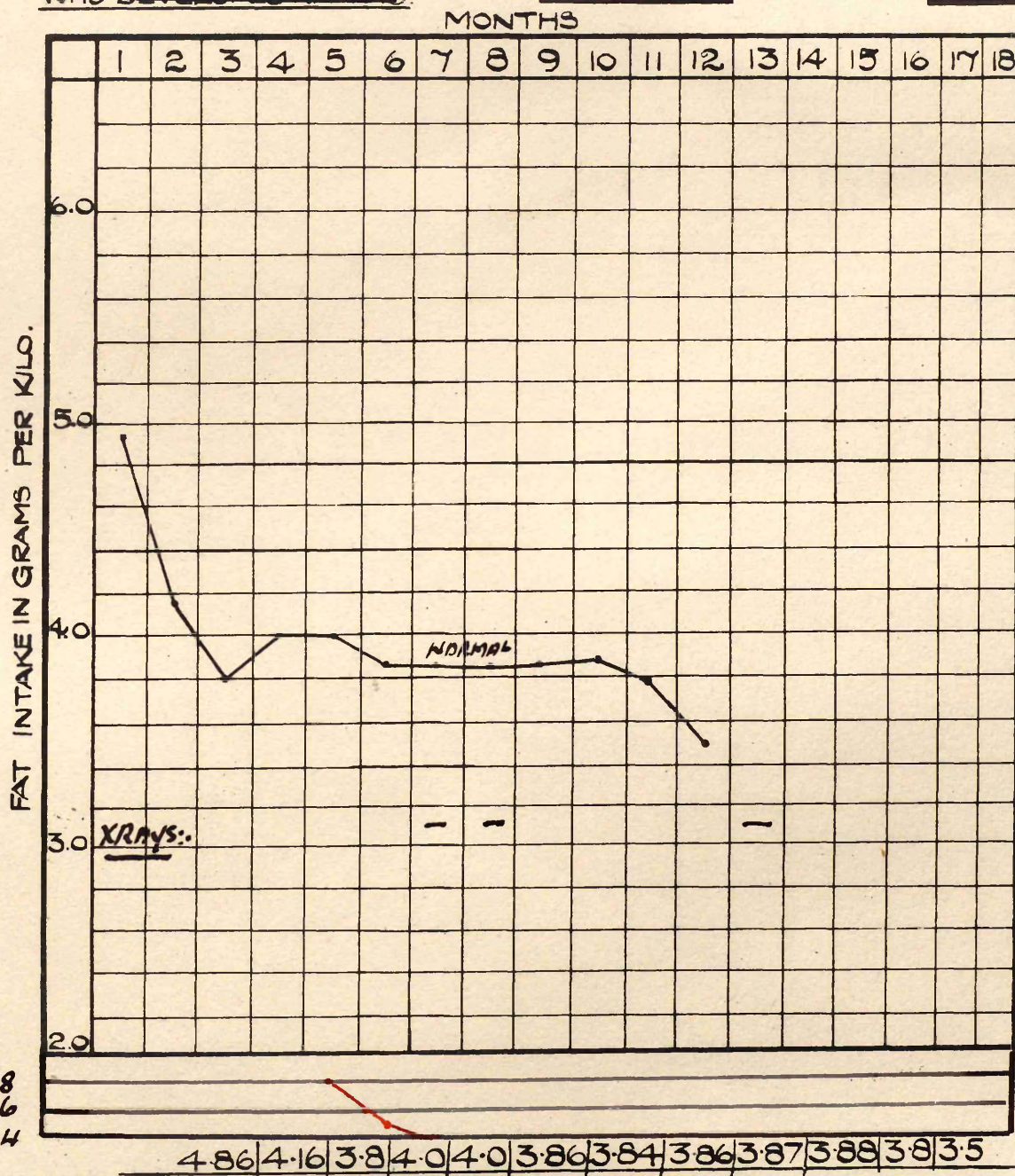
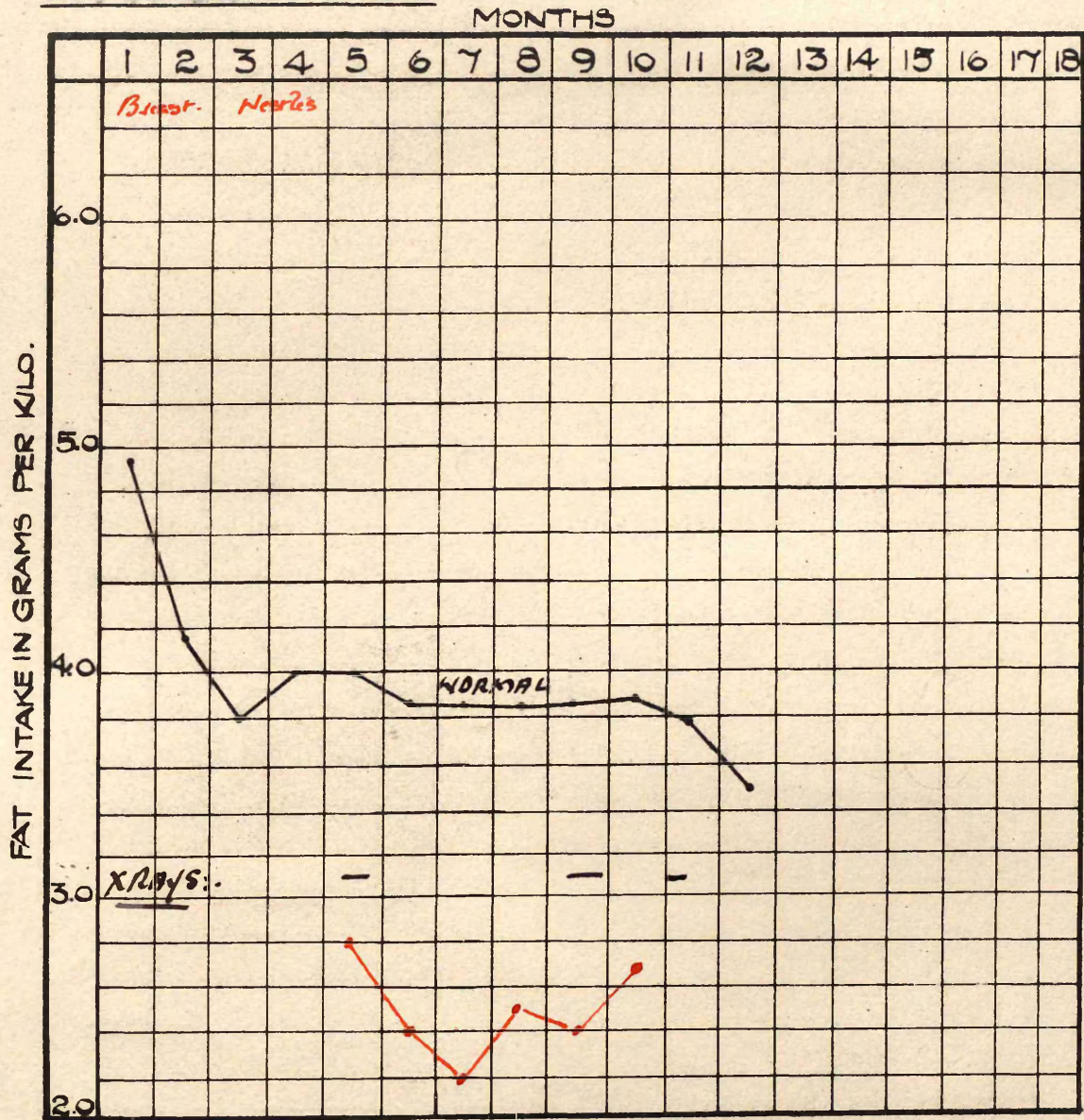


CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER
KILO OF ACTUAL BODY WEIGHT WITH THE OBSERVED IN A CHILD
WHO DEVELOPED RICKET, ON POOR FAT DIET.

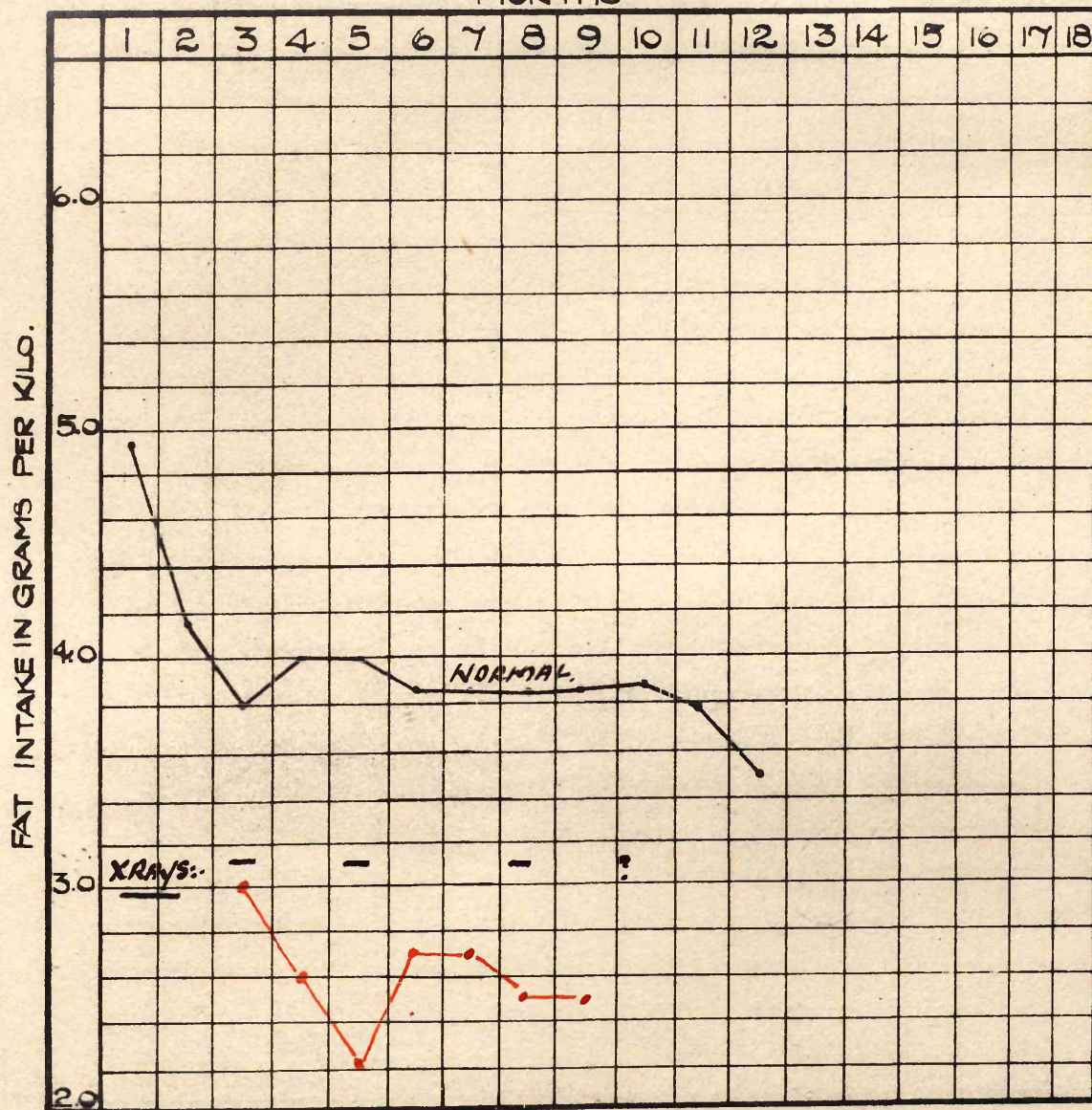
2. EDWARD FARMER



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

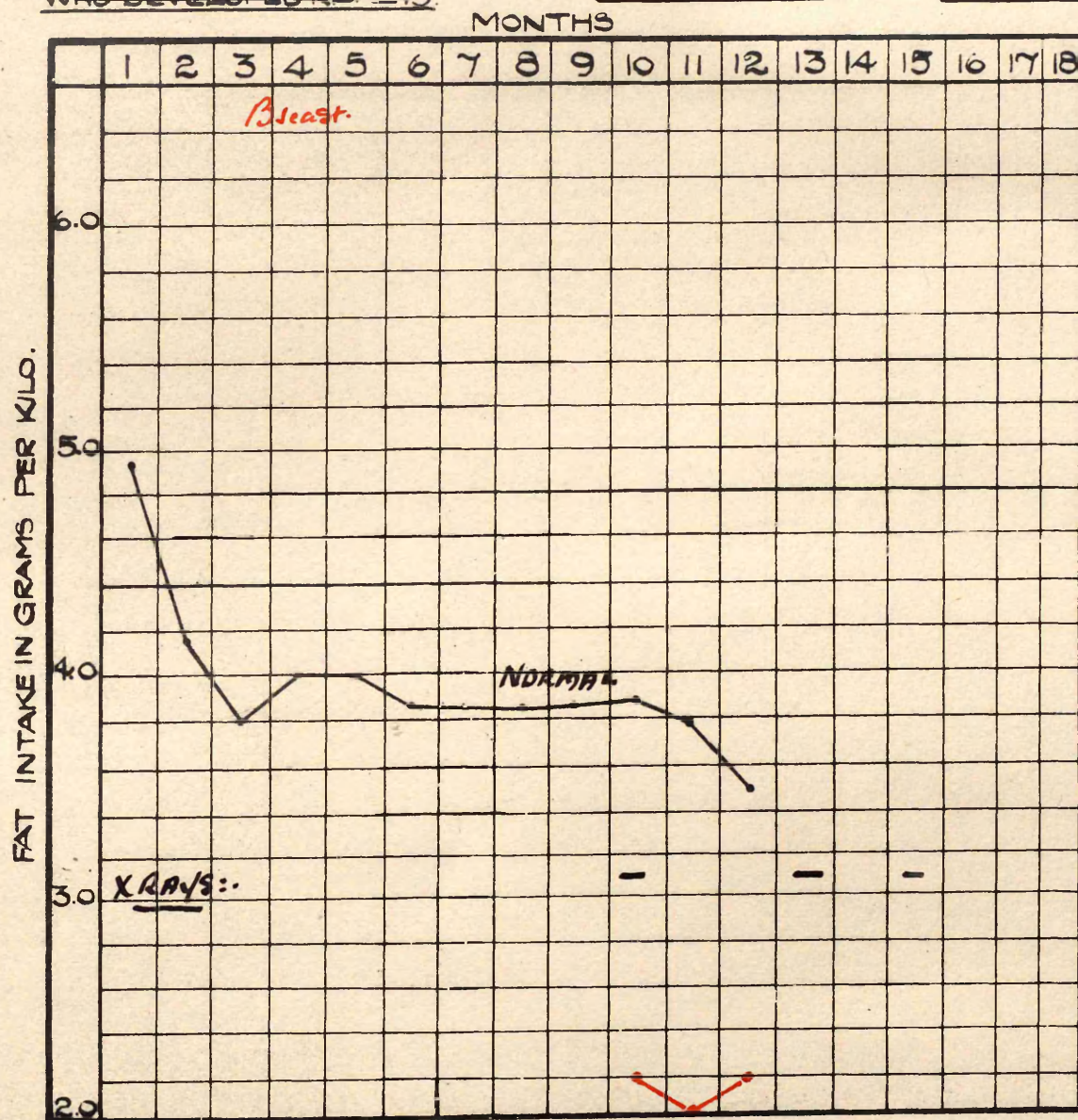
CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER
KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD

WHO DEVELOPED RICKETS ON POOR FAT DIET S. MATTHEW SHANNON
MONTHS



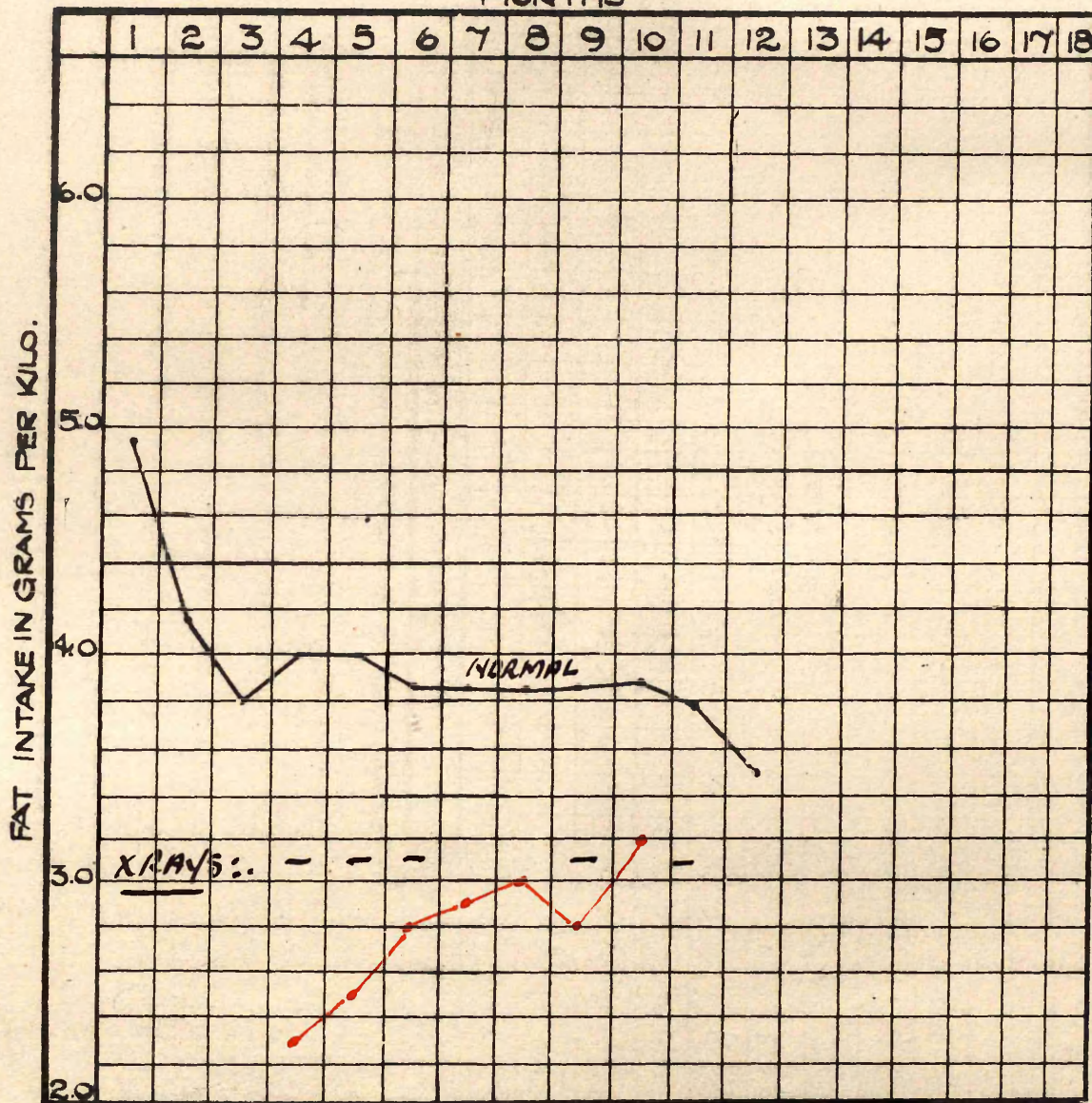
4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER
KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD
WHO DEVELOPED RICKETS ON POOR FAT DIET H. MARQT. NY MONICAL



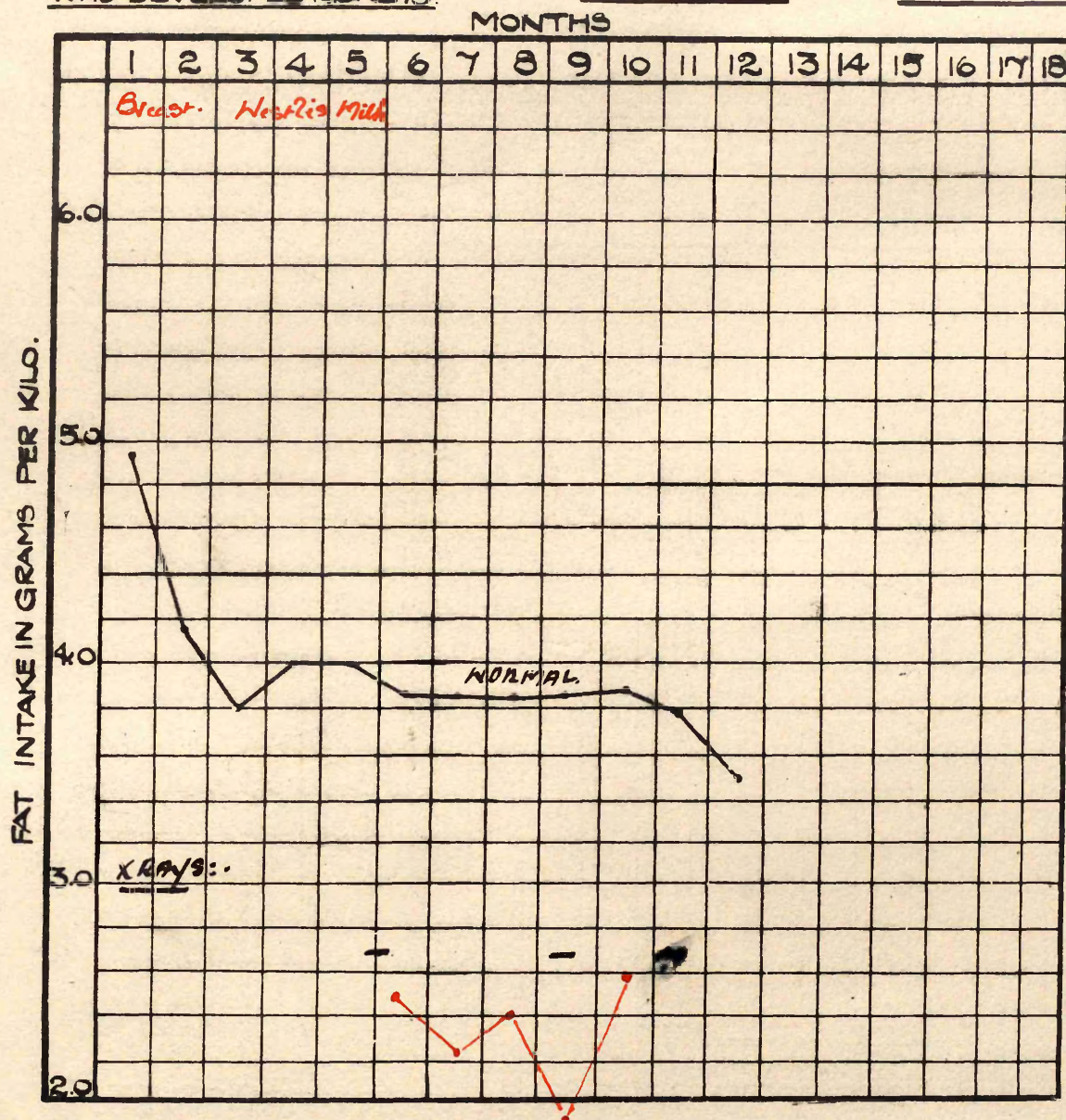
4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD WHO DEVELOPED RICKETS. ON POOR FAT DIET. S. THELMA WINNING



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER
KILO OF ACTUAL BODY WEIGHT WITH THE OBSERVED IN A CHILD
WHO DEVELOPED RICKETS. ON POOR FAT DIET. G. JOHN SUNTERS

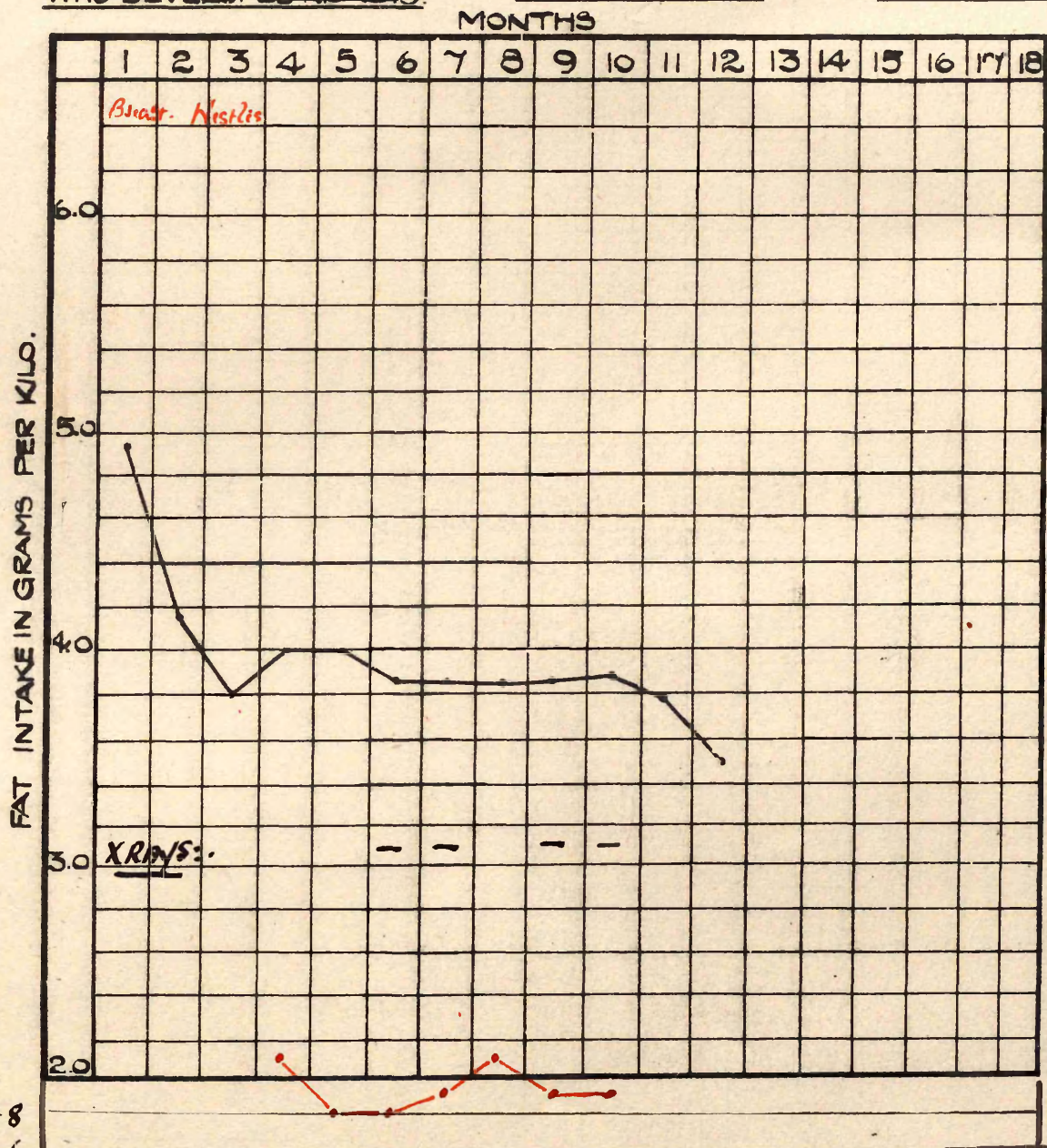


4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER
KILO OF ACTUAL BODY WEIGHT WITH THE OBSERVED IN A CHILD
WHO DEVELOPED RICKETS.

ON POOR FAT DIET

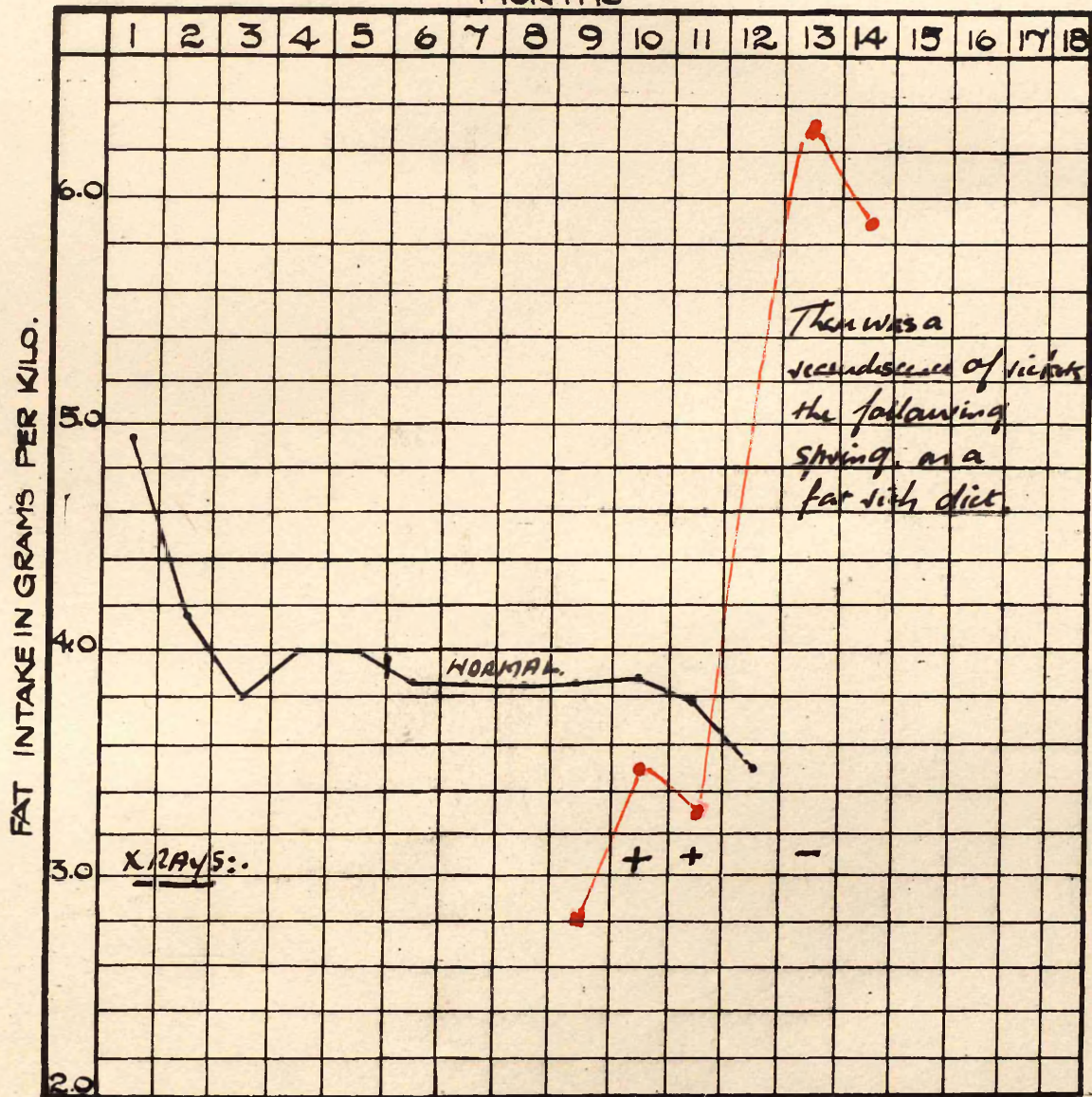
7 CHARLES LOCKHART.



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

1.8
1.6

CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER
KILO OF ACTUAL BODY WEIGHT WITH THE OBSERVED IN A CHILD
WHO DEVELOPED RICKETS. ON POOR FAT DIET 8-ALFRED QUINN
MONTHS



There was a
recurrence of rickets
the following
spring, on a
fat rich diet.

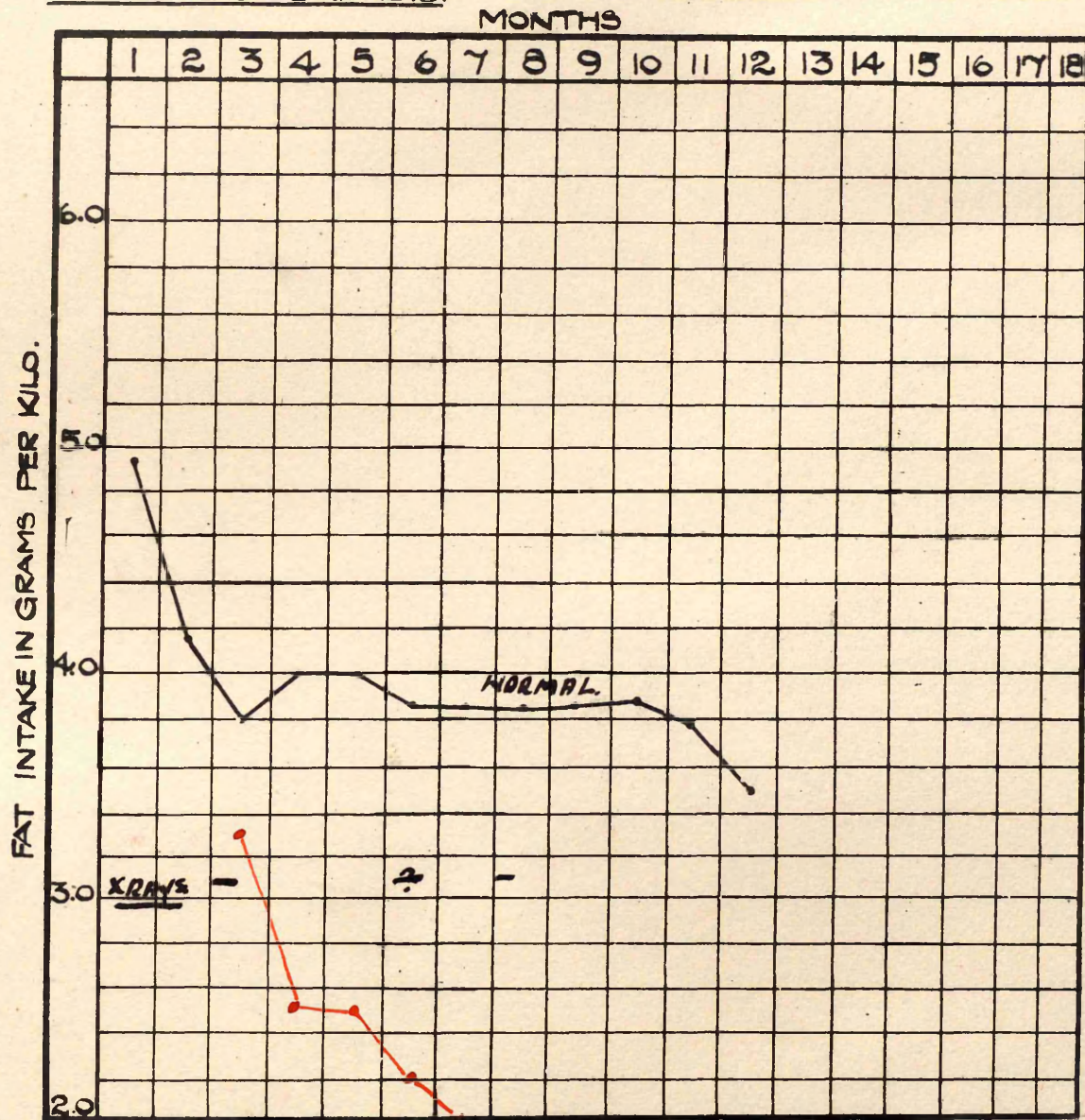
4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER
KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD

~~WHO DEVELOPED RICKETS.~~

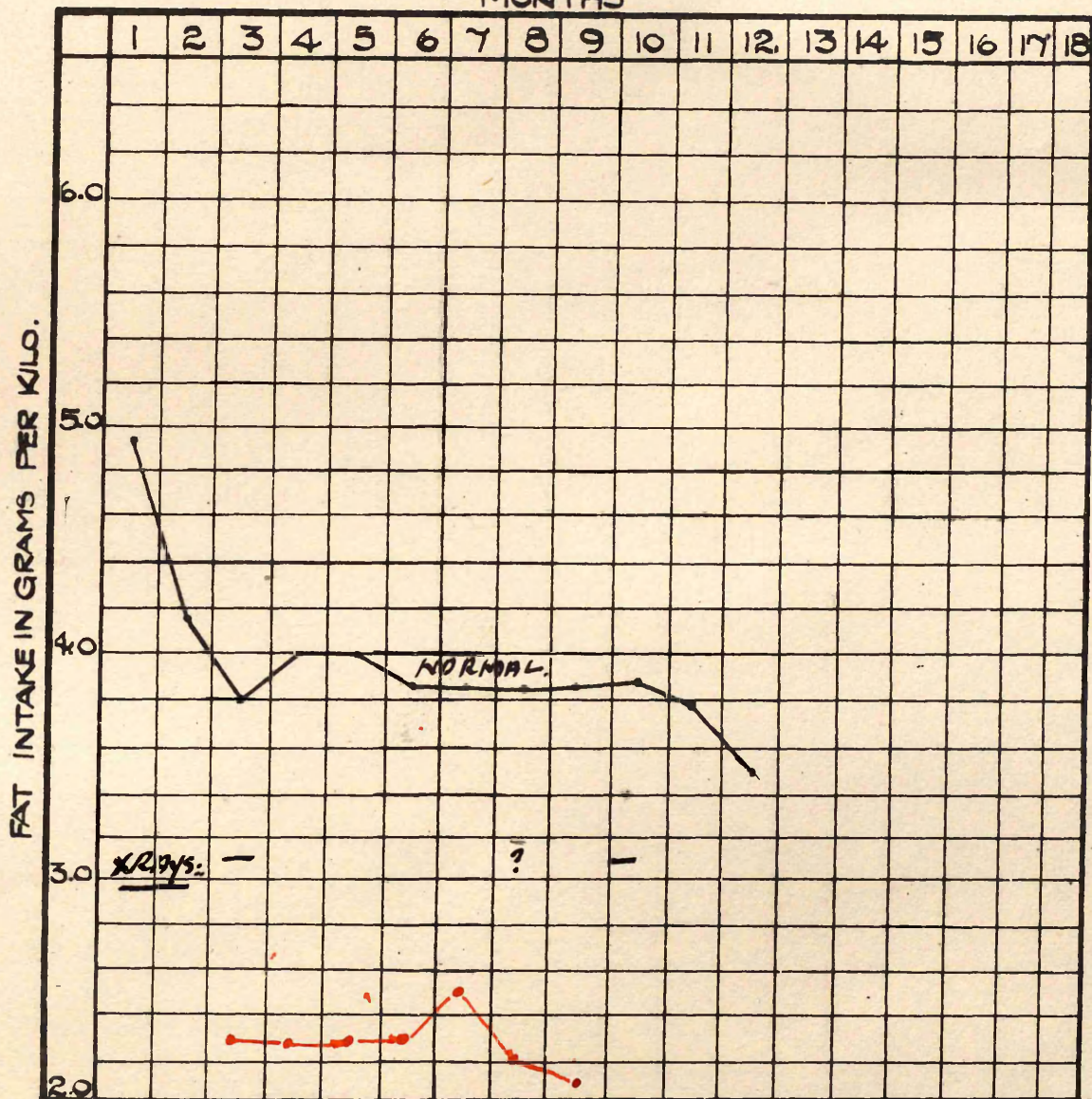
ON POOR FAT DIET

G. ROBT. WILLIAMSON



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER
KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD
~~WHO DEVELOPED RICKETS~~ ON POOR FAT DIET II ROBT. M^c PAKE.

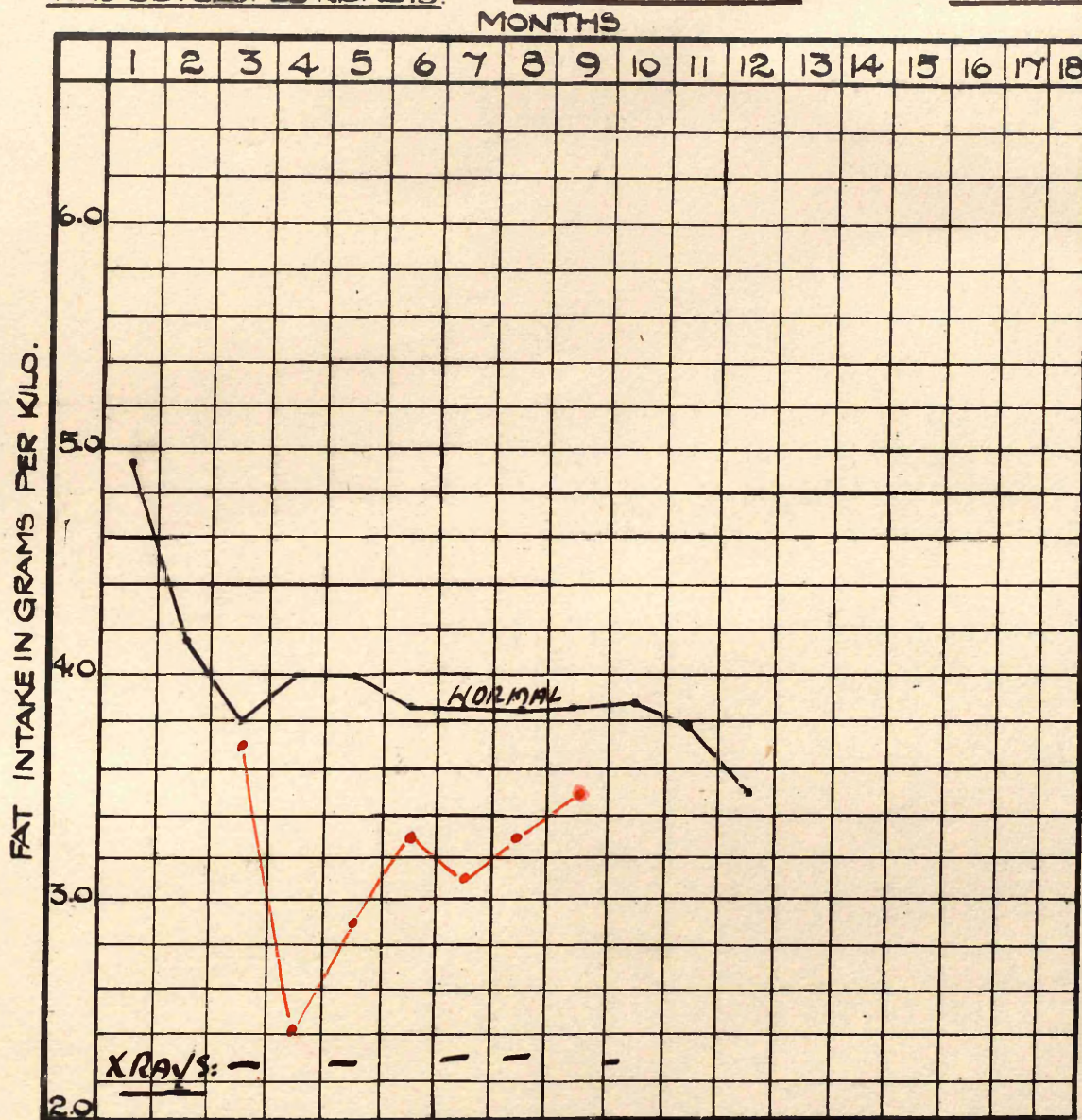


4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD WHO DEVELOPED RICKETS.

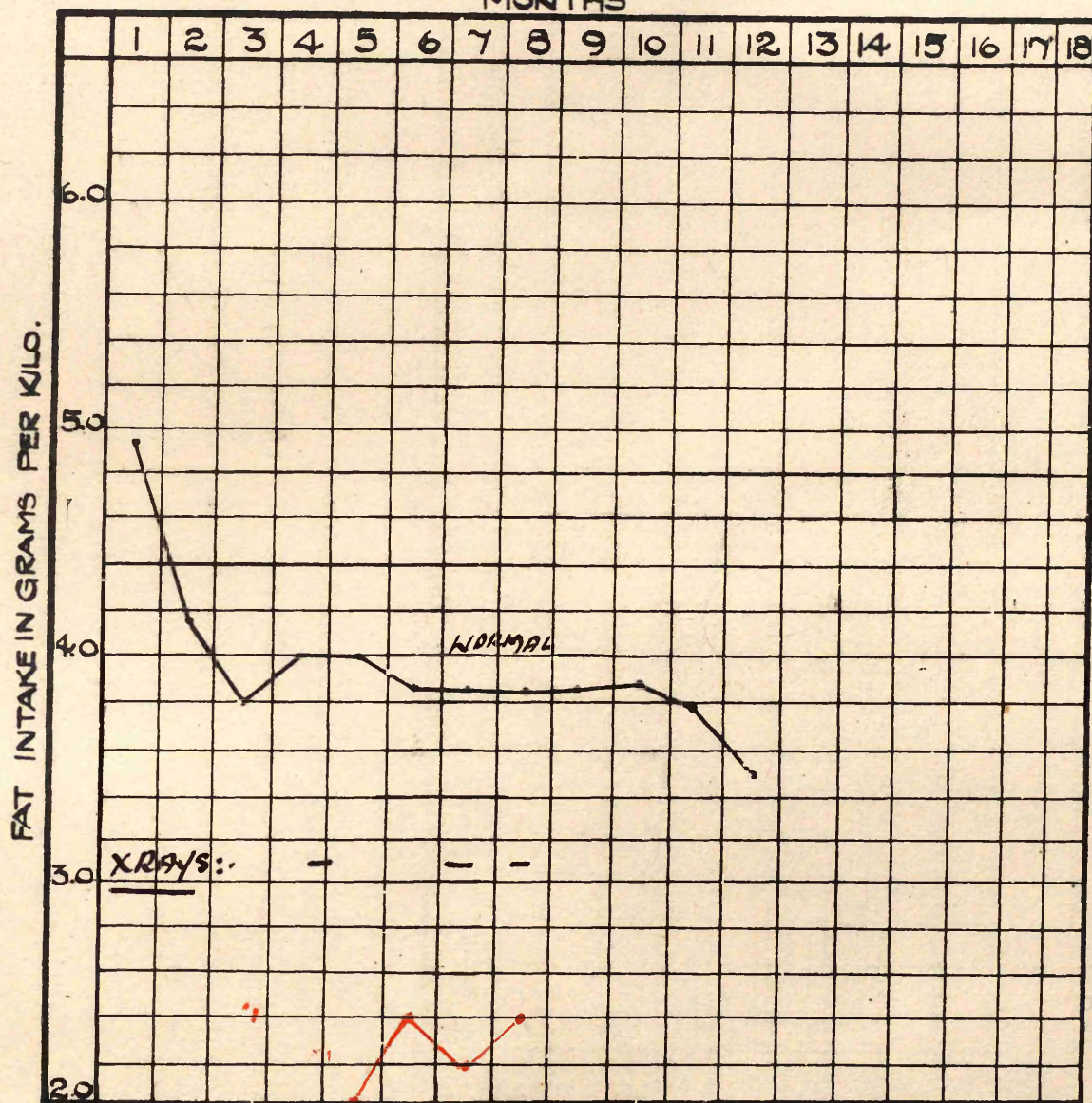
ON POOR FAT DIET

10 SARAH DOYLE



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.5

CHART COMPARING THE NORMAL FAT INTAKE, IN GRAMS PER
KILO OF ACTUAL BODY WEIGHT WITH THAT OBSERVED IN A CHILD
WHO DEVELOPED RICKETS. ON POOR FAT DIET. 12. JAMES PAILE



4.86 | 4.16 | 3.8 | 4.0 | 4.0 | 3.86 | 3.84 | 3.86 | 3.87 | 3.88 | 3.8 | 3.5

APPENDIX E.

DAILY FAT INTAKE FROM PATENT FOODS.

1. Glaxo. (Full Cream) 3.25% Fat.

Month.	Grams of fat.	Month.	Grams of fat.
1.	13.5.	7.	31.5.
2.	16.5.	8.	37.0.
3.	21.0.	9.	42.0.
4.	22.5.	10.	42.0.
5.	25.0.	11.	42.0.
6.	27.5.	12.	42.0.

2. Glaxo. (Half Cream) 1.75% fat.

Contains 55% of above.

3. Allenbury No. 1. 2.3% fat.

1.	13.9.
2.	16.36.
4.	22.75.

4. Allenbury. No. 2.

About 24.6 gm. daily.

4. Robinson's Patent Barley. .9% fat.

Given with 1/3 pint cow's milk = 6.05 gm.

5. Sister Laura's Food. (with cow's milk) .89% fat.

1.	18.12.
3.	21.76.
6.	29.0.
9.	31.7.
12.	31.7.

6. Nestle's Milk. 1% fat.

1.	9.0.	4.	12.6.
2.	9.6.	6.	14.2.
3.	12.0.	10.	18.0.

7. Savory and Moore's Food.

1.	8.7.	9.	18.0.
3.	9.0.	12.	18.0.
6.	13.4.		

APPENDIX F.

DETAILS OF DIET IN INVESTIGATED CASES.

Average normal daily fat intake up to 1 year is taken as:-

(1st month. 18.0 gm.	6th month. 27.0.	1 year 30.0 gm.
(3rd " 22.5	10th " 30.0.	

Name.	Age at 1st. observ- ation.	Diet.	Severity of Rickets.	Fat Sufficiency
1. John McLennan.	$\frac{11}{12}$ yrs.	Breast to 3 months. Then Sister Laura's Food and W.M. according to directions.	Slight.	Sufficient.
2. Jeanie Paterson.	$\frac{11}{12}$ yrs.	Breast to 3 months. Then Sister Laura's Food and W.M. plus an extra pint of W.M.	Moderate.	"
3. George Smith.	$\frac{8}{12}$ yrs.	Breast to 3 months. W.M. 2 pints with bread and butter and milk pudding to 1.5/12 yrs. when soup and gravy added.	Severe.	"
4. Jack Green.	$\frac{10\frac{1}{2}}{12}$	Breast to 3 months. Sister Laura's Food and W.M. to 9 months, then added bread and butter, soup, gravy, mince, $\frac{1}{2}$ pint milk.	Moderate.	"
5. Walter Elliot.	$\frac{9}{12}$	Breast to 3 months. Sister Laura's Food and W.M. to 1.2/12 yrs. Then general diet with gravy, soup, egg, margarine, $\frac{1}{2}$ pint milk.	Severe.	"
6. Peter Forisky.	$\frac{5}{12}$	Breast to 3 months. W.M. 2 pints to 1 year (also "Virol" from 7th to 10th month) Then general diet with butter and margarine (half of each) gravy, soup, egg.	Moderate.	"
7. Patricia Warnoch.	$\frac{10}{12}$	Breast to 3 months. Robinson's Barley with 2 pints W.M. to 1 year. General diet with butter, soup, gravy, $\frac{1}{2}$ -1 pint milk. Scott's Emulsion 1.6/12 to 1.9/12.	Severe.	"
8. Margaret Tooley,	2 yrs.	Breast to 3 months. Sister Laura's Food and W.M. to 8 months. Glaxo (full cream) to 1 year when supplemented with bread and butter. At 1.3/12 soup, gravy, general diet.	Moderate.	"
9. Patrick Crossan.	$\frac{4}{12}$	Breast to 5 months. In Belvedere Hospital to 7 $\frac{1}{2}$ months. W.M. 1 pint & Allenbury's Food and W.M. to 1 year. 3 months. Then 1 pint milk, soup, gravy, mince.	Moderate.	"

Name.	Age at 1st. observation.	Diet.	Severity of Rickets.	Fat Sufficiency.
10. Stewart Armour.	$\frac{10}{2.12.}$	Breast to 6 months. Full Cream Glaxo to 1 year. Then general diet with butter, soup, gravy, and at least $\frac{1}{2}$ pint milk.	Severe.	Sufficient.
11. James Campbell.	$\frac{1}{1.12.}$	Breast to 6 months. W.M. (about 2 pints) with milk foods and bread and butter.	Moderate.	"
12. Margaret McGregor.	$\frac{2}{1.12.}$	Breast to 8 months. W.M. 32 oz. to 1.1/12 then Benger's Food added.	Severe.	"
13. Agnes Miller.	$\frac{10}{1.12.}$	Breast to 8 months. W.M. 2 pints to 1 year supplemented by porridge from 10 months. Then general diet with butter, soup and gravy.	Severe.	"
14. Allan Cassidy.	3 yrs.	Breast to 8 months. Then gradually ordinary diet with 1 pint milk, soup, gravy, and margarine.	Moderate.	"
15. Mary McKellar.	$\frac{9}{1.12.}$	Breast to 9 months. Then $1\frac{1}{2}$ pints W.M. with soup, gravy, egg, margarine.	Moderate.	"
16. Philip Dally.	2 yrs.	Breast to 9/12, supplemented from 3 months with full cream Glaxo. Then $1\frac{1}{2}$ pints milk with puddings and milk to 1 yr. when gravy, soup, 1 pint milk, margarine.	Severe.	"
17. Robert Warnoch.	$\frac{2}{1.12.}$	Breast to 9 months. Then 1 pint milk, butter, soup, and gravy.	Slight.	"
18. Peggy McPherson.	4 yrs.	Breast to 9 months. In Fever Hospital for 1 month. Then general diet with $\frac{1}{2}$ pint milk, soup, gravy, egg, butter, and margarine (half and half).	Moderate.	"
19. Jessie Lawson. (Twin)	2 yrs.	Breast supplemented by 1 pint W.M. to 9 months. Then general diet with 2 pints W.M. margarine, soup.	Severe.	"

Name.	Age at 1st. observation.	Diet.	Severity of Rickets.	Fat Sufficiency.
20. Henrietta Lawson. (Twin)	2 yrs.	Breast supplemented by 1 pint W.M. to 9 months. Then general diet with 2 pints W.M. margarine and soup.	Severe.	Sufficient
21. Olenod Maezaroli.	$\frac{3}{1.12.}$	Breast to 10 months, then general diet with soup, gravy and butter.	Severe.	"
22. James McKenzie.	$\frac{8}{1.12.}$	Breast to 10 months. Then general diet with soup, gravy, and meat and occasionally butter.	Moderate.	"
23. John Steel.	2 yrs.	Breast to 10 months. W.M. 1 pint and milk pudding and milk to 1 year. $\frac{1}{2}$ pint W.M. gravy, soup, egg, butter, and margarine (half of each)	Severe.	"
24. Joseph McCabe.	$\frac{9}{3.12.}$	Breast to 10 months. Then general diet with 1 pint W.M. gravy, soup, and margarine.	Severe.	"
25. Alex. Currie.	2 yrs.	Breast to 11 months supplemented from 3 months with bread and milk. Then 1 pint milk, butter, gravy and egg.	Severe.	"
26. Sarah Lawson.	$\frac{10}{2.12.}$	Breast to 1 year, supplemented with Sister Laura's Food and W.M. Then general diet with soup, gravy, meat, bacon, fat and margarine.	Severe.	"
27. Nan Waddell.	$\frac{10}{2.12.}$	Breast to 1 yr. then general diet with 1 pint milk, soup, gravy, butter and meat.	Severe.	"
28. Agnes Watson.	$\frac{10}{1.12.}$	Breast to 1 year then milk pudding and 3 pints W.M. to present.	Severe.	"
29. Agnes Russell.	2 yrs.	Breast to 1 year. Then general diet with soup, gravy, egg. Occasionally butter and meat.	Severe.	"

Name.	Age at 1st. observ- ation.	Diet.	Severity of Rickets.	Fat Suffic- ient.
30. Elizabeth Collins.	$\frac{11}{12}$.	Breast to 1 year then ^{milk} $1\frac{1}{2}$ pints with porridge and breast at night to 1.4/12, then general diet with butter, gravy, soup & eggs.	Severe.	Suffic- ient.
31. Margaret Welsch.	$\frac{2}{12}$.	Breast to 1 year, then general diet with $1\frac{1}{2}$ pints milk. Soup, gravy and margarine.	Severe.	"
32. John Kane.	$\frac{4}{12}$.	Breast to 1 year. Then $1\frac{1}{2}$ pints milk, milk pudding and bread and butter to 2 yrs. after which soup, gravy, and meat added.	Severe.	"
33. Arthur Bain.	$2\frac{1}{2}$ yrs.	Breast to 1 year. Then general diet with butter, soup, eggs, and at least 1 pint of milk.	Moderate.	"
34. Joe Stewart.	$\frac{6}{12}$.	Breast to 1 year. Then milk puddings and 2 pints milk to 1.3/12, when gravy, meat, and soup added.	Severe.	"
35. Susan McGhee.	$\frac{8}{12}$.	Breast to 1 year. Then milk $1\frac{1}{2}$ pints, gravy, soup, mar- garine and occasionally egg.	Moderate.	"
36. Jessie Kennedy.	$\frac{8}{12}$.	Breast to 1 year. Then general diet with $\frac{1}{2}$ pint milk, butter, soup, and gravy daily.	Moderate.	"
37. Joe Geoghegin.	$\frac{7}{12}$.	Breast to 1 year. Milk $\frac{1}{2}$ pint, butter and gravy to 1.3/12 when occasional egg added.	Severe.	"
38. Joe McCulloch.	$\frac{6}{12}$.	Breast to 1 year. Milk 1 pint, butter, egg, to 1.6/12 when soup and gravy added.	Severe.	"
39. Elizabeth Watson.	3 yrs.	Breast to 1 year. $\frac{1}{2}$ pint milk, butter, gravy, soup, egg, meat.	Almost healed.	"

Name.	Age at 1st. observ- ation.	Diet.	Severity of Rickets.	Fat Suffic- iency.
40. William Lauder.	$\frac{4}{4.12.}$	Breast to 14 months. Then general diet with soup, gravy, egg, butter and $\frac{1}{2}$ to 1 pint milk.	Severe.	Suffic- ient.
41. Thomas Coutte.	2 yrs.	Breast to 13 months, then general diet including butter, soup, gravy, and 1 pint milk daily.	Severe.	"
42. Thomas Beattie.	$\frac{10}{1.12.}$	Breast to 14 months, then general diet including soup, butter and $\frac{1}{2}$ to 1 pint milk.	Moderate.	"
43. John Robinson.	$\frac{6}{1.12.}$	Breast to $\frac{6}{1.12.}$, supplement- ed from 3 months by Sister Laura's Food and 1 pint W.M. and from 1 year by soup, gravy, and occasional egg.	Severe.	"
44. Andrew Young.	$\frac{10}{1.12.}$	Breast to 1.2/12 supplement- ed from 6 months by Sister Laura's Food and 1 pint W.M. Then general diet with gravy, soup, and margarine,	Severe.	"
45. Donald Miller.	$\frac{10}{1.12.}$	Breast to 13 months. Then $1\frac{1}{2}$ pints milk, soup, gravy, vegetables and margarine.	Moderate.	"
46. John Hughes.	$\frac{8}{2.12.}$	Breast to 15 months. Then $\frac{1}{2}$ pint milk, gravy, fish, egg, margarine.	Severe.	"
47. Edward McCrae.	$\frac{2}{3.12.}$	Breast to 15 months. Then general diet with gravy, soup, meat, margarine.	Severe.	"
48. Running Thomas.	$\frac{7}{1.12.}$	Breast to 5 weeks. W.M. 2 pints to 9 months. Then "Special Dairy Milk for Babies". 2 pints to 1.2/12. Nestle's milk, bread and butter for 1 month. Then 2 pints W.M. butter, soup, and gravy.	Moderate.	"
49. John. McCann.	$\frac{1}{1.12.}$	Breast and Nestle's Milk to 2 months. Full Cream Glaxo to 3 months. W.M. 38 oz. to 11 months, then soup and gravy added.	Moderate.	"

Name.	Age at 1st. observation.	Diet.	Severity of Rickets.	Fat Sufficiency.
50. William Moffat.	$\frac{7}{1.12}$.	Breast to 6 weeks. Sister Laura's Food and W.M. to 1 year. Then general diet with $\frac{1}{2}$ pint milk, butter, gravy, soup.	Moderate.	Sufficient.
51. Mary Forsyth.	2 yrs.	Breast to 6 weeks. W.M. $1\frac{1}{2}$ to 2 pints to 1.3/12. 2 pints milk with milk foods to 1.9/12, when general diet with soup, butter, and gravy.	Moderate.	"
52. Agnes Baird.	11 months.	Breast to 5 weeks. Full Cream Glaxo to 3 months. Then W.M. 1 pint increasing to 2 pints daily from 4 months.	Slight.	"
53. James Smith.	$\frac{5}{1.12}$.	Breast to 1 month. Sister Laura's Food and W.M. to 1 year. Then $1\frac{1}{2}$ pints milk, butter and egg.	Moderate.	"
54. Donald McMillan.	9 months.	Breast to 2 months. Then W.M. $1\frac{1}{2}$ pints with breast at night.	Moderate.	"
55. John Hamilton.	$9\frac{1}{2}$ months.	Unknown to 2 months. Then at least $1\frac{1}{2}$ pints W.M. to 9 months, when oat flour added.	Severe.	"
56. Bernard Hcey.	$\frac{5}{1.12}$.	Sister Laura's Food and W.M. to 13 months. Then general diet with soup, gravy, butter, and margarine (half of each) and $\frac{1}{2}$ pint milk.	Severe.	"
57. John Villiers.	11 months.	Glaxo, Full Cream, to 4 months. W.M. 2 pints to 7 months when bread added. At 10 months, soup and gravy added.	Moderate.	"
58. Alex. Donald.	1 year.	Began with W.M. 16 ozs. and gradually increased to $2\frac{1}{2}$ pints at 6 months. At 11 months bread and butter added.	Moderate.	"
59. Agnes McKechnie.	$\frac{2}{3.12}$.	W.M. 20 ozs. gradually increased to 2 pints at 6 months. Continued to 2 to $2\frac{1}{2}$ pints W.M. to 1.6/12 when general diet with milk, soup, gravy, margarine.	Severe.	"

Name.	Age at 1st. observation.	Diet.	Degree of Rickets.	Fat Sufficiency.
60. Annie Leitch.	$\frac{10}{1.12.}$	Glaxo to 1 month. $1\frac{1}{2}$ -2 pints W.M. daily to 9 months. Has continued on 2 pints W.M. milk puddings to present.	Moderate.	Sufficient.
61. Eileen Carlin.	$\frac{6}{1.12.}$	Over 1 pint milk daily to 6 months. Then Sister Laura's Food with 2 pints W.M. to 1 year. Then soup, gravy, margarine, milk 1 pint.	Severe.	"
62. John McKechnie.	$\frac{4}{3.12.}$	W.M. 1 to 2 pints to 6 months. $2\frac{1}{2}$ to 3 pints to 1.9/12. Then general diet with soup, gravy, meat, egg, margarine and butter. (half and half).	Severe.	"
63. Annie Finniegan.	$\frac{9}{3.12.}$	Sister Laura's Food with 2-3 pints W.M. to 2 years. Then gravy, soup, and margarine added.	Moderate.	"
64. Jenny Simpson.	$\frac{4}{2.12.}$	W.M. $1\frac{1}{2}$ pints to 9 months. Then 2 pints with butter to 1 year when general diet with soup, butter, gravy and 1 pint milk daily.	Severe.	"
65. Sarah Neillie.	3 yrs.	W.M. 1 pint to 3 months (diluted). Then 2 to $2\frac{1}{2}$ pints undiluted to 14 months when butter, soup, and gravy added.	Moderate.	"

Details of the diet in some of the cases where it was considered to be deficient in fat are given below:-

Name.	Age at 1st. observation.	Diet.	Degree of Rickets.	Fat Sufficiency
1. Alex. Ramsay.	⁷ 1.12.	Breast to 3 months, 1 pint milk to 10 months when milk pudding and egg added. At 1 year, butter, gravy, soup.	Moderate.	Deficient 3rd to 10th month.
2. George Timothy.	² 5.12.	⁵ Breast to 1.12 yrs. Milk plentiful but mother's diet poor. Followed by general diet with soup, gravy and margarine.	Severe.	Deficient to 1.5/12.
3. Mary Thompson.	² 2.12.	Nestle's Milk to 1 year, then general diet with butter, $\frac{1}{2}$ pint milk, gravy and soup.	Severe.	Deficient to 1 year.
4. Neil Turpie.	¹⁰ 3.12.	Breast to 8 months. Allenbury's No.1 Food to 1 year, when general diet with soup, gravy and margarine.	Severe.	Deficient. 8th month to 1 yr.
5. Sarah Anderson.	¹⁰ 3.12.	Savory & Moore's Food to 1 year. Then general diet with soup, gravy and butter.	Severe.	Deficient to 1 yr.
6. Lenita Rossi.	1 yr.	Breast to 5 months, 1 pint milk to 8 months then $1\frac{1}{2}$ pints to 1 year. Scott's Emulsion 10th to 12th month.	Moderate.	Deficient. 5th month to 1 yr.
7. Margaret Boyle.	¹⁰ 1.12.	Not more than 1 pint milk to 6 months. Then 2 pints to 1 year when general diet with soup, butter and gravy.	Moderate.	Deficient to 6 months
8. Robert McKendrick.	¹ 1.12.	Half Cream Glaxo to 3 months. Then Savory & Moore's Food with 2 pints of milk to present.	Slight.	Deficient to 3 months.
9. Christina Johnstone.	⁷ 1.12.	W.M. 16 ozs. to 3 months. Sister Laura's Food to 1 year. Then $1\frac{1}{2}$ pints milk, butter, and milk puddings.		Deficient to 3 months.

APPENDIX G.

TABLES TO SHOW RESULTS OF TREATMENT.

1. COD LIVER OIL.

a. In Hospital.

Name.	Age when treatment commenced.	Degree of Rickets.		Result.		Duration of treatment.	Season
		Radio-graphic.	Clin-ical.	Radio-graphic.	Clin-ical.		
1. Margaret McGonlay.	$\frac{10}{1.12.}$	Severe.	Severe.	Marked im- provement.	No im- provement.	2 mths.	Summer.
2. Harriet Smith.	$\frac{9}{1.12.}$	Severe.	(Moder . (Severe.	do.	do.	1½ do.	do.
3. Joseph McCulloch.	$\frac{6}{3.12.}$	Severe.	Severe.	do.	Slight im- provement.	2 do.	do.
4. Margaret Reid.	$\frac{9}{1.12.}$	Severe.	Moder. Severe.	Definite improv.	No im- provement.	2 do.	do.
5. Stewart Armour.	$\frac{10}{2.12.}$	Severe.	Severe.	No im- provement.	do.	1 do.	do.
6. Robert Mathews.	$\frac{10}{1.12.}$	Severe.	Severe.	do.	do.	1½ do.	do.
7. Richard McGregor.	$\frac{6}{1.12.}$	Severe.	Mod. Severe.	Marked im- provement.	Very slight improv.	3 mths.	Winter.
8. Sarah Lawson. X	$\frac{10}{2.12.}$	Severe.	Severe.	do.	Slight improv.	3 do.	do.
9. Ella Rodgers.	$\frac{6}{2.12.}$	Severe.	Mod. Severe.	Definite improv.	Walks alone.	3½ do.	do.
10. Christina Johnstone.	$\frac{8}{1.12.}$	Severe.	Severe.	No improv.	No improv.	1½ do.	do.
11. Amelia Hart.		Severe.	Severe.	Definite improv.	do.	2 do.	do.

b. In Country Branch.

12. Agnes Russell.	$\frac{1}{2.12.}$	Severe.	Severe.	Definite improv.	Walks alone.	4 mths.	Summer.
13. Alfred Donald.	$\frac{10}{1.12.}$	Severe.	Severe.	Normal.	Very slight improv.	5 do.	do.
Sarah Lawson. X	$\frac{1}{3.12.}$	Mod. Severe.	Severe.	Further improv.	Walks alone.	2 do.	do.
14. Agnes Millar.	$\frac{10}{1.12.}$	Severe.	Severe.	Marked improv.	Slight improv.	2 do.	Winter.
15. Annie Leitch.	$\frac{10}{1.12.}$	Mod. Severe.	Severe.	Definite improv.	Very slight improv.	2 do.	do.
Alfred Donald.	$\frac{3}{2.12.}$	Normal.	Severe.	Normal.	Slight improv.	2 do.	do.

Cod Liver Oil (continued).

c. At home.

Name.	Age when treatment commenced.	Degree of Rickets.		Result.		Duration of treatment.	Season.
		Radio-graphic.	Clin-ical.	Radio-graphic.	Clin-ical.		
1. Alex. Sherry.	$2\frac{2}{12}$.	Severe.	Mod. Severe.	Definite improv.	Walks alone.	4 months.	Summer.
2. Thomas Small. X	1 yr.	Severe.	Severe.	Normal.	No improv.	5 "	"
3. Arch. Holmes.	10 mths.	Mod. Severe.	Mod. Severe.	Marked improv.	Definite improv.	3 "	"
4. Francis Bradshaw.	$2\frac{1}{12}$.	Mod. Severe.	Walking alone.	Definite improv.	Walking better.	5 "	"
5. Ina Hyslop.	2 yrs.	Mod. severe.	Mod. severe.	Definite improv.	Definite improv.	3 "	"
6. Christina Johnstone.	$1\frac{10}{12}$.	Mod. severe.	Severe.	Normal.	Slight improv.	4 "	"
7. Peggy McPherson.	4 yrs.	Mod. severe.	Walking alone.	Slight improv.	Walking better.	4 "	"
8. Priscilla Freeman.	$1\frac{2}{12}$.	Severe.	Severe.	No improv.	No improv.	2 "	"
9. Margaret Welsh.	$2\frac{2}{12}$.	Severe.	Mod. Severe.	No improv.	No improv.	2 "	"
10. Walter Elliot.	$1\frac{10}{12}$.	Severe.	Mod. severe.	Marked improv.	Walks alone.	4 "	Winter.
11. Agnes Russell.	$2\frac{6}{12}$.	Mod. severe.	Walks alone.	Definite improv.	-	5 "	"
12. Alex. Ramsay. O.	$1\frac{7}{12}$.	Mod. severe.	Walks alone.	Definite improv.	-	3 "	"
Alex. Sharp.	$2\frac{6}{12}$.	Mod. severe.	Mod. severe.	Slight improv.	Walks alone.	4 "	"
13. Lenita Rossi.	1 yr.	Slight.	Mod. severe.	Normal.	No improv.	$2\frac{1}{2}$ "	"

X = Mentally deficient child.

O = Phosphorated cod oil.

2. MASSAGE.

a. In Hospital.

Name.	Age when treatment commenced.	Degree of Rickets.		Result.		Duration of treatment.	Season.
		Radio-graphic.	Clin-ical.	Radio-graphic.	Clin-ical.		
1. John Villers.	11 mths.	Severe.	Severe.	Marked improv.	Very slight im.	2½ mths.	Summer.
2. Joseph McCabe.	$\frac{10}{3.12}$.	Severe.	Severe.	Marked improv.	Walks alone.	2 "	"
3. Jenny Simpson.	$\frac{7}{2.12}$.	Severe.	Severe.	Def. improv.	Def. improv.	2 "	"
4. May McVey.	$\frac{10}{1.12}$.	Mod. severe.	Severe.	Def. improv.	Walks alone.	2 mths.	Winter.
5. Alex. Currie.	2 yrs.	Mod. severe.	Severe.	Slight improv.	Walks alone.	2 "	"
6. John Robinson.	$\frac{6}{1.12}$.	Severe.	Severe.	Slight improv.	Marked improv.	4 "	"
7. Nan Waddell.	$\frac{10}{2.12}$.	Severe.	Severe.	Slight improv.	Slight improv.	4 "	"
8. John Kane.	$\frac{4}{3.12}$.	Severe.	Severe.	No improv.	Def. improv.	4 "	"
9. Bernard Hoey.	$\frac{5}{1.12}$.	Severe.	Severe.	No improv.	Slight improv.	3 "	"

b. In Country Branch.

10. Eliz. McDade.	$\frac{11}{1.12}$.	Severe.	Severe.	Normal.	Walks alone.	5 mths.	Summer.
11. Eliz. Morrison.	$\frac{9}{1.12}$.	Severe.	Severe.	Def. improv.	Def. improv.	2 "	"
12. William Lauder.	$\frac{5}{4.12}$.	Severe.	Severe.	Def. improv.	Def. improv.	2 "	"
13. Olendo Mazaroli.	$\frac{3}{1.12}$.	Severe.	Severe.	Marked improv.	Slight improv.	4 "	"
14. John Hughes.	$\frac{9\frac{1}{2}}{2.12}$.	Severe.	Severe.	No improv.	Slight improv.	2 "	Winter.
15. Connie Gillan.	$\frac{10}{1.12}$.	Mod. severe.	Mod. severe.	Slight improv.	Marked improv.	2 "	"
16. Edward McLae.	$\frac{2}{2.12}$.	Severe.	Severe.	Def. improv.	Slight improv.	4 "	"

PASSAGE (Contd.)

c. At Dispensary.

Name.	Age when treatment commenced.	Degree of Rickets.		Result.		Duration of treatment.	Season.
		Radio-graphic.	Clin-ical.	Radio-graphic.	Clin-ical.		
1. Thos. Coutts.	2 yrs.	Severe.	Severe.	Def.improv. in 2 mths.	Walking alone.	6 wks.	Summer.
2. Eliz. Collins.	¹¹ 1.12.	Severe.	Severe.	Marked im. in 2 mths.	Walking alone.	5 "	"
3. Gabriel McDonald.	⁴ 3.12.	Severe.	Severe.	Marked im. in 2 mths.	Walking alone.	6 "	"
4. George Cavena. X	⁴ 1.12.	Severe.	Severe.	Def.im. in 2 mths.	Walking alone.	5 "	"
5. Sarah Neillis. X	3 yrs.	Severe.	Severe.	Slight im. in 5 wks.	Walking alone.	3 "	"
6. Jessie Lawson.	2 yrs.	Mod. severe.	Mod. severe.	Mod. im. in 3 mths.	Walking alone.	3 wks.	Winter.
7. Henrietta Lawson.X	2 yrs.	Mod. severe.	Mod. severe.	Marked im. in 3 mths.	Walking alone.	3 "	"
8. John Hughes.	3 yrs.	Severe.	Severe.	Very slight improv.in 4 mths.	Walking alone.	4 "	"
9. Agnes McKechnie.	² 3.12.	Severe.	Severe.	Very slight improv.in 7 mths.	Walking alone.	6 "	"
10. Eliz. Watson.	⁴ 2.12.	Almost normal.	Severe.	No im. in 3 mths.	Walking alone.	4 "	"
11. Donald Johnstone.	4 yrs.	Severe.	Severe.	No improv. in 1 mth.	Walking alone.	3 "	"
12. Connie Gillan.	¹⁰ 1.12.	Severe.	Severe.	No improv. in 3 mths.	Walking alone.	3 "	"

X = cod oil in addition.

d. At home.

13. Jack Green.	³ 2.12.	Severe.	Severe.	Def.improv.	Walks alone.	2 mths.	Summer.
14. Lily Harrison.	2 yrs.	Mod. severe.	Mod. severe.	Marked improv.	Walks alone.	2 "	"
15. Thos. Beattie.	² 2.12.	Mod. severe.	Severe.	Very slight im. in 6 mths.	Walks alone.	2 "	"

(over)

MASSAGE (Contd.)

d. At home.

Name.	Age when treatment commenced.	Degree of Rickets.		Result.		Duration of treatment.	Season.
		Radio-graphic.	Clin-ical.	Radio-graphic.	Clin-ical.		
16. Jack Adams.	$\frac{7}{1.12.}$	Mod. severe.	Mod. severe.	Def. improv.	Def. improv.	3 mths.	Summer.
17. Alex. Donald.	1 yr.	Mod. severe.	Mod. severe.	Slight improv.	Slight improv.	3 "	"
18. Arthur Bain.	$\frac{7}{2.12.}$	Mod. severe.	Mod. severe.	Normal.	Walks alone.	4 "	Winter.
19. Arthur Copland.	$\frac{3}{3.12.}$	Mod. severe.	Severe.	Very slight im.	Marked improv.	2 "	"
20. Patricia Warnoch.	$\frac{10}{2.12.}$	Severe.	Walks alone stiffly.	Slight im. in 4 mths.	Def. improv.	2 "	"
21. Jessie Kennedy.	$\frac{8}{2.12.}$	Mod. severe.	do.	do.	Def. improv.	2 "	"
22. Eliz. Dillan.	$\frac{4}{4.12.}$	Mod. severe.	Mod. severe.	No improv.	Def. improv.	2 "	"
23. Susan Bell.	$\frac{3}{5.12.}$	Mod. severe.	Walks alone stiffly.	Slight im. in 3 mths.	Marked improv.	1 "	"

4. PHOSPHORUS.

a. In Hospital.

Name.	Age when treatment commenced.	Degree of Pickets.		Result.		Duration of treatment.	Season.
		Radio-graphic.	Clin-ical.	Radio-graphic.	Clin-ical.		
1. Agnes Watson.	$\frac{10}{1.12.}$	Severe.	Severe.	Almost normal.	No improv.	6 mths.	Summer.
2. Bernard Hoey.	$\frac{5}{1.12.}$	Severe.	Severe.	Almost normal.	Slight improv.	4 "	"

b. At home.

1. Agnes Harley.	$\frac{3}{1.12.}$	Mod. severe.	Slight.	Marked improv.	Walks alone.	5 mths.	Summer.
2. James Smith.	$\frac{8}{1.12.}$	Mod. severe.	Walks alone.	Slight improv.	Def. improv.	4 "	"
3. Jas. Donachie.	1 yr.	Slight.	Slight.	Almost normal.	Def. improv.	5 "	"
4. Philip Dally.	2 yrs.	Severe.	Severe.	No improv.	No improv.	4 "	Winter.

5. VIOLET RAYS.

a. In Hospital.

1. Thos. McKendrick.	$\frac{1}{1.12.}$	Mod. severe.	Mod. severe.	Def. improv.	Def. improv.	1 mth.	Summer.
2. Joe Geoghegin.	$\frac{8}{1.12.}$	Severe.	Severe.	Marked improv.	Def. improv.	2 "	Winter.

b. As out-patients.

3. Ellen Carter.	$\frac{6}{1.12.}$	Severe.	Severe.	No improv.	Slight improv.	1 month.	Winter.
4. David King.	$\frac{4}{1.12.}$	Severe.	Severe.	No improv.	No improv.	1 "	"

6. REMAINING UNTREATED.

Name.	Age when treatment commenced.	Degree of Rickets.		Result.		Duration of treatment.	Season.
		Radio-graphic.	Clin-ical.	Radio-graphic.	Clin-ical.		
1. George Timothy.	$\frac{2}{5.12.}$	Severe.	Mod. severe.	Def. improv.	Walks alone.	4 mths.	Summer.
2. Mary Robinson.	$\frac{7}{1.12.}$	Mod. severe.	Walks alone.	Normal.	-	3 "	"
3. John McCann.	$\frac{3}{1.12.}$	Mod. severe.	Mod. severe.	Def. improv.	Walks alone.	3 "	"
4. Ellen Timothy.	$\frac{5}{1.12.}$	Mod. severe.	Walks alone.	Def. improv.	-	4 "	"
5. James McKenzie.	$\frac{8}{1.12.}$	Mod. severe.	Walks alone.	Normal.	-	4 "	"
6. James Campbell.	1 yr.	Mod. severe.	Mod. severe.	Normal.	Walked alone at 1.6/12.	3 "	"
7. Donald Millar.	$\frac{10}{1.12.}$	Mod. severe.	Walks alone.	Very slight improv.	-	2 "	"
8. Annie Finnigan.	$\frac{9}{3.12.}$	Mod. severe.	Walks alone.	Slight improv.	-	4 "	"
9. John McLennan.	11 mths.	Slight.	Slight.	Normal.	Walked at 1.7/12.	3 "	"
10. Patrick Crossan.	$\frac{4}{1.12.}$	Slight.	Slight.	Normal.	Walks alone.	4 "	"
11. Mary Livingstone.	$\frac{3}{1.12.}$	Slight.	Slight.	Normal.	Walks alone.	4 "	"
12. Thos. White.	1 yr.	Slight.	Slight.	Normal.	Walked at 1.6/12.	1 "	"
13. Thos. Wyllie.	1 yr.	Slight.	Slight.	Normal.	Walks alone.	5 "	"
14. Eliz. Davies.	$6\frac{1}{2}$ mths.	Slight.	Slight.	Normal.	Walked at 1.6/12.	2 "	"
15. John Hill.	1 yr.	Mod. severe.	Slight.	Normal.	No improv.	3 "	"
16. Agnes Baird. X	11 mths.	Mod. severe.	Mod. severe.	Almost normal.	No improv.	5 "	"
17. John <i>McRusait</i> .	$\frac{2}{1.12.}$	Mod. severe.	Mod. severe.	Marked improv.	Def. improv.	5 "	"
18. Andrew Naylor.	$\frac{8}{1.12.}$	Mod. severe.	Mod. severe.	<i>Almost normal.</i>	<i>Walks alone.</i>	4 "	"
19. John McCann.	$\frac{6}{1.12.}$	Mod. severe.	Walks alone.	No improv.	-	5 mths.	Winter.
20. Eliz. Morrison.	$\frac{1}{2.12.}$	Mod. severe.	Walks alone.	No improv.	-	6 "	" (over)

6. REMAINING UNTREATED. (Contd.)

Name.	Age when treatment commenced.	Degree of Rickets.		Result.		Duration of treatment.	Season.
		Radio-graphic.	Clin-ical.	Radio-graphic.	Clin-ical.		
1. Jack Green.	1. ¹⁰ / ₁₂ .	Mod. severe.	Mod. severe.	No improv.	No improv.	4 mths.	Winter.
2. David Wark.	1. ¹ / ₁₂ .	Mod. severe.	Slight.	No improv.	No improv.	3 "	"
3. Mary McGhee.	2. ⁹ / ₁₂ .	Mod. severe.	Severe.	No improv.	Slight improv.	3 "	"
4. May Tooley.	2 yrs.	Mod. severe.	Walks alone.	Very slight improv.	-	2 "	"
5. Joe McCulloch.	3. ⁶ / ₁₂ .	Severe.	Severe.	No improv.	No improv.	4 "	"
6. Donald Millar.	1. ¹⁰ / ₁₂ .	Mod. severe.	Slight.	No improv.	No improv.	2 "	"
7. Allan Cassidy.	3 yrs.	Mod. severe.	Mod. severe.	Slight improv.	Slight improv.	2 "	"

X = Mentally deficient child.

All these children were out-patients except No. 18 who was kept in the Country Branch at Hospital.

7.

PROGRESS OF YOUNG RACHITIC BABIES.

DURING THE SUMMER MONTHS.

Name.	Age when first observed.	Radio-graphic degree of Rickets.	Radio-graph at end of Summer.	Clinical signs of Rickets at end of Summer.	Dietary changes from 1st. observation to end of Summer.
1. James Brady.	5½ months.	Definite.	Normal.	None.	Unchanged.
2. Margt. Dailly.	8 "	Definite.	Marked healing.	Slight.	"
3. Joan Kerr.	9 "	Definite.	do.	Slight.	"
4. John McKinney.	5 "	Slight.	Almost normal.	None.	"
5. May McKinney.	5 "	Slight.	do.	None.	"
6. Geo. Syme.	10 "	Definite.	do.	Slight.	"
7. Francis Taylor.	6 "	Definite.	Normal.	Very slight.	"
8. Chas. Boyd.	11 months.	Definite.	Definite healing.	Slight.	1 pint milk to 1 yr. then diet with 1 pint milk, gravy and margarine.
9. Mary King.	9 months.	"	Normal.	Very slight.	½ pint W.M. added to breast,
10. Matilda McEvan.	12 "	Slight.	Normal.	do.	Weaned at 12 mths. General diet with 1 pint milk, gravy and margarine.
11. Jane Newlands.	10 "	Moderately severe.	Almost normal.	None.	Cod oil stopped. Bread and margarine added.
12. Violet O'Rowke.	11 "	Definite.	Normal.	None.	½ pint less milk, but soup and margarine added.
13. Margt. Paterson.	10 "	Definite.	Almost normal.	Slight.	½ pint less milk: butter, soup, and gravy added.
14. Edward Wallace.	7 "	Severe.	Marked healing.	Slight.	½ pint W.M. added to breast.
15. David Wallace.	10 "	Definite.	Almost normal.	None.	Margarine and gravy added.
16. Hugh McGuire.	8 "	Definite.	Moderately severe.	Definite.	Gravy and margarine added.

ON FAT DEFICIENT DIET DURING SUMMER.

a. Untreated, but fresh air advised.

Name.	Age when treatment commenced.	Degree of Rickets.		Result.		Duration of observation.
		Radio-graphic.	Clin-ical.	Radio-graphic.	Clin-ical.	
1. David Rose.	4 months.	Definite.	Definite.	Marked healing.	Improved.	5 months.
3. Eliz. Connelly.	7 "	<i>Moderately severe.</i>	<i>Definite.</i>	Almost normal.		4 "
5. John McGregor.	4 "	Severe.	Severe.	do.	Marked improvement.	6 "

b. Phosphorus added to diet.

4. Edward Murray.	6 months.	Mod. severe.	Mod. severe.	Marked healing.	Marked improvement.	5 months.
-------------------	-----------	--------------	--------------	-----------------	---------------------	-----------