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A study of the nutritional state of urban bantu women(Witwatersrand) relative to their dietetic customs

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"A STUDY OF THE NUTRITIONAL STATE OF

URBAN BANTU WOMEN (WITWATERSRAND)

RELATIVE TO THEIR DIETETIC CUSTOMS."

by

PHYLLIS BRIGHT FLEMING.

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A STUDY OF THE NUTRITIONAL STATE OF URBAN BANTU WOMEN (WITWATERSRAND) RELATIVE TO THEIR DIETETIC CUSTOMS

INTRODUCTION:

This study was undertaken during the tenure of a joint appointment in the Departments of Physiology and Medicine at the University of the Witwatersrand. It was carried out throughout 1944 and the first half of 1945 when the incidence of malnutrition was high among African Native peoples, but as yet there was no detailed knowledge of their diets.

The author made the acquaintance of a number of Bantu women so that their mode of living could be observed, specimens of typical foodstuffs collected for chemical tests, and the subjects taught to weigh their own food portions on a spring balance which was provided. Women were chosen rather than men or children as they were capable of making the observations themselves, and are not as liable to eat "snacks" during the day, which the men do while at work. Their selection was made by a Native social worker from the Native Affairs Department of the City of Johannesburg. They were selected for their probable co-operation and not because they were malnourished or part of any social group. Only one was illiterate.

f the 35 women originally selected and studied, only 21 gave results satisfactory enough to report. They lived in either the Eastern or the Western Native Township, which are administered by the Johannesburg Municipality. These are fenced areas with Native guards on duty at the gates, and a certain standard of behaviour is expected from the inhabitants. In return, these families hired well planned comfortable houses, and enjoyed certain communal facilities i.e. attendance at a Medical Clinic. The right to purchase limited market produce at somewhat reduced prices, and an

opportunity to attend domestic science classes.

Most of these contacts were made in the first month of this survey, while the Native social worker was on full time loan. Thereafter she continued on a voluntary basis and spent many of her leisure hours consolidating the former cases, and slowly acquiring new ones.

The women who already knew the social worker became accustomed to our coming and going, and accepted the explanation that we were studying their diets and general state of health. No antagonism was ever encountered, but several subjects expected active medical treatment in return for their co-operation.

At the first visit a medical history and details of their social and economic status were obtained and recorded in a small book. A book was given to each woman, together with a spring scale and a carton drinking cup and a plate. She was instructed to record the weight of everything she ate and drank. The waste and bone were also weighed and noted. Wherever possible the record was continued for seven consecutive days. In addition a separate list was made in the book covering all cash expenditure of any form, during the same period.

To obviate inaccuracy and help to standardise the technique employed, the first meal or first few meals in each case were weighed, and recorded by one of us, in the presence of the woman. One subject was illiterate, and a few others proved unreliable. For these, the measuring and recording was done by the social worker for a shorter period.

For about a year after completing the above investigations, the writer and the worker continued to visit the women at irregular intervals, so that it was possible to verify their feeding habits, and opportunities arose for the collection of specimens of the more typical types of Bantu food, both in their cooked and raw states. These specimens

were readily given except in the case of Kaffir Beer, when the actual source was not disclosed, for fear of the police. It was not possible to do more than a limited number of vitamin estimations on the food specimens. These were carried out by Dr. L. Golberg of the South African Institute for Medical Research.

The women consented readily to venipuncture, or finger prick, so that enough blood could be withdrawn for a number of laboratory tests. The procedure was carried out in their own homes at a suitable opportunity, most of the women were familiar with what was expected of them, as they had formerly attended an ante-natal clinic. Haemoglobin and Haematocrit determinations were done by me. Serum proteins, and in some cases serum calcium values and the Wassermen reaction were carried out by the routine Department of the Institute.

Arrengements had been made for the use of the scale in the Municipal Clinic in each township, and batches of women were taken by car when convenient. Their heights and weights were recorded, standing bare feet and clad only in a thin cotton petticoat. A Spirometer was borrowed from the Physiology Department, for measuring vital capacities. Each women was given a general medical examination some time during the survey.

The raw dressed equivalent of the food actually consumed was calculated. The South African Food Tables of Fox and Golberg (39) were used, since many South African analyses are included by them. In some instances the water content of local samples of food, determined by Dr. Golberg, were used instead. In the case of composite recipes, use was made of the Food Tables of McCance and Widdowson, (72a).

Volu Full dietary records and calculations of all Bantu women are attached to this report, the maximum, minimum and medium daily intakes of the main constituents of the diet are

recorded. Vitamin losses in cooking could only be determined for Thiamin in a number of foods, but these have been included and are specially indicated.

The Author has acquainted herself with published dietary findings for the Bantu of Africa and has compared these with her own results. Where suitable, comparison has been made with similar studies on women elsewhere in the world. A section deals with the characteristics of Bantu cooking and food preparation.

The physical state of the 21 women is discussed with special reference to the diet they consumed during the period of observation and their cost of living in as far as it was possible to estimate the latter.

The Author concludes with a critical evaluation of her findings.

THE SOCIO-ECONOMIC BACKGROUND OF THE SUBJECTS

Information concerning the general environment of the subjects of the survey, together with relevant facts concerning their past histories, their financial state, and method of budgeting, was obtained by personal interview, when the Native social worker acted as an interpreter. She later assisted in the correct evaluation of the information which had been obtained.

The women proved co-operative, and did not object to making disclosures of a personal nature. Most of them were supported by their husbands, but could not say what proportion of the man's total income this represented.

Difficulties were encountered, however, due to the variable number of inhabitants in some of the homes, some of whom did not seem to be immediately related to the householders and since they might terminate their occupation abruptly without due notice, payments they made were irregular and unpredictable.

The Bantu are not given to the accurate observation of time, and the difference between four weeks and a full month is likely to have been ignored when attempting to record monthly cash expenditure on food. Purchases were often made in small quantities with no forethought, but just as the need arose, without regard to the extra cost entailed.

Information about expenditure was collected in two ways:-

At the general interview the women stated from memory all the items of any type which they considered formed a part of their monthly expenditure as a general rule. Costs and quantities were noted by the interviewer. Direct questions were also used to fill any gaps in the information. In addition, each woman was required to write down in a small

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book which was provided, the entire daily expenditure throughout the period when she recorded her diet. Both of these sources of information have been used.

Before proceeding to a description of the facts and their significance, it is important to understand the subjects and their environment.

ENVIRONMENT.

The women were fortunate in living in municipal townships in Johannesburg, these were enclosed areas with restriction of entrance. They lived in two or three roomed houses at a reasonable rental, water was laid on in the grounds of each house, and a coal stove was provided. With few exceptions, the houses were neatly kept and well furnished, but most of the fittings did not show much originality and the furniture and fittings were European in style. The grounds were usually uncultivated, some had made a flower bed, but vegetable growing was not usual, and the fruit trees which existed were untended and unlikely to yield much fruit. Little if any use was made of the ovens in the stoves, flat irons were used for ironing.

RACIAL ORIGINS.

The group of women under study was typical of the mixed communities which have arisen in urban life, for they were representative of no special tribe or race. This information was not obtained from two of the twenty one subjects, but of the remaining nineteen, seven were Zulu, four were Basuto, two Swazi, three Fingo and three Xosa.

MARITAL STATE.

Fourteen of the women were married, either according to the Native law, or by the Church, of these one was a widow, one was divorced. Six of the women did not know how long they had been married, the remainder stated periods from 1 - 27 years, average 12 years.

PERIOD OF RESIDENCE IN JOHANNESBURG.

None of the subjects was a newcomer from a rural area, the majority had spent most of their lives in Johannesburg. In Table I it will be seen that the shortest period of residence was 3½ years, the longest 46 years.

TABLE I

Years of Residence in Johannesburg.

Case Number	1	2	3	4	5	6	7
Residence Period	?	20	3½	12	3½	29	38
Case Number	8	9	10	11	12	13	14
Residence Period	17	?	10	30	20	12	20
Case Number	15	16	17	18	19	20	21
Residence Period	21	23	46	26	10	13	?

STANDARD OF EDUCATION.

This information was omitted in two cases, but with the exception of Case 9, an old woman of 75 years of age, there was no illiteracy. All the subjects had had some schooling and the majority had reached Std. VI or higher. They were therefore capable of recording their own diets.

TABLE II

Educational Attainment of 19 Bantu women.

Standard of Education	Case Number
No schooling	9
Grade II	2
Standard II	17
Standard III	7, 8, 11
Standard IV	12
Standard V	4
Standard VI	5, 6, 10, 13 14,15, 16, 18
Standard VII	19, 20
Domestic Science Teacher	3
No information	1, 21

OCCUPATION.

Fifteen of the twenty one women were housewives, some of whom took in piece work such as washing or dressmaking. Two single women, similarly occupied lived with their parents. Three others earned their livings as a midwife, a teacher in a creche, and a full time dressmaker respectively. The oldest member of the group, a woman of 75 years, boarded with a married child, where she did a little washing.

In the case of washerwomen, the collection and delivery of washing necessitated a bi-weekly trip to town, and the women were responsible for the cost of transport as well as the provision of laundry materials. Employers on the other hand, were not bound to give due notice and earnings might fluctuate abruptly.

SIZE OF HOUSEHOLD.

Five of the women boarded out and the remaining sixteen who were members of private households, gave the following information:-

TABLE III

Size of the women's Families.

Subject	1	2	3	4	5	7	8	10
No: in family	5	5(+)	3	4	5	8	9	6
Subject	11	12	13	14	15	16	17	18
No: in family	3	11	4	7.	7+	14(.)	3	6

(+) = Widow

. = Single, living with parents - one child receives support from father of child.

\+ = Single, living with mother only.

(.) = Single, living with parents.

The average household was five.

INCOME.

This information was obtained in two ways. At the general interview the women recalled from memory all the

items which they considered formed part of their monthly expenditure, the quantities and prices being noted by the interviewers. Gaps in the information were filled by direct questioning. Later, while recording her diet, each woman was asked to record her entire expenditure for the same days.

In the case of statements concerning weekly income, the amounts for thirty days were calculated and added to monthly payments to obtain the total monthly income. In most instances the husband made a contribution, but what proportion this was of his total earnings, was unknown, and in common with other contributions, it might be subject to variations.

TABLE IV

Main Incomes.

Case No.	Earnings of woman	Occupation of woman	Financial Contribution of husband or male supporter.
	£. s. d.		£. s. d.
1	-	Housewife	2. 0. 0. wk.
2	3. 0. 0. wk.	Dressmaker, Housewife	nil.
3.	16. 0. 0. mth.	Social worker, Housewife	6.10. 0. mth.
4	-	Housewife	2. 0. 0. wk.
5	1. 5. 0. mth.	Laundry, Housewife	No support
6	-	Housewife	1.10. 0. wk.
7	-	Housewife	8. 0. 0. mth.
8	18. 0. mth.	Laundry, Housewife	1. 0. 0. mth.
9.	12. 6. mth.	Laundry. Subject is elderly staying with daughter.	1.12. 0. mth.
10	-	Housewife	1.10. 0. wk.
11	-	Housewife	4. 0. 0. mth.
12	4. 2. 4. mth.	Teacher (Creche)	2. 0. 0. wk.
13	-	Housewife	1.10. 0. wk.
14	2.10. 0. mth. 2. 0. 0.	Laundry) for housework) European	1.11. 0. wk.

Main Income (Cont.)

Case No.	Earnings of women	Occupation of woman	Financial Contribution of Husband or male supporter
	£. s. d.		£. s. d.
15	1.10. 0. mth.	Laundry	stays with parents
16	1. 0. 0. mth.	Laundry	stays with parents
17	1. 5. 0. mth.	Laundry Housewife	2.12. 0. wk.
18	2. 5. 0. mth.	Laundry Housewife	2. 0. 0. wk.
19	10. 0. 0. mth.	Midwife, O.P.D.	lives in Natal
20	4.10. 0 mth	in hospital Dressmaker	divorced.
21	not disclosed	Helps in printer's office	not disclosed

TABLE V

Additional Income

Subject Number	Source of Income	Amount
		£. s. d.
12	Lodger (brother)	10. 0. wk.
	Sister (sub-lets)	1.10. 0. mth.
7	Lodger (brother)	10. 0. mth.
13	Lodger (male)	variable
14	Sister	5. 5. 0. mth.
	Sister's child	1. 0. 0. wk.
15	Mother	2. 0. 0. mth.
	Brother (painter)	5. 0. or 10. 0. wk.

It is obvious that only tentative amounts can be calculated for the income of the subjects. Not only do the members of the households alter without notice, but the greater part of the income is not "fixed".

TABLE VI

Total assessed Incomes

Number	£. s. d.	Number	£. s. d.
1	10. 0. 0.	11	4. 0. 0.
2	15. 0. 0.	12	18. 2. 4.
3	£2.10. 0.	13	7.10. 0.
4	11.10. 0.	14	17. 5. 0.
5	(see 12)	15	+ 4.10. 0. - 5. 0. 0.
6	7.10. 0.	16	1. 0. 0.
7	8.10. 0.	17	16. 5. 0.
8	5.18. 0.	18	12. 5. 0.
9	2. 4. 6.	19	10. 0. 0.
10	7.10. 0.	20	5. 0. 0.
		21	not disclosed

It is not possible to state the average income, but the incomes which were fully accounted for (as far as could be judged) ranged from £2. 4. 6. to £22.10. 0. monthly. It is of interest to study the details of the incomes of 8 washerwomen.

TABLE VII

Monthly

Incomes of 8 Washerwomen

Case No.	Laundry expenses A(1)	B(2)	Total(3)	Laundry Income	Profit or Loss(4)
8	2/6	4/8	10/8	18/-	+ 7/4
9	2/6	3/6	9/6	12/6	+ 3/-
12	6/-	5/4	14/10	25/-	+ 10/2
14	3/3	9/8	16/5	50/-	+ 33/7
15	2/6	4/11	10/11	30/-	+ 19/-
16	2/10	14/-	20/-	20/-	± 0
17	6/7	1/1	11/2	25/-	+ 13/10
18	11/-	6/10	21/4	45/-	+ 23/8

(1) Fuel, estimated at 20 per cent of total monthly expenditure on fuel.

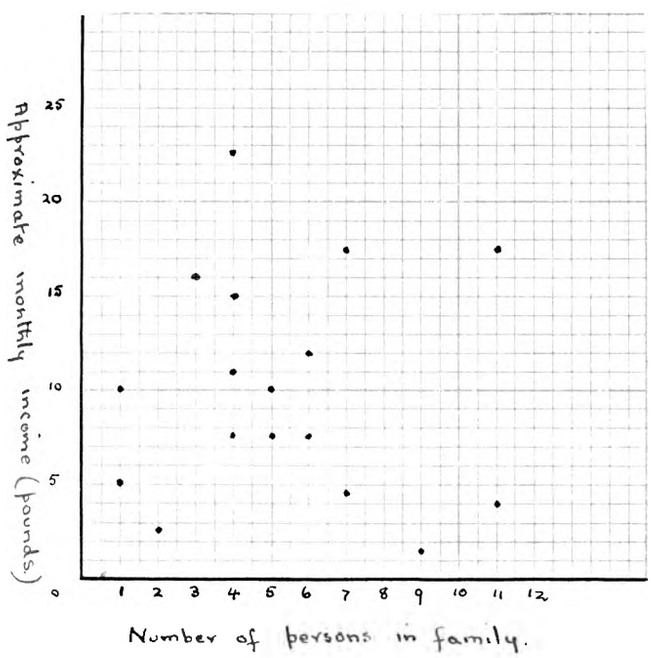
(2) Expenditure on laundry materials.

(3) Total of A and B plus 5/6 average transport costs.

(4) Difference between income and total expenses.

GRAPH I

Correlation between household size and Income



These figures can only be taken as approximate, however.

TOTAL EARNINGS.

The data available did not make it possible to estimate the earnings of the men in full, nor were their expenses known, i.e. transport, additional food bought, purchases of luxuries, etc.

Clothing outlay is very difficult to assess and was not recorded by many of the women. Often it is purchased secondhand and garments are passed on from one member of the family to another. It will only be possible, therefore, to record what was known.

The following list indicates the prevailing costs for the more usual items purchased, together with the range of quantities bought and frequency of purchase.

TABLE VIII

Estimated general expenditure. Rent fuel Food.

M = one month. W = one week. D = one day. Multiples indicated by Figures.

Item	Quantity	Cost	Period
Rent	-	17/4	M
Fuel			
Coal	4 bags	10/-	
Wood	1 bag	1/6	M
	1 load	1.6.6	3 - 4 M
Paraffin	½ - 1 bottle	6/10	
	4 gallons	7/4	4 M
Butter	¼ - 1 lb.	8d. - 1/10d.	W
Dripping	1 lb.	10d.	1 - 1½ W
Tea	1 - 2 lbs.	3/4. 6/8	M
Coffee	1 - 1½ lbs.	1/1d. 1b.	M
Sugar	Ave. 4 - 6 lbs.	1/6d. - 2/-	W
Bread	1 loaf	6d.	D
Milk			
fresh	1 pint	4½d.	D
condensed	1 tin	1/-	W
Soap	1 bar	10d.	W
Jam	2 lbs.	1/3	W
Meat			
beef mutton		1/-	D
offal, ox liver	?	1/6	½ W
Fish	?	?	Rarely
Cereals			
Mealie Meal	5 lbs.	1/-	W
	25 lbs.	3/6. - 4/-	3 - 4 weeks
	180 lbs.	1. - £1.5.0	1 - 3 M
Mealie rice	?	6d. - 1/6d.	W
Samp mealies	?	6d. - 1/6d.	W
Nobela	3 lbs.	not recorded	?
Beans			
Dry	?	3d. 6d. 1/-	W
Butter			rarely W
Green	?	6d.	W
Vegetables			
Potatoes	4 lbs.	1/-	
	2 - 8 lbs.	6d. - 2/-	} 2 D
Cabbage	1 - 2	6d. - 1/-	W
Onion	?	3d. - 1/-	W
Tomatoes	?	3d.	W
	box	1/-	W
Pumpkin	1	1/3d.	1 - 2 W

TABLE VIII (Cont.)

Item	Quantity	Cost	Period
Fruit			
Oranges	pocket	1/- - 1/3d.	D
			W
Unusual Items			
Cream Crackers	1½ pkt.	1/3d.	W
Lemonade	1 bottle	5d.	D

TABLE IX

Per Capita Expenditure on Food in Twelve Families

Case Number	Expenditure recorded	Days	Expenditure calculated 30 days	Number in family	Mean monthly expenditure per member
2	26/2	8	81/6	4	24/5
3	36/11	7	156/-	3	52/-
4	23/9	6	119/-	4	29/9
6	68/5	7	165/-	5	33/-
7	25/6	8	96/-	8	12/-
8	15/10	5	95/-	9	10/6
10	16/-	4	120/-	6	20/-
12	40/-	8	150/-	11	13/7
13	35/5	8	133/-	4	33/9
14	42/-	7	180/-	7	25/9
16	28/6	5	191/-	15	11/5
18	25/2	7	107/-	6	17/10

EXPENDITURE ON INSURANCE AND CHURCH PAYMENTS.

Nine of the 21 families paid monthly contributions to the Church or Insurance Societies. The latter usually took the form of burial fees, a matter on which many Bantu set great store. Payments ranged from 1/- to 2/6d. a month. Church fees ranged from 4/- per month, to approximately £1 per year. This fee might cover a person or a whole family.

OTHER EXPENDITURE

Schooling: Four women stated they paid the following amounts for schooling:-

Case 2 £1.19. 0. year.

Case 11 1. 5. 0. year (boarding school)

Case 18 17. 0. 0. boarding school
3. 0. 0.) books - 2 children
1. 0. 0.)

Case 4 paid 6d. week to a creche.

Case 6 paid 8d. month for Sunday School.

ENTERTAINMENT:

Five women mentioned attendance at a bioscope by younger members of the family. The estimated costs were:- Case 2 3/- month.

Case 13 6d. occasionally

Case 14 1/1d. once or twice a month.

Case 17 1/1d. twice a week.

TRANSPORT:

The following transport allowances were listed:-

Case 4 1/6. week (husband).

Case 15 8d. return weekly (washerwoman).

Case 16 4d. return weekly (washerwomen).

Case 17 8d. return by train.

OTHER PURCHASES:

Case 3 Repayment on hire purchase of car - £10.0.0. month.

Case 15 Cooked fish and chips occasionally 4d. - 9d. portion.

Case 17 Sweets 6d. daily to twice a week.

A number of women purchased a bottle of lemonade at 5d. for the whole family for a day.

It will be obvious that it is not possible to calculate the total expenses for the families with any degree of accuracy, consequently the following comparison must be looked upon as approximate, and figures are quoted

for some of the women only.

TABLE X

Comparison of Calculated Food Expenditure and Income per Month

Case No.	Calculated Food Expenditure	Partial Income
	£. s. d.	£. s. d.
2	4. 1. 8.	15. 0. 0.
3	7.16. 0.	22.10. 0.
4	5.19. 0.	11.10. 0.
6	8. 5. 0.	7.10. 0. *
7	4.16. 0.	8.10. 0.
8	4.15. 0.	5.18. 0.
10	6. 0. 0.	7.10. 0.
12	7.10. 0.	15. 2. 4.
13	5.13. 0.	7.10. 0.
14	5. 5. 0.	17. 5. 0.
18	5. 7. 0.	12. 5. 0.

The following are the main points deduced from these figures:-

(1) The average admitted (but obviously partial) income was £11.10. 0. per family. Incomes varied from £2. 4. 6. to £22.10. 0.

(2) The average expenditure on food was £6.11.1. per family for 30 days. The proportion of the income spent on food varied from one third to seven eighths, the average being a half.

(3) 10 per cent of the income was spent on rent.

(4) The proportion spent on transport is not known, as full information for the whole family was not obtained.

(5) Expenditure on fuel was estimated in only four cases, i.e. 8, 12, 14, 18. It ranged from 5 - 21 per cent, with an average of 12½ per cent which is a relatively high proportion.

(6) School fees were a fairly small item - unless

boarding school was provided. Probably the provision of clothing and books is the most important aspect.

(7) Church fees differed widely per individual. £1 per year was on average for a family.

Burial Insurance amounted to 1/- - 2/6d. per family per month.

It is of interest to compare the above findings with similar calculations made by Miss Jenisch (5).

Item	Jenisch Report 1940	Present Report 1944 - 1945
Income		
Average.	£3. 6. 9	£11.10. 0.
range	10/- - £20 month	£2.4.6. - £22.10.0
Expenditure		
Average	£5.11.0. month	£6.11.1. month
Proportion on:		
Food	50%	50%
Rent	18%	10%
Transport	6%	?
Fuel	12%	12½%
School	negligible	negligible
Church	18/- yearly per family	£1 yearly per family
Insurance	2/6d. month per family.	1/-, 2/6d. month per family.

As in the Jenisch Report it was found that expenditure generally exceeded income, but it must be borne in mind that the information available was incomplete. In some cases the deficit is made up by illicit means of livelihood or running into debt. According to Batson (6, 9) the mean weekly allowance for food expenditure, per adult woman, varied as follows:-

1938 - 39 6/3d.

1949 11/2d.

In the present survey a comparable figure per woman is not available since the known food expenditure covers the households. An approximate value can be deduced however, as follows:-

The average monthly (30 day) expenditure was £6.11.1., thus the weekly expenditure was £1.10.0. The average number of persons in the households was five, this would give a per capita allowance of 6/-.

CONCLUSION:

1. The 21 women lived in comfortable circumstances, they were old residents of Johannesburg. Most were middle-aged, married and had their husbands' support.
2. They were of different races.
3. They were fairly well to do, and some did occasional work.
4. Their standard of education was high.
5. The average size of the families was 5. This included lodgers who were not always relatives.
6. Income which was only partially estimated, ranged from £.2. 4. 0. to £22.10. 0. per month. The average was £11.0.0. per month.
7. The average expenditure on food was £6.11.1. per family for 30 days. According to Batson's estimate, this is probably inadequate, but it is known to be based on incomplete data.

THE ASSESSMENT OF THE CLINICAL STATE OF THE SUBJECTS.

This aspect of the survey formed an important means of judging the value of the diets which it was the purpose of the survey to determine. To obtain the information required, the subjects were first questioned for certain facts in their medical history which it was felt might have a bearing on their state of nutrition.

These were:-

1. The history of symptoms of eye disease, with special reference to the conjunctivae and cornea.
2. The history of any changes the subject may have noted in her skin at any time.
3. The development of tender joints, sore gums, ready bruising, or small haemorrhages under the skin, The occurence of blood loss from any site.
4. The history of a sore "cracked" tongue, or an alteration in the colour or sensation of the tongue. The history of cracks or sores on the lips or at the corner of the mouth.
5. The history of swelling with pitting of the legs.
6. The history of any alteration in weight.
7. The number of abortions, the incidence of haemorrhage in new born children.
8. The history of pronounced lassitude and sensory loss.

Later when the subjects were at home with the investigation, a complete routine general physical examination was carried out on each woman. Particular attention was paid to the following, in view of their possible relationship to the nutritional state:-

1. Skin.
2. Eyes - in particular the bulbar conjunctivae.
3. Mouth - gums, tongue, lips, teeth.
4. General physique, the amount of subcutaneous tissue,

the signs of weight loss. The presence of oedema.

5. The nervous system, evidence of sensory loss, changes in the limb reflexes, alterations in the fundus of the eye.

6. The examination of the liver, and the parotid glands.

The following recordings were made:-

1) Blood pressure. 2) Height, Weight. 3) Vital Capacity.

The following section deals with the clinical examination of the subjects, and sets forth all the positive observations which have a bearing on the state of nutrition of the subjects.

Attention is directed to the table of clinical findings in Volume 2.

CLINICAL EXAMINATION OF TWENTY ONE BANTU WOMEN

Physical proportions.

Heights and weights were measured while the subjects were clad in cotton petticoats only and with their feet bare. The findings are classified according to the standards for American women.

(McLester and Derby (75) see page 24)

TABLE XI

Classified Heights and Weights of 21 Bantu Women

Subject No.	Age Years	Height ins.	Weight lbs. Under-weight	Small	Medium	Large	Extra large
1	33	62				132	
2	42	59					140
3	34	63½					160
4	30	60					148
5	26	64		120			
6	29	61					137
7	38	62		115			
8	40	64					195

TABLE XI (COnt.)

Subject No.	Age Years	Height ins.	Weight lbs. Under-weight	Small	Medium	Large	Extra large
9	75	62					152
10	35	64					191
11	39	60					147
12	32	65			133		
13	30	63					150
14	20	59					139
15	21	57		100			
16	23	61			116		
17	46	59					143
18	40	60				124	
19	35	60					188
20	34	62	106				
21	?	63					157

The range in weight is 100 - 194 lbs. The average weight is 142 lbs. (142.5 ± 25.2 lb.). The average height is 5'1" (61") 61.1 ± 2.2".

The following comparisons are made with women, African, Asiatic and European.

(1) AFRICAN WOMEN

(i) West Africa (Nigeria)

Nicol (87) 1074 women (weight only)

Age years	Weight lbs.	Variations in 4 Tribes
20	97	93 - 112
25	106	103 - 119
30	108	105 - 126
35	108	108 - 131
40	108	105 - 133

(ii) Central Africa (Kenya) Orr and Gilks (91)

Age years	Height inches		Weight lbs.	
	Kikuyu	Masai	Kikuyu	Masai
17 - 18	59.4	62.1	92.1	114.2
19 - 20	59.7	62.7	94.1	119.6
21 - 25	60.2	62.8	100.6	127.4
26 - 30	60.2	61.8	99.7	117.9
31 - 40	59.7	61.8	94.2	113.8

(iii) North Africa (Sudan. Culwick (25a))

Weight 100 - 105 lbs.

Height 5'2½"

(iv) Southern Africa a) Personal communication Dr. Walker (123)

Race	Number	Average Height in inches.
Bushman	16	62" (5'2")
Hottentot	14	60¾" (5'0¾")

The subjects were measured bare foot.

b) Natal Personal communication Dr. Adolfsson (2)

Reference	Weight lbs.			Height inches		
	Average	Max.	Min.	Average	Max.	Min.
(37)	142.0	211	114	58.0	64	50
	141.7			55.7		
	∓ 19.7			∓ 5.3		

c) Bechuanaland Women (Non-pregnant) Personal communication Dr. Squires (112)

Reference	Weight lbs.			Height inches		
	Average	Max.	Min.	Average	Max.	Min.
(67)	111.0	150	88	61.0	71	57
	111.2			61.9		
	∓ 13.7			∓ 2.4		

SUMMARY OF AFRICAN WOMEN

Reference	Number	Average Height ins.	Range or Average Weight lbs.
87	1074	-	97 - 108
91	?	60	Kikuyu 94 - 100.6
25a	?	62½	Masai 114 - 127
123	16 Bushmen	62)	-
	14 Hottentots	60¼)	
2	37	58	142
112	67	61	88 - 150
Present Series	21	61	142

(2) ASIATIC WOMEN

(i) Ceylon Coolies Nicholls (85)

Number	Average Height in inches	Average Weight lbs.
?	58½	98

(ii) Chinese Women (Native women South Formosa) Chen and others (22)

Age in years	Weight in lbs.	Height in inches
25	94	60

(iii) Japanese Women Yanagi and others (138a)

Age in years	Weight in lbs.	Height inches.
30	107	60
41 - 51	110	-
71 and over	97	-

SUMMARY OF ASIATIC WOMEN

Reference	Number	Average height inches	Average weight lbs.
86	?	58¼	98
22	?	60	94
138a	?	60	97 - 110

Reference	Number	Average height inches	Average weight lbs.
Present series	21	61	142

(3) European Women

(i) Britain a) Kemsley (62, 62a)

33,500 Women all occupations.

Age - years	Height - inches	Weight - lbs.
19.5 - 24.5	62	114
24.5 - 29.5	62	116
29.5 - 34.5	62	118
34.5 - 39.5	62	121
39.5 - 44.5	62	125
44.5 - 49.5	61	128
49.5 - 54.5	61	131
54.5 - 59.5	61	129
59.5 - 64.5	61	127
64.5 - 69.5	60½	124
69.5 and over	60	119
All ages	62	122

(ii) America a) McLester and Derby (75)

Age - years	Height - inches	Weight - lbs.		
		Small	Medium	Large
	60	105-113	114-120	119-131
	61	107-115	114-122	121-131
25	62	110-118	117-135	124-138
years and	63	113-121	120-128	127-138
over	64	116-125	124-135	131-142
	65	119-128	127-135	133-145
	66	123-132	130-140	138-150

b) Mirone (76a).

Women

Age years Average	Height inches Average	Weight lbs. Average
27.1	64.1	126.2

(iii) Australia Woodhill (138)

5,270 cases

Age years	Height inches	Weight lbs.
30 - 39	64	114 - 140

(Range 60 - 68").

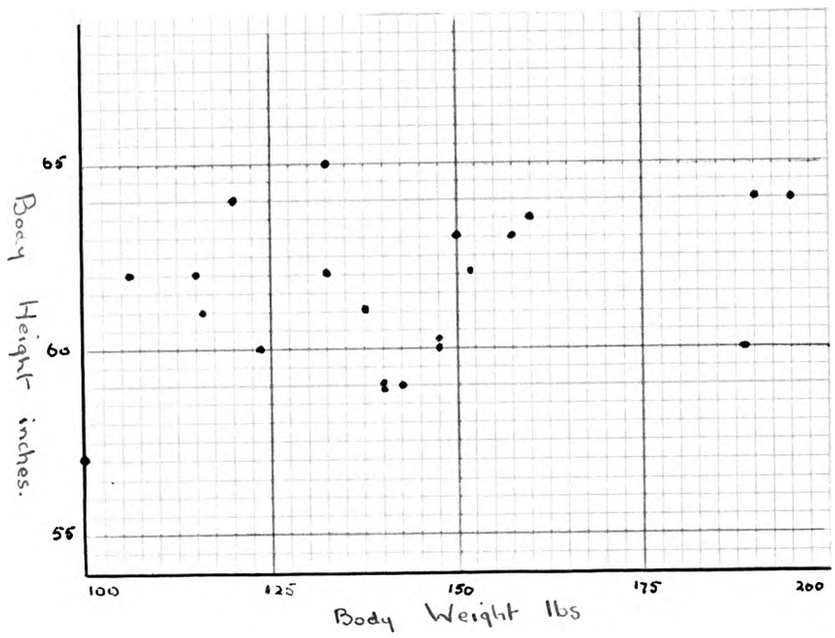
Summary of European and American Cases

Source of Date	Number	Average Height inches	Average Weight lbs.
(62, 62a)	33,500	62	122
(75)	?	60 - 66	105 - 150
(138)	5,270	63½	114 - 140
(76a)	?	64	126
Present series	21	61	142

I am informed by Dr. P. Tobias (118) that bone measurement for the various Bantu tribes, suggest no marked difference in stature.

The average height of the present series of Bantu women differs little from that of other groups of African women. It is slightly higher than the means of several groups of Asiatic women, but rather lower than the means of women in England, United States and Australia. Nevertheless, the average weight of the women in the present series is higher than that of all these groups. The accompanying diagram shows no correlation between height and weight.

GRAPH 2 CORRELATION OF HEIGHT AND WEIGHT



BLOOD PRESSURE RECORDINGS - 21 BANTU WOMEN

The recordings were taken by the author after each subject had rested in the supine position, during the course of a physical examination at her home. The examiner was by this time an accustomed visitor to the home, and all subjects were wholly co-operative so that undue agitation should have been minimized, if not altogether excluded.

The individual recordings are listed in the Table of Clinical Findings Volume 2. The mean figures were:- systolic 126, and diastolic 84 mm. Hg.

A diastolic pressure over 90 mm. when recorded in the resting subject, is considered to be evidence of hypertensive disease. Six of the women had such a reading, they are considered in greater detail below:-

TABLE XII

Possible Causes of Hypertension in six of the Women

Subject No.	Age	Ht. ins.	Wt. lbs.	Blood Pressure	Related Physical findings	Conclusions
* 8	40	64½	194	172/98	Enlarged thyroid	Obese, Menopause, ?Thyrotoxicosis
9	75	62	151	152/100	nil	Senile
10	35	64	191	142/100	nil	Obese
* 17	46	59	143	Rt. arm 228/98 Rt. leg 184/98	Cardiac murmur, Enlarged thyroid	Obese, Menopause, Thyrotoxicosis Co-arctation of the Aorta
19	35	60½	188	142/106	nil	Obese
* 20	34	62	106	118/95	W.R. and Kahn, + Hb. 9 gm. Retinal vessels show hardening.	Syphilis, Arterial disease

The cases marked * have obvious causes for their hypertension. Of the remaining three cases, two are over weight and one was senile.

DISCUSSION:

It has been stated, (Becker (10)) that hypertensive heart disease is very common among the Bantu and coloured races in South Africa as judged by post-mortem studies. The incidence is given as 8.2 per cent, rather less than that found in the white races of the United States. The incidence increases with advancing age, with a maximum of 15 per cent at the 6th decade. Sixty one per cent of the cases are primary in type.

The prevalence of hypertension among urban Bantu people has been described by other South African investigators Heimann, Strachan and Heymann (52), Ordman (90). The latter describes the blood pressure in groups of South African Bantu subjects. In this series a high incidence of hypertension was revealed and the blood pressure was found to rise with age. No racial or tribal correlation was noted, but there

was an association between hypertension and obesity.

In contrast to these views, hypertension has been stated to be rare among rural Bantu. Donnison (29); Jex-Blake (60).

The average findings for the present group of urban Bantu women namely 126/84 mm. Hg., are comparable with those recorded for two African tribes - Orr and Gilks (91).

Tribe	Kikuyu	Masai	Other similar tribes.
No.	54	26	46
Av. age	28 yrs.	28 yrs.	27 yrs.
Weight	128 lbs.	133 lbs.	128 lbs.
B.P.	122/77	117/79	115/82

CONCLUSION:

The average blood pressure of the group was within the normal range. Six of the cases suffered from hypertension.

EXAMINATION OF THE SKIN

The skin changes in the women of this survey were only of the mildest type. Such changes have always been the subject of considerable discussion among expert examiners, and have given rise to considerable differences in opinion among them. They should only be considered when reviewing the subject as a whole, and must not be taken to constitute ~~the~~ evidence of malnutrition, unless supported by other associated findings.

The findings in the twenty one Bantu women will be discussed under various headings.

Pigmentation

In four of the women there were patches of increased pigmentation over the outer borders of the forearms, and on the malar regions of the face. One of these subjects had recently been pregnant, which may account for the increased pigmentation of the cheeks.

An increase in pigmentation on the forearms and malar regions, occurs in pellagra. Nicholls (86), Gelfand (41), Suzman (114a).

It is felt however, that in the present cases, the changes noted were not of themselves significant.

Texture

The texture of the skin was normal in fourteen of the twenty one women. Of the remaining seven, one who was 75 years of age, showed a laxity and wrinkling of the skin, which was compatible with her age. In the six other women, one or both of the following were noted:-

a) Enlargement and plugging of the perinasal sebaceous glands.

b) Dryness and fine browny scaling of the skin (Xerosis).

According to Nicholls (86), blockage enlargement and plugging of the sebaceous glands of the face, does not constitute phrynoderma, which does not occur on the face. Instead, he describes this as the third type of sebaceous enlargement, a form of hyperkeratosis, which is usually accompanied by mouth lesions, which are attributed to ariboflavinosis. He acknowledges however, that a number of types of follicular hyperkeratosis have been described by dermatologists with little reference to aetiology.

Nicol (87), in a survey of Nigerian peasant farmers, describes nasolabial seborrhoea, and ascribes it to ariboflavinosis.

Loewenthal (69), in a study of apparently pure Vitamin A deficiency in a Uganda population, describes phrynoderma as a symptom, but considers that it does not occur on the face or scalp. Facial eruptions must be carefully differentiated from acne which occurs in the adult.

The blocked sebaceous glands which were noted in

six women of this series, were only in the creases at the sides of the nose, and were in all probably due to lack of hygiene in persons who do not wash their faces frequently but prefer to oil them and who live in a hot climate where sweating is usual.

There are no convincing grounds for considering these findings as evidence of avitaminosis, either A or B (Riboflavin.)

Xerosis

A dry skin with fine brawny scaling was noted in four of the women, this usually occurred on the upper arms, but in one it was found on the covered areas of the body.

Though generalised dryness of the skin is associated with many forms of malnutrition including Vitamin A deficiency, the mere finding of a dry skin does not necessarily indicate a deficiency disease, and nearly every old person in South Africa suffers from some degree of dryness of the skin during the winter months. Some of the younger persons will also show this if ill-wrapped and frequently exposed.

Squires (111) describes mild dryness of the skin influenced by seasonal variations, and a skin mosaic, which is caused by crouching for warmth over open fires. The incidence of dry lustreless skin was between 16 - 37 per cent in Bechuanaland school children. The dryness is on exposed areas as a general rule. On one of the present subjects however, it was noted under the clothing and at the upper arm sleeve margin. This is probably explained by the fact that the application of fat or oil i.e. Cocoanut oil, Vaseline, is popular among the Bantu, but is usually only applied to the face, forearms and legs, and after washing. In such persons therefore, the dryness of the skin would be more marked under the clothes, than out of them.

Various findings have been reported by different

investigators in the course of nutrition surveys: Loewenthal (see Le Riche (67)) describes significant differences in the skin texture of African boys fed on different diets. Brock and Latsky (18) in a survey of school children between the ages of 8 - 16 years, most of whom were Coloureds, detected some possible evidence of Vitamin B deficiency i.e. dryness of the extensor surfaces of the forearms, the severer forms resembling perifollicular hyperkeratosis. In a later survey by the same workers, Brock and Latsky (19) few stigmata were reported. Le Riche (65), in a study of 3,510 African school children, reported that 47 per cent suffered from dry skins, 22 per cent from rough skins. Trowell (119. 120) found ill defined skin changes in 500 African railway workers, which he was not able to explain satisfactorily.

It is highly debatable therefore, whether mild degrees of dryness and scaling of the skin are significant, and it is unwise to dogmatise concerning minor findings during a nutritional survey, since it is not easy to differentiate between the changes which result from mild avitaminosis and those which are the results of alterations in the temperature and humidity of the surrounding air.

It is unlikely that the subjects of the present survey suffered from skin changes due to any form of avitaminosis.

Oedema

Pitting oedema of the lower extremities, is a finding in gross protein deficiency where there are alterations in the serum proteins. Oedema may also arise from circulatory congestion and in cases of impaired venous return, especially if aided by immobility. This sign was looked for in the present physical examinations because of its relationship to the protein intake. It was present in one subject only, on one leg only, and there was a history of alba dolens.

Five other women had findings which were equivocal. One was 75 years of age - her skin was lax and wrinkled in proportion to her age. Another was 32 weeks pregnant, and a third in whom the pitting was unilateral, had gross varicosity of that limb. In the remaining two women, the condition which was only very slight, was unexplained in one while the other was obese and suffered from a mild secondary anaemia and her protein values were near the lower limit of normal. Any or all of these might have been contributory to the oedema.

With the possible exception of the last quoted case, no case of oedema could be ascribed solely to malnutrition.

EXAMINATION OF THE MOUTH

Consideration of this examination will be dealt with under a number of headings:-

Lips

The examination of the lips was recorded in 19 subjects only, and in all cases they appeared normal to inspection, with no evidence of cheilosis or angular stomatitis.

These signs are attributed to riboflavin deficiency, but according to Nicholls (86), their onset may be determined by the onset of the summer's heat or the winter's cold.

Cullumbine and others (24a) found that evidence of riboflavin deficiency was absent in various Ceylonese communities despite a low intake, and suggested some biological adaptation by these people.

As will be discussed later, the present series of women were found to have a slightly reduced riboflavin intake.

Gums, Teeth

There has been considerable discussion by many investigators about the possible relationship between

gingivitis, caries and scurvy. Since gingivitis and caries are so commonly associated, it is probably wisest to discuss these together.

The following are the findings in the twenty one Bantu women of the survey:-

Gums.

The gums were normal in seven of the women. The remaining 14, showed the following findings:-

		No. Subjects.
a)	Recession of the alveolar margins.	10
b)	Reddening and oedema.	7
c)	Tartar deposits on bases of exposed teeth with or without discolouration.	5

Teeth.

The examination consisted of inspection. The teeth appeared healthy in ten women. Three women were edentulous, two of these wore dental plates. In the remaining eight women, all degrees of caries ranging from mild to severe were observed. The teeth most often affected were the upper and lower incisors which were frequently discoloured, broken and loose.

Of the ten women who had healthy teeth, only four had healthy gums.

Discussion.

The high incidence of caries and gingivitis in this group of subjects, is in accordance with the findings of most workers among the Bantu, more especially urban Bantu, whose adoption of European habits of feeding, and the use of a tooth brush and dentifrice is probably associated. A number of the women in this survey gave histories of bleeding gums, and four of the women related this to the use of a tooth brush, some in fact had reverted to the rural Bantu use of finger cleansing of the mouth, this being done twice a week, dipping a finger in wood ash.

Others no longer cleaned their teeth.

The following table sets out the relationship which has been noted by other workers in Africa, between these mouth lesions and the clinical evidence of scurvy.

RELATIONSHIP OF GINGIVITIS CARIES AND SCURVY

Reference	Subjects	% Gingivitis	% Caries	% Scurvy
(65)	35,100 African school children	12.8		nil
(66)	57 Bantu reformatory boys.	26.3 combined	1.7	nil
(111)	Supplementary school feeding of two groups of Native children (Bechuanaland) a) Kanye 319 subjects b) Molepolole 199 "	slight a) 19 b) 48 severe a) 13 b) 19	a) 32.6 b) 34.1	No other scorbutic evidence
(12)	Bantu children Northern Rhodesia		12	No frank deficiency state found
(120)	500 East African railway workers	46	6	Laboratory tests suggested mild Vit.C deficiency in a few subjects

Nicol (87) describes caries and infective gingivitis in Nigerian peasant farmers, who do not appear to suffer from any ascorbic acid deficiency. Squires (111) includes a dental report in which the spongy haemorrhagic gums found in some of the African children were ascribed to mouth breathing and subsequent gum infection. No other evidence of scurvy was found.

With the exception of Trowell then, whose evidence in support of scurvy was said to be only slight, the remaining workers confirm the widespread incidence of gingivitis and caries without associated evidence of scurvy.

Nicholls (86) states that while ascorbic acid deficiency is certainly the cause of swollen bleeding gums, it may occur in subjects known to have an ample supply of ascorbic acid. He considers it may be due to ariboflavinosis instead, and suggests that cases of pyorrhoea with swollen gums, should be recorded in nutrition surveys without prejudice as to its causation. The work of Fox (38) and others make it clear that it is possible to subsist on a low ascorbic acid intake, without subjective symptoms of scurvy. Irowell (120) has stated that scurvy should only be implicated if the gingival changes are well marked and the subject is fairly young (under 30 years of age.) There must also be additional ascorbutic signs. Magee (76) considers that spongy infected gums are not the evidence if nutritional changes, bu rather of infection. Thomson and Duncan (117) state that the degree of caries is of no assisstance as an aid to the diagnosis of malnutrition, or the subjects' state of health.

Conclusion.

In the present series the changes in the gums were not accompanied by any other evidence of scurvy, and the condition may be regarded as one of infective gingivitis. There was in addition an unassociated high incidence of caries.

Tongue.

Examination of the tongues of the subjects gave the following findings:-

Pigmentation	6 cases
Fissure	3 cases
Marginal indentation	1 case
Cyanosis	1 case
Pallor	2 cases

Since the significance attached to these is different, they will be discussed in turn.

Pigmentation. This consisted of pin point black spots over the tip or just lateral to the tip of the tongue. A purplish shading of the gums and inner surface of the cheek near the anterior half of the mouth has been considered a normal finding in dark skinned people and of no nutritional significance (Squires (111)).

The stippled pigmentation of the tongue noted in this survey, has also been reported elsewhere. Best (11) reported pigmentation of the fungiform papillae of the tongue in 12 per cent of African children. He considered their clinical state was in no way different from those children who showed no such pigmentation. Roper (104) reported melanin deposits in nearly half of the African adult tongues he examined, without relationship to their state of nutrition.

An entirely different view is held however, by Gillman and Gillman (42). They consider that the stippled pigmentation of the Bantu tongue corresponds with a disordered metabolism, and that excess iron will be found in the liver of such a subject.

The more widespread opinion is that it is a normal characteristic of deeply pigmented persons occurring at the sites of maximal irritation and as such has no nutritional significance.

Fissure and marginal indentation. Three subjects had fissures on the tongue, the tongues of two of these were otherwise normal in appearance, but in the third there was some marginal pigmentation of the tongue and slight indentation. The first two may be considered normal, in the last case, although the pigmentation may be dismissed, the indentation suggests slight oedema of the tongue, an early sign of ariboflavinosis. The fissuring may be due to the same cause, but if only slight, it is equivocal.

As none of the women had changes in the colour of the tongue such as reddening, there is no evidence that the ariboflavinosis was more than mild, if present at all. There are no signs in the tongues of the women of the survey suggesting niacin deficiency, in which a fiery red tongue is described. Nicholls (86), Nicol (87).

Pallor. It is notoriously unreliable to assess anaemia by inspection of the mucous membranes. In the two subjects of this series, who were thought to have pallid tongues, one had a lowered, the other a normal haemoglobin value.

Cyanosis. This was suspected in one case. The subject was obese, with no clinically detectable abnormality of the cardio-vascular system.

To summarise

The only abnormal observations made on the tongues of the subjects, might be ascribed to an anaemia, or to deficiency of riboflavin, but in no case were the findings certain.

EXAMINATION OF THE EYES

An opthalmoscopic examination was carried out on most subjects, in almost all cases there was some difficulty in obtaining co-operation from the patients who appeared to resent and fear this form of examination, whereas they had submitted to vein puncture with unexpected readiness. When visualised, the fundus was normal in most cases, the exceptions noted were not related to the nutritional state.

The main interest from a nutritional standpoint was related to the inspection of the cornea and conjunctivae, in particular the bulbar conjunctivae.

The following observations were made:-

		No: Subjects
1)	Thickening, wrinkling.	7
2)	Pinguecula	5

		No: Subjects.
3)	Pigmentation	8
4)	Limbal congestion	1
5)	Conjunctivitis	1
6)	Arcus senilis	3
7)	Corneal scar (Keratitis)	2
8)	Shrunken bulb (Keratomalacia)	1
9)	Normal	14

These findings will be discussed in turn:-

Thickening, wrinkling. In 7 of the subjects the conjunctivae were lustreless, with some thickening. Vertical furrows were seen during movement of the eyes, most marked to the nasal side of the eye. This is known as Xerosis conjunctivae - it is usually described as an early sign of Vitamin A deficiency. Gelfand (41). Other writers have noted its association with or without pigmentation, with chronic irritation from dust, smoke, heat or glare. Nicholls (86), Squires (111). The latter noted that in some cases the condition improved spontaneously with the onset of the rainy season. In other cases, improvement only resulted when the diet was supplemented. Both these investigators are agreed that though these syndromes may arise from defective diets, there may also be other explanations.

Pinguecula. This consists of a slightly elevated triangular patch of yellowish colour and opaque appearance, which lies in the conjunctiva bulbi usually nasal to the cornea. This may occur in mild form at any age in persons exposed to dust, wind, etc.

Pigmentation. In eight women there was yellow or brown pigmentation of the bulbar conjunctivae, it was most marked at the line of closure of the lids, the site of friction. There appear to be differences of opinion as to

its significance. Le Riche (65) describes a range of colours from white to orange which he considers are due to Vitamin A deficiency, the depth of colour depending on the severity of the aviteminosis. Boshoff (16) considers the colour deposits are a natural process in persons of a highly pigmented race, and are the result of exposure to dry air and intense radiation.

Limbal Congestion. This was present in only one subject, consisting of lesshes of capillaries running up to the margin of the cornea, but not on it. It has been ascribed to riboflavin deficiency. Nicholls (86), Gelfand (41), Squires (111) found additional signs of riboflavin deficiency in only 3 of his subjects in whom limbal congestion was present. He suggests that the pericorneal pigmentation (grey) which is normal in the Bantu eye, may make the increased vascularity difficult to detect, and some cases are not therefore diagnosed. Boshoff (16) points out that limbal congestion though a sign of ariboflavinosis, may also result from chronic conjunctivitis, eye strain, conjunctival allergy, or even the mere rubbing of the eyes.

Little, if any, significance should therefore be attached to the milder forms of conjunctival change. It is probable that they fall within the normal range for the Bantu.

Keratitis and Shrinking and destruction of the cornea - Keratomalacia. There were two subjects who showed corneal necrosis. One, who was congenital syphilitic, had suffered from syphilitic keratitis of the one cornea with consequent loss of vision.. The other had gross shrinking of the bulb of the one eye - the cornea was replaced by a dense white scar. She gave a history of a purulent conjunctivitis at the age of seven years, with consequent blindness.

There is evidence therefore, that both these subjects had undergone an infective lesion of an eye in early childhood.

Summary.

Except for gross changes in the eyes of two of the women, which were due to a previous infection, the lesser findings are compatible with conjunctival irritation of a mild but chronic form.

It is just possible, however, that these might be the evidence of mild ariboflavinosis.

EXAMINATION OF THE LIVER

The finding of gross liver changes has taken on a particular significance in Africa where pathology of the liver is widely found and commonly ascribed to long standing malnutrition or parasitic disease. The liver was palpable in only one of the subjects, this woman was clinically well and apart from removal of a gland from her neck as a girl, had never been ill. The lower margin was felt, it was smooth and not tender. The upper limit of dullness was normal over the right chest. No explanation can be suggested for this finding in an otherwise healthy subject.

Dr. Keen (61) Non European Hospital, Johannesburg, stated that he occasionally noted a similar finding in Bantu women with lax abdominal walls, and certain characteristics of stature and build. In an examination of 500 African railway workers Trowell (120)) found 2 per cent had non-tender palpable livers, for which he could ascribe no cause. He states that many apparently normal Bantu show unexpected scarring of their internal organs at post mortem, it is probably the end result of malignant malnutrition in infancy. This is borne out by Gillman and Gillman (42), who found only 12.6 per cent of the livers of Africans dying accidentally, were free from all forms of a

pathological change.

The solitary finding of a palpable liver does not of itself imply liver disease, but in view of the prevelence of liver disease, the finding must be treated with reserve.

SUMMARY OF CLINICAL FINDINGS.

1. The subjects were of moderate height with a tendency to obesity.
2. Six of the twenty one women had diastolic blood pressures over 90 mm Hg., when taken at rest.
3. No subjects had changes in the skin which could be attributed with certainty to avitaminosis.
4. Two thirds of the women had infective gingivitis, while somewhat fewer suffered from caries. There was no evidence that these two conditions were related and none had associated evidence of scurvy.
5. The changes in the tongue were too slight to be diagnostic, they were those of mild ariboflavinosis, or possibly a disturbance of liver metabolism.
6. Two subjects each had impaired vision on one eye due to preceeding inflammation. The remainder had mild degrees of thickening and discolouration of the bulbar conjunctiva which are compatible with chronic mild irritation, or might be evidence of Vitamin A deficiency.
7. In one woman, the only abnormal finding was a palpable liver.

LABORATORY INVESTIGATIONS

A number of laboratory tests were carried out on the twenty one subjects. These were chosen partly with due consideration for the facilities available and partly as a means of determining the nutritional state of the subjects of the survey.

Where possible they were done personally by the author, but in some cases they were the work of the staff of the South African Institute for Medical Research, to whom due acknowledgement is made.

The results are tabulated in Volume II.

THE VITAL CAPACITY DETERMINATIONS

Below are set forth the calculated expected value for each woman based on the relationship of total height (cm) to vital capacity (cc.) Best and Taylor (15). The third column gives the mean value of five to six consecutive readings for each woman.

Case No.	Predicted Value cc.	Actual Measurement. cc.
1	3,120	2,049
2	3,000	2,056
3	3,060	2,025
4	3,040	2,300
5	3,260	2,556
6	3,040	2,353
7	3,160	2,458
8	3,260	2,027
9	3,160	-
10	3,260	1,629
11	3,040	3,025
12	3,100	3,015
13	3,200	2,055
14	3,000	2,042
15	2,860	1,471
16	3,100	-
17	3,000	-
18	3,040	2,053
19	3,040	-
20	3,160	2,052
21	3,200	2,030

The actual measurements are markedly reduced with two exceptions. No significance can be attached, however, to these findings. The test was carried out on a

spirometer and required good breath control and sustained co-operation by the subject. The women were apprehensive when confronted with the instrument and proved very inept at the technique. The results obtained therefore, are too low in general, doubtless the result of inadequate thoracic expansion due to nrevousness.

WASSERMANN REACTION

The test was carried out on fourteen of the twenty one women, the results were:-

14

Negetive 11

10 Neg. (1 formerly positive. Child found positive.)

Positive 2

(confirmed clinically)

Doubtful 1
(No clinical evidence or history.)

The number of subjects is too small to calculate a percentage incidence, in only two subjects is there supporting evidence of syphilis. One woman formerly positive, who had undergone treatment, requested that her children be tested, one of whom was found to be strongly positive.

One of the cases who was positive, also gave a strongly positive Kahn test, she had a congenital syphilitic facies, and was later admitted to hospital in coma and diagnosed as a case of meningo-vascular syphilis. She had undergone inadequate treatment on a number of occasions, refusing to continue the course.

Discussion

A positive Wassermann reaction by itself can be misleading if taken to be indicative of syphilis, as it may arise in association with many other conditions, many of which are common in the Bantu, such as tropical disease, extra-veneral treponomatosis, and some liver diseases with

an associated alteration in the serum proteins. The matter must be judged in the light of close personal knowledge of the subject, and even then there are cases where the significance of a positive reaction must be left in doubt.

The following values are quoted by different investigators, there are as might have been expected, some considerable variations.

Incidence of positive Wassermann Test in the Bantu

Reference	No. and type of subjects.	Per cent Incidence	Locality
(18)	Bantu children 8 - 16 years	27	Cape Peninsular
(33)	1,000 African mothers	17.3	Jabavu Clinic, Johannesburg.
	6,000 African mothers	25	Pimville ante-natal clinic. Johannesburg.
(54)	African mothers	23.1	ante-natal clinic Durban.
	African mothers	40.6	ante-natal clinic Johannesburg.
(109)	Bantu Obstetrical	23 - 34	Johannesburg.
(34)	68 normal pregnant Bantu	20	Alexandra Township ante-natal clinic. Johannesburg.
(100)	600 Bantu women	42	Germiston ante-clinic.
(13)	230 African mothers	26.1 (Eagle) (Test.)	Johannesburg.

It will be seen from these figures that the incidence of positive Wassermann tests is high i.e. 28 per cent.

Dr. Walker (123e) states, however, that the incidence may very very widely. Mine workers in at least

two investigations have been found to have a very low incidence of positive tests. Children living in the Rustenburg region of the Transvaal where bilharzia is common were found by him to have a 3 per cent positive incidence, while children from the central Kalahari were as high as 50 per cent. The disparity in the children may be explained on the grounds of extra-venereal treponomatosis, the matter is being investigated.

A high incidence of positive tests in all races (30 - 50 per cent), has been reported from a large routine laboratory, McNab (75a). Such figures, however, may be misleading as their selection is not a matter of routine in many cases, but a diagnostic procedure. The specimens are frequently repeated without special notification, more especially in the case of a positive test, where confirmation is sought.

Conclusion.

The number of subjects tested in the present series is too small to calculate the percentage incidence. There was supporting evidence of syphilis in two cases in which the serological tests were positive.

SERUM PROTEIN DETERMINATIONS.

Serum protein determinations were carried out on all the twenty one women. These were done by the staff of the South African Institute for Medical Research, using the biuret method, 22 per cent sodium sulphate was used in the precipitation of globulins.

The findings were:-

	Max.	Min.	Mean.
Total protein (gm. per cent)	8.6	5.3	6.9
Albumin "	5.0	3.6	4.3
Globulin "	3.7	1.2	2.5

In evaluating these findings, reference has been made to various values. As 28 and not 22 per cent. sodium

sulphate has been used by later workers, these references are listed separately as this procedure gives a somewhat higher globulin level.

Normal serum protein standards (22% salting)

Reference	Total Protein			Albumin			Globulin		
	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean
(51)	8.5	5.6	7.0	6.7	3.4	4.0	2.9	1.2	2.0

Later references to serum protein standards. (28% salting)

Reference	Total Protein			Albumin			Globulin		
	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean
(49)	8.5	5.6	-	6.7	3.4	-	3.0	1.3	-
(89)	8.0	6.2	-	6.7	3.4	-	3.0	1.4	-

Bessey and others (13a) regard a total protein of 6.4 per cent as good and below 6.0 as poor. Williams and others (135) give the normal range as 6.0 - 8.0 per cent.

The following values for serum proteins have been determined in the Bantu.

Serum protein in the Bantu (22% salting)

Reference	Total Protein			Albumin			Globulin		
	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean
68 normal males (95)	9.1	5.6	7.3	6.6	2.8	4.5	4.9	1.6	2.8

Possible 28% salting

Ref.	Total Protein Mean	Albumin Mean	Globulin Mean	Type of subjects
				East Africans
(51a)	7.02	3.74	3.28	A) 44 soldiers (King African Rifles.)
	7.96	4.89	3.07	B) 29 Employees, Kenya & Uganda Railways and Harbours.
				East Africans
(57)	7.6	3.27	3.99	86, Kampala Uganda
				Northern Rhodesia
(12)	6.9			77 children.

Bersohn and others (13) determined serum protein levels in new-born African infants (A) and their mothers (a) in a group of European infants (B) and mothers (b). The mean values were:-

	Total Protein	Albumin	Globulin
A.	6.21	3.71	2.29
a.	6.36	2.96	3.45
B.	5.97	3.59	2.39
b.	6.27	3.23	3.08

Serum protein values - Pregnant Women (22% salting)

Ref.	Total Protein Max.	Min.	Mean	Albumin Max.	Min.	Mean	Globulin Max.	Min.	Mean	Type of Subjects
(28)				5.4	3.6	4.4	3.4	1.5	2.7	(A)
				4.3	2.9	3.7	3.8	2.3	2.9	(B)
(35	8.7	5.3	6.6	4.8	2.7	3.5	4.0	1.2	2.8	(C)

A) American non-pregnant. B) American pregnant. C) South African pregnant.

Discussion.

In evaluating protein nutrition, the level of albumin is more significant than the level of the total serum proteins. The globulin fractions may however, be increased in a number of pathological states, Arens and Brock (6). These workers in a study of the chemical fractionation of the serum proteins, found a tendency for lower serum albumin values, to occur with higher total globulin values. Their subjects included Cape Europeans and Bantu, and the Bushmen of South West Africa.

A reduction in serum albumin alone is not necessarily attributable to simple protein undernutrition.

The inversion of albumin/globulin was noted by Arens and Brock(6) in both healthy non-tropical Africans and Europeans. They suggest it is therefore not merely genetic,

or due to tropical disease, but may be due to prolonged malnutrition and latent liver disease.

The following is a critical assessment of the serum protein values in the subjects of the present survey.

Assessment of present survey serum values.

With reference to 22% salting standards only.

Case No.	Total Protein	Albumin	Globulin	Comparative Standards (51)	(95)	(28)
1	7.3	3.9	3.4	G +	N	N
2	7.3	4.4	3.3	G +	N	N
3	7.9	4.6	3.3	G +	N	N
4	6.7	3.8	2.9	N	N	N
5	5.3	4.1	1.2	T.P. -	G - T.P.-	G -
6	6.2	3.7	2.5	N	N	N
7a	5.6	3.9	1.7			G -
7b	8.6	5.0	3.6	T.P.+ G +	N	G +
8	7.0	4.5	2.5	N	N	N
9	7.2	4.4	2.8	N	N	N
10	6.1	4.2	1.9	N	N	N
11	5.9	3.6	2.3	N	N	N
12	6.5	4.6	1.9	N	N	N
13	7.1	4.2	2.9			N
14	6.9	4.9	2.0	N	N	N
15	7.6	4.8	2.8	N	N	N
16	7.0	4.6	2.4	N	N	N
17	8.5	4.8	3.7	N	N	G +
18	7.3	4.7	2.6	N	N	N
19	6.4	4.0	2.4	N	N	N
20	6.3	4.7	1.6	N	N	N
21	5.6	3.9	1.7	N	N	N

ase 7a was 36 weeks pregnant and 13 was 32 weeks. Their erum proteins were normal according to the findings of leming and Barnes (35). Reference (28) gives ranges for regnant and non-pregnant groups which were used according to ircumstances in assessing these results.

These subjects have normal serum protein values ccording to all authorities with the following exceptions:-

Cases 1, 2 and 3. Globulin values are raised by

Harrison's (51) standards, but within normal limits according to Quinton & Barnes (95) and Dieckmann (28). Quinton & Barnes had carried out their estimations on Bantu living in the same locality as the women of the present series. The three women appeared to be entirely healthy and well nourished, there was no suspicion of liver disease - the Wassermann test was negative in Case 3 and the serum albumin normal. There is thus no evidence in support of a raised globulin level, which appears to be an isolated unexplained finding, and there is no associated change in the albumin value. Two out of three authorities do not class it as abnormal. It is probably not so in the Bantu.

Case 5. All authorities agree that the globulin (and in some cases the total protein) is reduced. No satisfactory explanation for such a finding can be given.

Case 7. This subject when non-pregnant had a raised globulin, the albumin/globulin ratio was not altered. She had a thyroid swelling, and cardiac pathology, her Wassermann reaction was unknown. It is just possible that she suffered from slightly altered liver function but no definite explanation can be offered.

According to Bersohn and others (13), the raised globulin is usually accompanied by a reduction in albumin, so that the albumin/globulin ratio is reversed. He reports an 85.4 per cent incidence of reversal of the ratio in 1,102 routine hospital examinations of Bantu, and a 69 per cent reversal incidence in 100 apparently healthy African natives.

No case of reversal of the ratio arose in the present series.

Conclusion.

No satisfactory explanation can be advanced for the relatively minor serum protein changes which are present in a few of the cases. In general the findings for the group were normal.

CALCIUM DETERMINATIONS

When sufficient serum remained after other tests were completed, calcium determinations were carried out. The method of Kramer and Tisdall was used. The findings in seven of the present series were:-

mg. Ca per 100 ml.		
Max.	Min.	Mean
11	9	10.2

Serum calcium determinations in Bantu women.

Kramer & Tisdall Method used except by Squires (Panton & Marrack)

Reference	No. and type of subject	mg. Ca. per 100 ml. Max.	Min.	Mean
(130)	33 adult hospital patients (not suffering from disease affecting serum calcium)	11.1	7.6	9.3
(130)	33 healthy pregnant Bantu women (7 - 9) months	11.3	8.9	9.9
(130)	55 lactating Bantu women	12.8	9.3	10.2
(130)	23 boys (7 - 12 yrs. old) (No disease affecting serum calcium)	11.8	8.8	9.9
	54 reformatory boys (14 - 15 yrs. old)	12.6	9.2	10.3
(91)	5 Kikuyu boys.	10.6	10.0	10.3
	90 healthy farm labourers and prisoners.	11.2	7.3	9.4
	42 male prisoners		7.3	9.2
(130)	48 healthy men (18 - 40 yrs.)	10.9	7.9	9.5
(110)	66 healthy Bechuanaland males	11.2	7.8	9.5
(114)	50 healthy Southern Rhodesian males	11.0	6.0	9.14
(73)	Nigerian people on calcium poor cereal diet	10.0	6.0	8.2

Serum calcium determinations Other races.

Reference	No. and type of subject	mg. Ca. per 100 ml. Max.	Min.	Mean
		Boys and men		
(98)	10 boys resident in Belgian Congo	-	-	10.1
(58)	85 American boys	11.5	10.0	10.9
(4)	10 Indian males	9.4	8.2	9.0
(70)	25 Indian students	12.4	9.4	10.85
(121)	17 Indonesian males	11.7	8.8	10.0
(131)	309 American negroes	11.85	9.0	10.4
(81)	19 working class Irish	10.9	10.0	10.3
	130 Irish students	12.9	9.5	11.0
		Women		
(88)	American women			
	(A) 16 non-pregnant	11.3	9.7	10.4
	(B) 33 pregnant	10.8	8.7	9.5
(80)	American women			
	(a) 207 non-pregnant	11.5	10.0	10.8
	(b) 900 pregnant	-	-	9.9
(99)	96 British women	13.7	6.0	9.35

The widely accepted normal range for serum calcium based on European and American experience is 9 - 11 mg. 100 ml. According to determinations carried out on the Bantu it would appear not uncommon to encounter values below 9 mg. per cent in apparently healthy persons. In a discussion of low serum calcium values in the South African Bantu, Walker and others (130) mention that serum calcium values in the Bantu are roughly one tenth lower than corresponding figures for white subjects, yet these subjects were all in good health and hard working people in many

cases. He suggests that low mean serum calcium values in population-groups reflect habitually low intakes of the element, and do not essentially indicate low body stores. In a personal communication (123a) he considers that adaptation is not a matter of generations, but may happen in a life time, and probably would also happen in the European on a maintained low calcium intake. Stone (114) suggests that the low intake may be due to the low calcium content of South African maize. According to Fox (36), the calcium content of maize foods varies according to the method of preparation. Squires (110) suggests the combined effect of a reduced mineral content of the local water supply, together with poor intestinal absorption. According to Odendaal (89) estimations of calcium content of the blood have not proved of great value in nutrition surveys. Only in states of severe calcium deficiency will the level of the blood calcium alter, the interpretation of borderline findings is extremely difficult. Fox F.W. (quoted by Stone (114) found no evidence of tetany in Bantu subjects with a serum calcium value of less than 7.0 mg 100 ml. The suggestion is made that after several generations of low calcium intake, the subjects become resistant to tetany.

In the present survey only seven calcium determinations were done. They were normal by all standards.

HAEMOGLOBIN DETERMINATIONS

Haemoglobin determinations were carried out on specimens of blood from all twenty one women. Three different methods were used on each, but the results were so unsatisfactory that they were rejected in toto.

In order to compare haemoglobin values with the determinations reported by workers who have reported similar investigations, the "probable" haemoglobin values for the

present series were claculated using the haematocrit readings made by me, and assuming a constant average MCHC of 33 per cent, which is regarded as the mean normal value at this altitude, Greig (47a).

On this basis the mean and range of the "probable" haemoglobin were 14.3 and 13.5 - 15.6 mg. per 100 cc. respectively. This was calculated on the remaining eighteen subjects after excluding three women who were pregnant, values for the pregnant women were:- 15.0, 13.5 and 12.8 mg. per 100 cc.

The following haemoglobin values for women have been collated from the literature for comparison. They are listed according to race and/or locality, where possible altitudes are given.

Haemoglobin determinations - Bantu women.

Ref.	No: Sub-jects	Description of Subjects	Alti-tude. ft.	Method of deter-mination	Haemoglobin Mean gm.	Haemoglobin Range mg.
(125)	40	Bantu female farm workers all found to be infested by animal parasites	1,000	Hilger Spekker Spectro-photometer	13.3	10.6-15.8
(125)		Bantu house-wives age 17 - 38 yrs.	4,500	Hilger Spekker Spectro-photometer		
	48	a) Non-preg.			13.9	12.3-16.0
	43	b) Preg. 1st. half			13.9	12.2-15.9
	49	c) Preg. 2nd. half			13.7	11.8-17.3
(125)		Bantu nurses 18 - 26 yrs.	5,500	- ditto -		
	102	On admission			14.7	11.1-17.1
	54	After 1 yr.			15.3	13.3-17.8
(34)	31	Bantu house-wives urban (pregnant)	5,700	Hellige mod. Sahli	12.06	10.0-14.5

Haemoglobin determinations (Cont.)

Ref.	No. Sub-jects	Description of Subjects	Alti-tude ft.	Method of Deter-mination	Haemoglobin Mean gm	Haemoglobin Range gm
(91)	?	Bantu women from two tribes	4,000 to 6,000 ft.	Haldane 13.8 gm = 100%		
		a) with tropical ulcer.			11.9	
		b) without tropical ulcer			11.2	
(68)	105	Cape coloureds pregnant	sea level	Hellige	12.4	
	22	Bantu pregnant			11.64	
	17	Present series	5,740	Calculated from haematocrit	14.3	13.5-15.7

Haemoglobin determinations - Indian women

Ref.	No. Sub-jects	Description of Subjects	Alti-tude ft.	Method of Deter-mination	Haemoglobin Mean gm	Haemoglobin Range gm
(96)	100	Pregnant	6,000	Bing and Baker mod. of Wu	15.52	8.5-21.0
	100	non-pregnant			15.81	8.0-20.5

Haemoglobin determinations White women

(134)	63	English women 30% with iron intake below 10 mg. daily	sea level	Haldane Gower	12.8	12.0-14.0
(84)	?	Women of 16 geographic sites of different altitudes	varied	?	13.65	12.96-14.7
(23)		British women preg.	sea	Haldane		
	686	Para. 1			12.7	9.7-15.7
	531	Para 2			12.6	9.5-15.7
	398	Para. 3			12.53	9.7-15.4
	140	Para. 4			12.64	9.2-16.0

Haemoglobin determinations - White women (Cont.)

Ref.	No. Subjects	Description of Subjects	Altitude ft.	Method of Determination	Haemoglobin Mean gm	Haemoglobin Range gm
(5)	40	White women 20 - 45 yrs.	5,280	van Slyke Neill, Osgood-Haskins	14.43	
(20)	16	European females, Witwatersrand.	5,740	Neoplan	14.79	13.05-16.67
(116)	16	European females, Witwatersrand	5,740	Summerson Haldane Newcomer	14.08	11.73-15.87
(71)	30	European females, 18 - 40 yrs. Witwatersrand.	5,740	Klett-Summerson	15.33	12.87-17.79
Quoted by (71)	43	Women Witwatersrand	5,740	Neoplan	12.97	9.41-16.53
(46)	50	European females, Witwatersrand	5,740	Hellige Neoplan	12.98	10.95-15.33
(133)		Women Normal range for clinical purposes (all countries)			13.7	12.0-15.5

In comparing these values which are drawn from women of many races, it must be borne in mind that racial differences have not been found to be significant, Myers and Eddy (84). Fitzgerald's Law states that the haemoglobin rises by 10 per cent for every 100 mm. mercury fall in barometric pressure, this would correspond to an elevation of 2.4 per cent per 1,000 ft. increase in altitude. At an altitude of 5,740 ft. the expected mean haemoglobin value for women would be 14.5 gm., with which the mean of the "probable" haemoglobins calculated for this series, corresponds for this

reasonably well, i.e. 14.9 gm.

It will be noted that many of the published figures for Bantu women at this altitude are lower, than this mean value, which may be due to these groups being less selected than the present series.

Conclusion.

Using "probable" haemoglobin values, calculated on the basis of haematocrit readings which were made on the subjects, and which will be discussed later, the women do not appear to be suffering from anaemia.

HAEMATOCRIT DETERMINATIONS

These determinations were carried out by the author on 20 of the subjects. The method was that of Wintrobe, the packed cell volume being read as a percentage of the total volume. Since three of the subjects were pregnant and the consequent change in blood volume might alter the readings, they are excluded from the discussion. (Cases 4, 7, 13.)

The findings for the remaining 17 women were:-

Mean: 43.7 ml. Range 40.8 - 47.5 ml.

The following are the values reported by investigators for women at the same or a nearly similar altitudes.

Haemstocrit determinations - Women 5,000 ft. and over.

Reference	No: Subjects	Altitude ft.	Mean ml.	Range ml.
(5)	40	5,000	43.22	-
(71)	30	5,740	45.2	41.5 - 49.0

It will be seen that the women in the present investigation have normal packed cell volumes, the values agree with those of Lurie (71) whose investigation was carried out at the same altitude.

MEAN CORPUSCULAR HAEMOGLOBIN CONCENTRATION

Since the haemoglobin determinations on these women were rejected, the MCHC values cannot be calculated or discussed.

TABLE XV

Discussion of Blood Loss.

Case No.	Age yrs.	"Probable" Hb. gm.	Parity Labours (Abortions)	Chronic blood loss Menstrual	Gums
1	33	13.6	4 (2)	+ +	-
2	42	15.6	5 -	+ +	+
3	34	14.0	1 Ectopic	N	-
4 P	29	15.3	3 (1)	N	-
5	26	15.0	2 -	N	-
6	29	14.3	2 -	N	-
7 P	38	13.2	5 -	N	-
8	40	15.8	6 -	+ +	-
9	75	omitted	?	M	-
10	35	14.2	6 -	N	-
11	39	14.0	- (4)	+ +	-
12	32	14.9	4 -	N	-
13 P	30	12.8	1 (1)	N	-
14	20	14.8	1 -	N	-
15	21	14.4	1	N	-
16	23	13.9	3 -	N	-
17	46	15.7	2 (1)	M	+
18	40	13.6	6 -	N	-
19	35	14.9	S	N	-
20	34	14.5	- -	Scanty	+
21	31	14.8	2 (1)	?	+

P in column 1 indicates pregnancy at the time of examination. The bracketed figure in column 4 is the number of abortions in addition to the number of labours recorded. S in this column indicates unmarried. N in column five indicates normal menstrual loss and M indicates menopause.

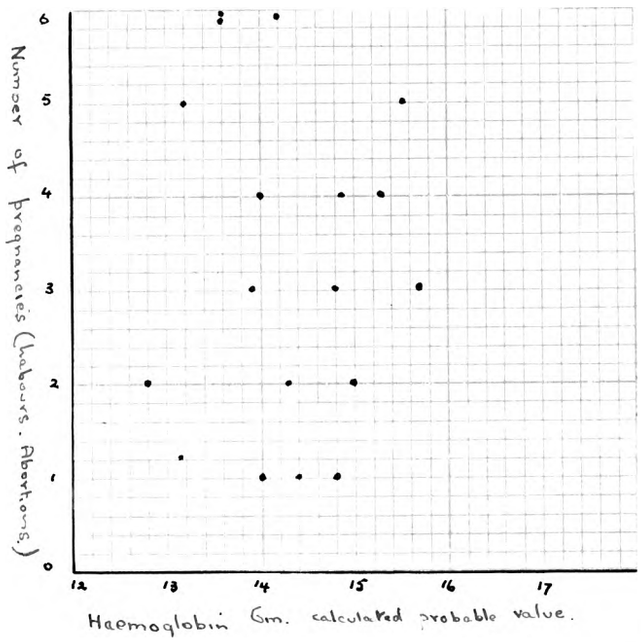
Correlation of history of blood loss and the haemoglobin level. (calculated "probable" value.)

Case 2 who had had five pregnancies and gave a history of excess loss had the highest haemoglobin (15.6 gm.)

Case 3, who had never been pregnant, and gave no history of blood loss, had a haemoglobin of 14.0 gm.

GRAPH NO: 2

Correlation of parity and the "probable" haemoglobin level.



From the graph it will be seen that women who had never been pregnant had haemoglobin values between 14 - 15 gm., while women who had had six pregnancies had haemoglobin values from 13.6 - 15.8 gm.

Conclusion.

It would be illogical to draw conclusions from any one given factor, when many factors combine to determine the haemoglobin level, but there appears to be no correlation between the history of blood loss, or the number of pregnancies and the haemoglobin level.

The evidence presented by Walker and Arvidsson (127) is that there is a habitually high intake of iron in these people, sometimes as much as 200 mg. per diem, and which acts as a "brake" on the fall in haemoglobin level, which might be expected to follow chronic blood loss, or to appear in women who have borne many children.

Iron deficiency anaemia has been stated to be very

rare in African populations on the Witwatersrand - Walker and Arvidsson (127).

On the whole, then, one must conclude that the women of the present series had no evidence of secondary iron deficiency.

SUMMARY OF LABORATORY INVESTIGATIONS

1) Vital capacity estimations were found to be unsatisfactory due to poor co-operation by the subjects.

2) Of the fourteen subjects who underwent a Wassermann test, eleven proved negative, but one of these had formerly been positive. Of the remainder two were strongly positive and one repeatedly doubtful.

3) Haemoglobin estimations were considered unsatisfactory but figures for "probable" haemoglobin claculated from the haematocrit value have been used to compare with other reports. The "probable" haemoglobin values were found to be :-

Mean 14.3 gm. Range 13.5 - 15.7 gm.

The findings for Haematocrit Determinations were:-

Mean 43.7 ml. Range 40.8 - 47.5 ml.

These are both within the normal range of findings for an altitude of 5,740 feet.

The Mean Haemoglobin Concentration could not be calculated.

There was no evidence of iron deficiency anaemia.

4) Serum protein determinations gave the following values:-

	Mean	Range
Albumin	4.6	3.6 - 5.0
Globulin	2.6	1.6 - 3.7
Total protein	6.9	8.6 - 5.3

No significant abnormalities were detected.

5) Calcium determinations on seven subjects gave a mean value of 10.1 mg. per 100 cc. A range of 9.0 - 11.0 mg.

per 100 cc. These findings are within normal limits.

Conclusion.

The tests on these subjects all gave normal results with the exception of a few positive Wassermann reactions. No deficiency states were detected by the laboratory tests.

SELECTION AND PREPARATION OF FOOD.

In order to gain a true impression of the feeding habits of primitive people, it is necessary to live with them for a considerable period. The mere intrusion of an interested observer will of itself produce a change in their mode of living. Their immediate reaction will be a desire to eat what they think the observer expects them to, or to consume items which are believed to be more in accordance with the observer's own habits of eating. Trulson and Stare (120a) have stated: "It has been observed that a gradual decrease of mean intake values for most nutrients occur the longer a dietary survey is conducted."

The present study suffers from this disadvantage therefore, but as the author maintained regular and frequent contact with most of the subjects for over a year, much supplementary information was obtained from repeated casual visits to the homes, and in the course of ordinary conversation with the women. The information obtained in 5 - 7 day records is considered an advance on the method of questionnaire assessment. (Young and others (145)).

Women of this social group and mental development, are not really capable of giving consistent attention and application to dietary and income records for much longer than a 5 - 7 day period. For them it is a procedure involving extra labour and trouble, the object of which is beyond their understanding and though they co-operate while it is still a novelty, they can hardly be expected to maintain

their interest for longer, unless they foresee some personal gain, and to offer rewards is immediately to invite endeavours to produce the information it is believed the questioner desires.

Choice of Food.

As is common to all people, there are certain individual likes and dislikes where food selection is concerned. In addition, it was also noted that certain varieties of common foodstuffs are particularly favoured by certain tribes. Sex discrimination rarely arises, but it is mentioned in a study in Kenya (Orr and Gilks (91)).

In the present group only the traditional aversion of most of the women to eggs was noted. It is believed, however, that although these women denied the use of kaffir beer, it is customary for the 'small beers' which are more dilute to be left for the women and children after the men have consumed the main brew.

The women in the present study were urbanised, some were born in the town, the others had lived there most of their lives. Visits to their country homes are few and far between, but despite this detachment from their old associates, some continued to prefer home ground cereals, and wild spinach (imfino). In contrast, others developed a liking for European snacks and prepared foods.

Number and choice of meals.

It has been customary in the past for the Bantu to consume one large meal a day, towards evening when the whole family are together, this is becoming less common and especially the urban native who has adopted European customs of eating, has tended to eat two or three meals a day, and may often have an additional morning and afternoon tea. The lunch, however, consists merely of left over food where the women are concerned, and the men frequently go to work without breakfast. Increase in the number of meals has

been noted by other observers, Orr & Gilks (91), Trowell (120). Comparing the men and women, the latter who usually stay at home and are solely responsible for food preparation, have the opportunity to enjoy more meals. On the other hand, the men make up for their lack of breakfast by the purchase of food and drink while at work in town. This is an uneconomical procedure, but they do not usually provide themselves with a lunch packet.

The women, however, have a breakfast at about 10 a.m. consisting of porridge with or without tea. At 2 - 3 p.m. they eat lunch which may consist of anything from left over porridge to a cooked meat and vegetable meal. The evening meal is served late at about 7.30 p.m. when the men return, and is the large meal of the day. It consists of a meat stew, with the addition of a number of vegetables. A maize product is often cooked separately and forms the bulk of the meal. Some families include bread or tea. Puddings are not made, but fruit is eaten in season, and since it deteriorates, it is usually eaten at once and none is left, consequently there are periods of scarcity and plenty.

The women state that when busy or away collecting washing, they often go without food till sundown, while some, however, buy food on passing through town, but not the poorer ones. It is known that employers offer snacks or even a whole meal to itinerant workers, and it is unthinkable that they are always refused. The habit of foregoing a meal or meals, is however a custom among some of these people, the author has noted it in some of her domestic employees, especially after the first enthusiasm for European food is on the wane. But far from eating one meal a day, they will occasionally do without breakfast or lunch, and resume their old routine by partaking of an especially large dinner in the evening on that occasion.

Similar habits have been noted by Trowell (120), and Gilks (91).

Sunday differs from weekdays, as the major meal is cooked at midday, and the whole family is present. It is usually the largest meal of the week. If anything is over this is eaten in the evening. The day is characterised by an especially high calorie intake, as there is more leisure for cooking and eating. It is customary for the Bantu to consume perishable foods as soon as possible, with the exception of milk, which they often prefer soured rather than sweet. The households have no provision for preservation, and little storage space of any kind. As has been commented on elsewhere, these people are given to buying in small quantities and frequently. Some made an exception by availing themselves of bags of oranges and boxes of tomatoes, sold at special prices by the Municipality, but not all did so.

THE COMPONENTS OF THE DIETS.

Beverages.

These include:- Tea, coffee, aerated drinks, sugar-water, amasi (sour milk), marewu, kaffir beer, "Barbeton".

Tea, Coffee. These beverages are becoming increasingly popular and are bought by even the poorest families, this was noted also for urban Bantu communities in Johannesburg by Janisch, (59). The families preferred tea to coffee, and despite it's costliness 3/- to - 3/6d lb., or more at black market prices, they used from ½ - 2 lbs. a month. Bush tea which is much cheaper (2/- lb.) and is prepared from a wild bush (the twigs, leaves and growing tips) was only used by one family. Tea is drunk with fresh or condensed milk - or black with a lemon slice. Coffee was less popular, its price was 1/1d. lb., lasting from 2 - 3 weeks. One family used coffee powder at 2/- tin.

Aerated flavoured drinks. The custom of buying aerated mineral waters is growing among the Bantu, they may be consumed in the shop, but a more popular purchase is a 25 fluid oz. bottle containing dilute coloured and flavoured syrup, which costs 6d. but does not go far among the family. These are a daily item in some homes.

Sugar water. Three of the women mixed sugar and water and drank this with, or following, a meal. The amounts of sugar used varied from time to time and from subject to subject. The meals at which it was taken could be any of the three during the day and one subject drank it more than once on one day. The quantity of sugar used varied from 1 - 8¼ ozs. per drink, the latter amount would correspond to a dose of close on 250 gram of glucose, a ~~dose~~ which would scarcely be tolerated by the average person. It has, however, been observed that some of these people can ingest large amounts of sugar in solution with no apparent effect.

The content of the meals which were taken with this beverage varied widely, most commonly it consisted of sour mealie meal only. In some women the following were eaten, the sugar water being taken along with it:-

a. Doughnuts.

b. Oatmeal, milk and a boiled egg.

c. Ginger cakes.

d. Bread and jam.

e. Homemade scone and pumpkin.

f. Putu (dry scoalded mealie meal.)

Amasi. (Sour milk.) It is an age long custom among Bantu to use a hollow gourd called a calabash in which to sour milk, the supply was seasonal, however, due to variations in the milk supply. The urban native still continues the habit in some cases, but usesan ordinary jug or bowl, and it is less commonly chosen by those who eat the varied Europeanised diet. It may be drunk as a plain beverage or

served with dry scalded mealie meal, (putu).

Marewu. This is a thin fermented mealie meal gruel which forms a beverage, or a thin porridge and goes to make up the meal. It is non-intoxicating and has a high thiamin content.

Kaffir beer. It is illegal to brew this privately, and the sale of yeast in shops is forbidden. The Municipalities have opened beer halls in some locations, profits being allocated to the Native Affairs Department. However, some Bantu contrive to brew and sell it illegally. The following ingredients were said to go into its make up:- exact quantities were not given. Yeast, mdogo mabela (fermented kaffir corn porridge), bread, warm water and sugar. The whole is stewed, not boiled, and the final product is mildly intoxicating.

"Barbeton". This is potent and toxic - the ingredients are kept a secret, and there are heavy penalties for illegal brewing, and when discovered by the police, it is confiscated.

Deiry products.

Milk. Both fresh and condensed milk were purchased. Fresh milk at 4½d. per pint was more popular than condensed at 8d. tO 1/- per 14 oz. tin, in spite of the better keeping qualities of the latter. These people are, however, given to buying in small amounts, usually just sufficient for one meal at a time, and initial outlay is apt to receive greater consideration than saving over a longer period. Both forms of milk were used for tea or coffee, except for a minority of women, who drank rather larger amounts of amaas or sour milk, when it constituted part of a meal rather than a beverage. Every subject used milk at some time during the period she recorded her intake. Powdered milk, whole or skim, was not used.

Milk consumed. (Present survey.)

Type of milk	No: Subjects	Daily consumption (oz. per woman) Max.	Min.	Mean
Fresh	20	12	2.5	5.5
Sour (amass)	6	20	9	13
Condensed	5	1.5	0.3	0.5

The mean daily consumption shown by these figures may be compared with others collected in other dietary surveys in rural and urban populations.

Comparative MILK INTAKES FOR BANTU POPULATIONS.

Ref.	Description of Subjects	Type of Milk	Percentage of population using.	Daily individual consumption. oz. (per capita)
(59)	987 urban families Johannesburg	Fresh	55	-
		Condensed	29	-
		Both	10	-
(14)	Rural families in 3 areas.			
	a) 93 Transkei and East Griqualand	a) Fresh	34	6.3
		Condensed	10	0.3
	b) 41 Nongoma Zululand	b) Amass	93	11.0
		Fresh and amass	94	12.6
	c) Letaba N. Tvl. 3 families in 3 locations	c) All locations		
		Fresh	3	1.9
		Condensed	1	0.57
		Separate locations		
		1) Fresh	-	-
		Condensed	2	0.6
		2) -	-	-
		3) Fresh	10	1.9
		Condensed	-	-
(30) (calculated) not actual values	a) European Coloured Asiatic.	a) Fresh	-	15
	b) Urban Bantu	b) Fresh	-	10
	c) Rural Bantu	c) Fresh	-	10

Milk consumed. (Present survey.)

Type of milk	No: Subjects	Daily consumption (oz. per woman) Max.	Min.	Mean
Fresh	20	12	2.5	5.5
Sour (amass)	6	20	9	13
Condensed	5	1.5	0.3	0.5

The mean daily consumption shown by these figures may be compared with others collected in other dietary surveys in rural and urban populations.

Comparative MILK INTAKES FOR BANTU POPULATIONS.

Ref.	Description of Subjects	Type of Milk	Percentage of population using.	Daily individual consumption. oz. (per capita)
(59)	987 urban families Johannesburg	Fresh Condensed Both	55 29 10	- - -
(14)	Rural families in 3 areas.			
	a) 93 Transkei and East Griqualand	a) Fresh Condensed	34 10	6.3 0.3
	b) 41 Nongoma Zululand	b) Amass Fresh and amass	93 94	11.0 12.6
	c) Letaba N. Tvl. 3 urban families in 3 locations	c) All locations Fresh Condensed	3 1	1.9 0.57
		Separate locations 1) Fresh Condensed	- 2	- 0.6
		2) -	-	-
		3) Fresh Condensed	10 -	1.9 -
(30) (calculated) not actual values	a) European Coloured Asiatic.	a) Fresh	-	15
	b) Urban Bantu	b) Fresh	-	10
	c) Rural Bantu	c) Fresh	-	10

Comparative MILK INTAKES FOR BANTU POPULATIONS (Cont.)

Ref.	Description of Subjects.	Type of Milk	Percentage of population using.	Daily individual consumption. oz.
(32)	Urban families 100 Springs.	Fresh	93	6.35
				(woman unit)
(55)	50 urban families Alexandra Township	Fresh	78	1.8
		Condensed	64	0.28
		Sour	26	0.46
		Skim	2	0.016
(55a)	as above 12	Fresh	100	4.17
		Condensed	59	0.89
		Sour	33	1.15
				(woman unit)
Present series	21 urban women Johannesburg	Fresh	95	5.5
		Condensed	23	0.5
		Sour	38	13.0

In comparing these milk intakes with those of the present survey, only one series is expressed in woman units i.e. Alexandra township survey - the other values being per capita values. Of the two Alexandra township surveys, the series covering 12 families was a more detailed study than that for the 50 families, and the intake of fresh milk is near the value for the present survey.

The intake of amaas for the present survey is far greater than in either Alexandra survey, but it is realised that variability of milk supply and individual preference is likely to affect this commodity. It may be said, however, that seasonal variations in the milk supply and the consequent consumption of milk, are more evident among rural than urban peoples. The prejudice which prevent the women from drinking milk, is more strictly applied in the country, however, and milk is not a generally popular beverage in the country, unless first soured, (amaas), Fox (37), Best (14). Even in the towns it is not used

in the larger quantities except when soured (du Toit (52)), otherwise small amounts are added to tea and coffee.

Squires (111) in his Bechuanaland study, found that the milk supply was very irregular except at the distant cattle posts. Those members who lived at home in the villages only received a little when it was sent to them in skin bags after souring. It proved impossible to measure the quantity allocated per person.

As a comparison with dark skinned people elsewhere, the following values are quoted for Cingalese families:-

Cingalese milk consumption.

Ref.	Description of families	Type of milk	Percentage of population using.	Daily individual consumption oz.
(24)	27 British women living in Ceylon	Fresh	?	6.68
		Powdered	?	0.05
(24a)	373 Cingalese families	Fresh	18	0.38

It will be seen that the Cingalese use less milk than persons of European descent living in Ceylon - and that only a small percentage of the Cingalese people use milk.

Butter. Nine of the women did not take butter during their periods of recording, one who recorded on two separate occasions used it during one period but not the other. One women recorded the consumption of butter once 4½ oz. !

The amount of butter purchased was 0 to 2 lbs. a week, with an average of 1 lb. a week. The sizes of the families varied from 2 to 15 persons, not all of whom ate butter, consequently the individual consumption rates can only be calculated for the women of the survey.

These were:-

Daily butter intake Mean: 1 oz. Range: 0 - 4½ ozs. The size of helpings ranges from 1/6 to 4½ ozs. It was stated to be in short supply at the time of the survey or more

might have been used.

Most of the subjects used the butter on bread or scone, but not in the preparation of dishes.

The most consistent user took butter twelve times in nine days.

Though it has generally ~~always~~ been held that the Bantu have little taste for butter, the records of the present survey show that four or five of the twenty one women could be regarded as habitual consumers.

Other fats. The only other fat which was purchased regularly by any of the present subjects, was dripping. Some families bought 1 lb. every 7 - 10 days.

Kalings were used by some women, these are the fat cuttings off the meat, rendered down, the melted fat poured off, and the crisp brown portions added to cooked mealie rice or samp. Usually however, the meat was stewed with the fat left on.

Other surveys mention the purchase of other sources of fat e.g. fish oil (32), dripping, lard, peanut butter, fish oil and margerine products (55), lard, marigold fat (55a).

The following are the values given by other investigators for the fat consumption of the Bantu.

Bantu fat consumption.

Ref.	Type of subject Locality	Proportion (percent using)	Type of fat	Daily individual consumption oz. Mean	Range
(59)	987 urban families Johannesburg	Suggested diet. One family (5)	Dripping	¼ lb. (5 persons)	-
(30)	Union of S.A. 1) Europeans Coloureds Asiatics	Suggested diet	Butter and Margerine	1) 1½	-
	2) Urban Bantu			2) 1	-
	3) Rural Bantu			3) 1	-
(32)	100 urban families Springs	44	Butter	0.26	0.01-0.96
		35	Dripping	0.28	0.02-1.0
		3	Fish oil	-	-

Bantu fat consumption. (Cont.)

Ref.	Type of subject Locality	Proportion (per cent using)	Type of fat	Daily individual consumption oz. Mean	Range
(14)	1) 93 rural families Transkei & N. Griqualand	12.9	Lard	0.9	0 - 6.6
	2) 41 families Zululand.	No fat consumption recorded			
	3) 3 families Letaba. N. Tvl.	No fat consumption recorded			
	4) Keiskammahoek E. Cape Prov. 95 - 101 families	No fat consumption recorded			
Present series	21 urban women Johannesburg.	57	Butter	1	0 - 4.5
(55)	50 urban families Johannesburg. (Alexandra Township)	22	Butter	0.23	-
		16	Margarine products.	0.3	-
		14	Dripping	0.5	-
		8	Lard	0.34	-
		4	Peanut butter	0.38	-
		2	Fish oil	0.2	-
		48	Total fats	0.598	-

The following values are quoted for the butter consumption in Ceylon:-

Butter consumption Ceylon.

Ref.	Type of subject Locality	Proportion (per cent using)	Type of fat	Daily individual consumption oz. Mean	Range
(24)	27 women of British descent	?	Butter	0.93	-
(24a)	373 families (Cingalese)	14	Butter	0.0013	-

Conclusion.

Comparing the present series mean butter intake of 1 oz. per day per woman, it is somewhat higher than other reported intakes which are expressed in man units or per capita.

Rural Bantu do not eat extra fat with their diet, with the exception of the finding for the Transkei and East Griqualand , where the intake was 0.9 (per capita).

Cingalese people eat very little butter.

The butter intake of the Bantu women of the present survey is almost similar to women of European descent living in Ceylon.

This high value and its increasing popularity for urban Bantu, is a reflection of the change being brought about in their feeding habits due to their proximity to the European in urban areas.

Eggs.

In some African tribes there is an old standing taboo which prohibits women from eating eggs. It is said to make them wanton, and though the women of the present generation do not consciously hold this belief, they have not cultivated a taste for eggs. They are mostly used in baking, or as Janisch (59) has stated, for feasts. Half the women of the present series (10/21) did not eat eggs in any form.

The following table, illustrates the mode of utilization, and the rate of consumption:-

TABLE XVI

Egg consumption - 11 Bantu women.

Case No.	Frequency of use Day of diet	Meal	No eggs eaten	Method of cooking	Source of eggs. Purchased	Fowls kept
2	I	L	2	Boiled	No	Yes (not laying)
4a	III	L	1	Fried	Buys many	No
	VII	B	1	Fried		
5	V	B	1	Boiled	No	No
6	I	B	1	Fried	Yes - two	
	IV	B	2	Fried	Three times a week	No
7a	V	D	1	Fried	No	No
8a	I	B	1	Boiled	Yes	No

Egg consumption - 11 Bantu women (Cont.)

Case No.	Frequency of use Day of	Meal	No eggs eaten	Method of cooking	Source of eggs. Purchased	Fowls kept.
8b	I	D	1	Fried	Yes	
	II	B	2	Fried	1 doz. month	No.
		D	1	Fried		
14	VII	B	2	Boiled	Yes	No
		L	2	Scrambled	(occesionally)	
16	I	L	1	Boiled	No	Yes 2 eggs a day.
18	II	B	1	Fried		Yes 2 eggs
		L	1	Boiled	No	a day.
19	I	B	1	Fried	Boards with Case 6	
	IV	B	1	Fried		
21	I	B	1	Scrambled	Yes	No.

B = Breakfast L = Lunch D = Dinner

Cases 2, 5, 7a do not explain the source of eggs, they may possibly have been a gift. Case 6 who was pregnant was substituting the meat in her diet with eggs on the advice of a doctor. She did not normally eat eggs.

Egg consumption among Bantu

Ref.	Type subject. Locality	Proportion (per cent) using eggs	Daily individual consumption oz.
(32)	100 urban families Springs	22	0.29
(14)	1) Keiskammahoek E. Cape Province 95 - 101 families (rural	No eggs recorded	
	2) Transkei E. Griqualand 93 families (rural)	26.8	0.6
	3) Nongoma Zululand 42 families (rural)	1	2.4
	4) Letaba. N. Tvl " 5 families	1.8	0.25
(55)	100 urban families Alexandra Township Johannesburg.	10	0.36
Present survey.	21 urban women	48	2.2

(1 egg = 2 oz. approximately in shell.)

Comparison with Ceylonese figures are as follows:-

Egg consumption - Ceylon

Ref.	Type subject. Locality	Proportion (per cent) using eggs	Daily individual consumption oz.
(24)	27 women of European descent in Ceylon	?	1.25
(24a)	373 Cingalese families	6	0.022

Conclusion.

The proportion of women using eggs in the present survey was higher than in other surveys, possibly due to the fact that they represented fairly well to do families who lived near shops where they could be easily purchased, and who are rapidly adopting European habits of food selection and cooking.

The average daily consumption, approximately an egg a day, per person is similar to the finding in the Springs survey - also an urban community.

Cereals.

Maize was the most popular cereal, it was used by twenty of the twenty one women. (95 per cent.)

In addition three women used Mabela, a malted form of ground kaffir corn or sorgum. (15 per cent.) Two used oatmeal (10 per cent) and five used Indian rice (20 per cent.)

The white is always preferred to the yellow form of maize. It is purchased in many forms:- Mealie meal, mealie rice and samp.

There are numerous methods of preparing the meal, some are taken as beverages rather than as a porridge. The mealie rice is usually cooked alone, but samp may sometimes be cooked with dry beans, or the cooked beans added just before serving.

Porridge may be made from mealie meal, or mabela,

it may be soured or not. The soured porridge is sometimes cooked after souring and not before. A very great increase in the vitamin B complex vitamins, results from souring, especially if the porridge is eaten without boiling after souring. The ennoblement of cereal foods by fermentation makes an exceedingly important contribution to the Bantu diet. It is regrettable that less fermentation of natural foods is likely to occur as the Bantu adopt the European mode of feeding.

The following recipes are given for the more common forms of maize preparations.

Mealie pap or porridge. Recipe: 1 cup cold water, ½ cup mealie meal, pinch salt. Mix, bring to boil, boil approximately 20 minutes.

It is usually eaten at breakfast, when a cup of tea is drunk, and a slice or two of bread is eaten. Left over porridge may be eaten by the women at lunch. It is the most popular form of mealie meal.

Stiff mealie meal. Recipe: 1 cup water, ½ cup mealie meal, pinch salt.

The water is boiled and the mealie meal sprinkled on it, the whole stirred till stiff and steamed 15 - 20 minutes. It is usually served at dinner with meat, vegetables and gravy. When served with marewu, these two constitute the whole meal and sometimes it is taken at lunch with boiled wild spinach (imfino) and tea. Less frequently it is fermented first, then boiled before eating.

Putu. Recipe: 1 - 1½ lbs. mealie meal, 2 cups boiling water. The mealie meal is scalded with boiling water, it then appears dry and crumbly, no salt is added. It is eaten with amasi (sour milk.) and makes up the entire meal.

Marewu. Mealie meal pap is cooked, then cooled and added to the dregs of a former fermented batch in a paraffin tin. After 24 - 48 hours it is recooked and then eaten. At lunch

it may be combined with stiff mealie meal, or with meat and gravy for dinner.

Idogo mealie meal is a thin, sour, fermented mealie meal.

Recipe: Mealie meal is mixed with a little warm water, and added to the dregs of the last batch, and placed in a cupboard for three days. It is then boiled and ready for use.

It is eaten at breakfast with sugar, and occasionally a slice of bread.

Mealie rice. Maize ground to approximately the size of Indian rice which it resembles on superficial inspection. This is cooked with a little water and a pinch of salt. When completed, it has taken up all the water and is stiff and glutinous. The grains do not separate as readily as those of Indian rice, even if carefully cooked, and it is the custom of these women to cook the mixture over fast heat and burn the lower quarter which they usually discard.

Not uncommonly the pieces of hard fat left over from rendering fat are cooked along with the mealie rice and eaten too, (Kaiings.) It is served with meat and vegetables, and makes a large bulk of the meal.

Samp. This is much coarser than the above - often about one half of the whole grain in size. It takes longer to cook and is boiled for 2 - 3 hours in salt and water. Certain women serve it with dry beans, which may be boiled with the samp, or separately and added later. One woman had the curious custom of boiling the beans separately, then skinning them and adding the beans only to the samp.

Fresh mealies. These are very popular during the short season, when they are available. Rural natives roast them in a coal fire, or steam them over a boiling kaffir pot. Others boil them in water as is the more general habit among Europeans and the urban native. The more primitive native may cut the mealies off the cob, wash and eat them raw, or

make a small cake or loaf which is steamed or baked. Boiled mealies may constitute an entire meal such as lunch.

The water content of these various maize products varies very considerably. Samples were collected from the women and analysed by Dr. L. Golberg at the Institute for Medical Research, a few thiamin values were also done when time was available. These results were used in the dietary claculations.

TABLE NO: 17

Moisture Content of Typical and Common Raw and Cooked Maize Foodstuffs.

Maize foodstuff	Moisture percentage
Raw mealie meal 96% extraction No. 3 "straight run"	9.7
Mealie pap. (unfermented thin porridge)	a) 86.9 * b) 89.0
Stiff mealie meal (unfermented).	a) 66.0 * b) 75.4
Stiff fermented mealie meal with trace mealie rice).	82.9
Thin fermented mealie meal "mdogo"	86.5
Marewu	92.3
Putu	45.9
Raw mealie rice	5.3
Boiled mealie rice	a) 76.8 * b) 80.0
Raw samp	11.5
Boiled samp	a) 79.0 b) 72.0 average 75 *
Green fresh mealies	47.7
Boiled fresh mealies on cob	56.0
Steamed green mealie bread	50.6

* value for calculation.

In some cases specimens of the same type of cooked preparation differed quite considerably in water content. An average analysis of the more typical example was used for

calculation purposes.

Mealie pap served at breakfast is the most popular form of cooked maize eaten by the Bantu. A close second is stiff unfermented mealie meal, which is used with meat and vegetables at lunch or dinner. It may also be used cold with food scraps for a made up meal for the women at lunch. Only certain of the women favour the fermented forms of mealie meal, i.e. marewu, mdogo - or the slightly scalded putu. They may be said to be more characteristic of the less civilised members of the community. A large variation was noted in daily intake, both between the subjects and from day to day by the same women.

TABLE NO: 18

Daily Variation of Maize Intake (oz.)

Case No.	Maximum	Minimum	Mean
1	10.0	6.0	7.7
2	6.7	0	1.5
3	2.8	0	1.7
4a	3.7	0	2
4b	4.4	1.1	2.4
5	4.7	2.7	2.7
6	1.9	0.5	0.9
7a	13	3.7	5.3
7b	9.9	1.7	5.4
8a	11.7	1.8	7.7
8b	8.7	3.7	5.4
9	11.8	4.7	5.5
10	7.7	0.7	3.7
11	0	0	0
12	4.5	0.5	2.4
13	1.0	0	0.4
14	8.0	2.5	4.9
15	15.3	6.3	10.5
16	13.0	2.1	8.2
17	5.2	0	2
18	5.3	1.2	1.9
19	1.8	0.5	1.1
20	6.6	0.6	2.8
21	0.2	0	0.1
Average	7.5	2.4	4.2

Other Cereals.

These are used by a minority of the women, only mabela may be said to be a natural food, the rural and occasionally the urban native grows his own plot of kaffir corn and grinds it himself. With the advent of town life, certain of the women buy the processed meal known as mabela - it is more costly than mealie meal. In this series, four women used it, three to make breakfast porridge, one a fermented thin meal similar to mdogo mealie meal. Two of the women did not, however, eat the usual mealie meal preparations. The others combined both. Two ate oatmeal porridge very occasionally, it is precooked and expensive. They also used mealie meal preparations much more frequently than oatmeal.

Boiled Indian rice was used rarely by five women. It is very much more expensive than mealie rice and is an acquired European custom.

TABLE NO: 19

Comparative Use Maize - 21 Bantu Women.

Case No.	Length dietary record days.	Mealie meal porridge	Stiff mealie meal	Mdogo mealie meal	Putu	Mealie rice	Samp
1	7	B_5	L_3 D_3	B_2			D_2 L_1
2	8	B_4	D_1			L_1 D_1	D_1
3	5	B_1		B_3			D_2 L_1
4a	6	B_3	D_2 L_1				
4b	6		D_2 B_1 L_1			D_2	
5	6	B_5 L_1	D_2			D_2	D_2
6	6	B_5					D_3
7a	6	L_1	B_5(sour)		L_1 D_2	L_1 D_1	B_1
7b	4	B_3	D_2 L_1	B_3	L_1		D_1
8a	6		D_4 L_1	B_3	B_2	L_2 D_1	D_1
8b	5		D_2	B_4	L_2	D_2	L_1
9	5	B_2	D_4 L_1 B_1	D_1 B_1	L_1	L_1	

Comparative Use Maize - 21 Bantu Women. (Cont.)

Case No.	Length dietary record days.	Mealie meal porridge	Stiff mealie meal	Mdogo mealie meal	Putu	Mealie rice	Samp
10	6		L_3 D_1	B_1		L_1	D_1
11	5	---------- N I L ----------					
12	8	B_5	L_2 D_1	B_2		D_4 L_2	D_3
13	5	B_4					D_1
14	8	B_2	D_1	B_1 L_2		D_4	D_1
15	7	B_2	L_5 D_5		L_1 D_1		
16	7		L_4 D_3	B_3 D_1	L_1 B_1	D_1	D_1
17	6	B2	D_1 L_1				
18	5	B_4	D_1		L_1		
19	10	B_{10}					D_4 L_1
20	6	B_4	D_2	B_2			
21	4					L_1 D_1	D_1

B - Breakfast L - Lunch D - Dinner

Fresh mealies were eeten once by two women as lunch.

Marewu was drunk once at lunch by two women.

The following values are given for the consumption of maize by other investigators of Bantu surveys:-

Maize consumption - Bantu
A varieties.

Ref.	Description of subjects. Locality	Type of cereal	Proportion (per cent using.)	Daily individual intake oz. Mean	Range
(59)	987 urban families. Johannesburg.	Mealie meal	suggested diet one family (5)	(1¼ lb. 5 persons) 4 (per capita)	
(14)	1) 95-101 families rural Keiskammahoek	Mealie meal	94.8-99.0	5.3-8.0 (per capita)	-
		Maize grains	52.5-94.8	3.4-5.3	-
		Samp	73.8-95.8	3.7-7.7	-
	2) 93 rural Transkei & E.Griqualand	Mealie meal (White and yellow)	97.8	8.55	0.3-35
		Maize grains (White and yellow)	46.2	6.7	0.8-33
		Samp, white and yellow.	82.8	8.7	0.6-28.3

Maize consumption - Bantu (Cont.)

Ref.	Description of subjects. Locality	Type of cereal	Proportion (per cent using)	Daily individual intake oz. Mean	Range
(14)	3) 40, rural Nongoma Zululand.	Mealie meal	97.6	11.0	3.0-33.9
		Maize grains	75.6	6.2	0.4-19.8
		Mealie rice	2.4	0.8	-
		Samp	4.9	0.6	0.1-1.1
	4) 111 rural families Letaba N.Tvl.	Mealie meal	100	13.8	0.9-46.4
		Maize grains	1.8	0.7	0.1-1.7
		Mealie rice	4.5	1.7	?
		Samp	8.1	1.9	0.9-3.0
(32)	100 urban families. Springs.	Mealie meal	100	2.93	0.91-9.21
		Mealie rice	79	2.13	0.08-6.8
		Samp	35	1.56	0.1-4.11
				(woman unit)	
(55)	50 urban families. Alexandra Township J.H.B.	Mealie meal	100	9.2	
		Mealie rice	50	1.52	
		Samp	24	1.05	
				(woman unit)	
(106a)	Rural families Bechuanaland	Mealie meal	?	0.75	0-1.83
		Samp	?	1.19	0.08-2.66
		Whole mealies	?	1.41	0.08-3.15
(111)	1,681 rural school children Bechuanaland a) Kanye b) Molepolole	Mealie meal	?	a)1.2 b)2.1	0.3-1.8 1.0-3.0
		Samp	?	a)1.2	0.0-2.4
		Whole mealies	?	a)1.2 b)2.1	0.1-2.2 0.3-5.0
(97)	1) Urban families Johannesburg.	Mealie meal	?	1) 16.0	
	2) Non European families. Benoni			2) 5.0	
	3) Bantu paupers Cape province.			3) -	
		Mealies		1) -	
				2) -	
				3) 24.0	
				(woman units)	
Present series	21 urban women Johannesburg.	Mealie meal) Maize grains)	95	3.37	0-14.9
		Samp	56	0.7	0-7.0
		All types of maize.	100	4.2	2.4-7.5

The following is a comparison of the mean daily intake (oz.) of maize in all forms, for each of these investigations.

Maize consumption - Bantu.
B. Total (all varieties)

Reference	Type of Subjects Locality	No: of Subjects	Mean daily individual intake, all maize varieties oz.
(14)	1) Keiskammahoek (3 records)	Families 95 - 101	(per capita) 12.4 - 21.0
	2) E. Griqualand	93	25.0
	3) Nongoma Zululand	40	18.6
	4) Letaba N. Tvl.	3	16.2
(106a)	rural Bechuanaland	?	(woman unit) 3.32
(111)	rural Bechuanaland	children 1,681	(per child)
	a) Kanye	a) 950	a) 3.6
	b) Molepolole	b) 731	b) 4.2
(32)	urban Springs. Tvl.	families 100	(per capita) 6.62
(55)	urban Alexandra Township Johannesburg.	families 50	(woman unit) 9.76
Present survey.	urban Eastern and Western Townships Johannesburg.	women 21	(woman unit) 8.27

Conclusion.

Except for the values recorded for the Bechuanaland surveys, the maize intake of the rural population is considerably higher than that of the urban population. The mean value for the present survey is midway between values given for other urban surveys. The smaller maize consumption in the towns is probably due to the greater variety of foodstuffs available for purchase in the towns.

Other Cereals.

Mabela. This is the fine ground kaffir corn or sorgum,

which is cooked as a porridge, and may be used as such or after additional souring (mdogo.). Certain of the rural natives grow the corn near their huts, and very rarely a small patch is found growing in a location garden in the town, Case 16 had some growing and the family was found grinding it between two stones, on one occasion. Of the four women who used it, three did so once only and were more accustomed to the use of maize. The fourth did not use maize, she cooked mabela on three occasions. It is not therefore universally popular, as it is fairly costly if bought when malted for European consumption, which is how it is chiefly sold in the town.

Oatmeal. Only a few women (2) had cultivated this taste from their European employers, and occasionally made porridge in the mornings. They used maize in addition far more readily, however.

Indian rice. Five of the women cooked rice as a vegetable for the evening meal on one occasion each. The same women used maize products as a general rule, however.

Bread. This survey was carried out when the war time standard loaf was still almost compulsory and flour was rationed for invalids, rye bread though procurable, was expensive. Consequently 15 of the 21 women ate standard bread, 3 ate rye bread, 1 white bread.

Two subjects did not eat bread at all. One of these subjects, on repeating her record, made wholemeal bread at home on one occasion. This is unusual as yeast is unobtainable without a permit, and as has been formerly stated, little use is generally made of the oven provided in the stoves as extra fuel is a consideration.

The choice of standard bread is no indication of the natural selection of the group, all workers have remarked that they prefer the white loaf, in the same way as they prefer white to brown sugar.

Boermeal is, however, often made into dumplings by the women, and steamed over the meat stew on a saucer. The following table gives the bread intake of the group as a whole:-

TABLE NO: 20

Individual Bread Consumption - 21 Bantu Women.

All types bread. ozs. daily.

Case No.	Maximum	Minimum	Mean
1	8.8	0	5.7
2	4.7	0	2.6
3	2.5	0	1.8
4a	7.5	3.0	5.1
4b	9.7	0	3.4
5	7.5	3.0	5.5
6	6.5	1.3	4.0
7a	3.5	0	1.4
7b	12.6	0	4.4
8a	0	0	0
8b	9	0	6.6
9	0	0	0
10	6.8	0	3.3
11	12.4	0	5.3
12	14.2	0	4.9
13	4.4	1.7	3.2
14	11	0	6
15	2	0	1.1
16	2	0	0.3
17	9.3	3.1	5.3
18	9.5	1.6	6.3
19	5.3	1.3	3.9
20	11	4.1	7.1
21	3.6	0	1.2
Average	7.8	0.9	4.2

Comparative values for bread consumption in the Bantu have been given as follows:-

Ref.	Description of subjects. Locality	Type of bread	Proportion (per cent using)	Daily individual intake oz. Mean	Range
				per capita	
(32)	100 urban families. Springs.	White	94	3.72	0.76 -10.28
		Brown	20	1.73	0.38 - 6.65
				woman unit	
(55)	50 urban families Alexandra Township Johannesburg.	White	98	3.67	
		Brown	38	0.5	
		Bread rolls	4	0.15	
				per capita	
(97)	1) urban Bantu Johannesburg	Bread) Biscuits) Flour)		1) 4	
	2) non Europeans Benoni	"		2) 3.5	
	3) Bantu paupers Cape Town.	"		3) -	
	Rural			per capita	
(15)	1) Keiskammahoek E. Cape Prov.	Wheaten	1) 1.0 - 13.8	1) 0.7-1.4	
	2) Transkei, E. Griqualand.		2) 22.6	2) 1.9	tr. -6.3
	3) Nongoma Zululand		3) 14.6	3) 1.0	0.2 - 2.3
	4) Letaba N. Tvl.		4) 5.4	4) 2.2	0.4 - 3.0

Conclusion.

Rural bread consumption is about half of urban consumption, this is confirmed by a statement by Squires (111) that bread is considered a luxury by the Bechuanaland native, and its consumption is only increased at the time of a food shortage.

The present finding of 4.2 oz. mean daily intake, is not a true reflection of the women's choice, as they were compelled to choose standard bread, and may have eaten less, as white bread is normally their preference.

Brown bread intakes in other surveys are much lower if left to free choice.

MEAT

A census of the type of meat eaten by the 21 women, shows that beef was most popular 18/21, then mutton 13/21, pork 4/21 and chicken or fowl 2/21.

Beef. The cheapest cuts of beef were chosen, that is compound grade, also liver, beef sausage or "boerewors". The commonest mode of cooking was stewing in a closed pot, with tomato and onion. Occasionally a boermeal dumpling was added some hours later and steamed over the stew on an inverted saucer. Sausage and liver were fried. Of the three women who did not eat beef during a recorded period, two had repeated the period and it was only on one of them that beef was avoided. In one case other types of meat were eaten, and in the other case the woman was pregnant and had been told not to eat meat. The third member had chosen to eat eggs instead of meat of her own free will.

Mutton. This was somewhat in the nature of a delicacy but was expensive, so usually reserved for the week-end. Since a leg might cost as much as 6/-, the cheaper stewing portions were popular, and poor people ate tripe. The offal smelt very evil while cooking. Generally the mutton was stewed or chops were fried.

Pork. This is not widely popular as certain tribes do not eat "pig". Chops and sausages were fried, and some people boiled the head and trotters.

Fowl. Cases 15 and 16 lived next door to one another, both ate roast or boiled fowl, which were said to be gifts from people in the country. The mother of case 15 was known to brew illicit liquor and it is probable that they enjoyed certain luxuries in payment for their brews. In urban communities a fowl is a special delicacy.

Money spent on meat.

There was fairly good agreement in the data

collected. Most families spent 1/- to 2/- daily, but more over the week-end, 1/6d. - 6/6d., the latter including the rare luxury of a leg of mutton bought by the more lavish home.

TABLE NO: 21

Type of Meat Selection

B = beef L = liver Mn = mince M = mutton
T = tripe P = pork F = fowl Bw = boerewors
S = sausage - = no meat

Case No.	Day of Dietary Period 1	2	3	4	5	6	7	8	9	10
1	B	L	LB	SM	B	Ma	B			
2	-	B	B	-	SBB	B				
3	Mn	B	B	L						
4a	-	-	-	-	-	-				
4b	B	B	BB	Bw	B	BB				
5	B	B	B	B	B	-				
6	P	PB	P	B	PB	PM				
7a	B	B	-	-						
7b	B	-	B	M	-	-				
8a	B	B	B	B	B	B	B			
9	TB	B	T	-	B					
10	B	-	-	B	BB	MMnB				
11	BB	BB	-	BB	BB					
12	TM	-	TM	Bw	M	M	B	M		
13	-	LM	B	PP	P					
14	B	LM	ML	M	B	S	LB			
15	LM	BB	BMF	B	B	B				
16	BF	PS	BM	FB	B	B	-			
17	B	B	B	-	-	B				
18	-	-	-	-	-					
19	P	PB	P	M	PSB	PM	M	P	B	B
20	B	BB	B	M	-	BB				
21	M	M	MnM							

The evening meal was the most usual time for eating meat 20/21, some women ate meat twice a day 14/21, four women ate meat three times a day. Meatless days were not uncommon 11/21, but in half the cases substitutes such as eggs or fish were used.

The following table gives the average and individual ranges of intake of meat (all types) expressed in ozs. daily:-

TABLE NO: 22

Daily Meat Intake - 21 Bantu Women.

Case No.	Maximum oz.	Minimum oz.	Mean oz.
1	13	3.6	6.3
2	8.4	0	2.3
3	3.4	2.2	2.7
4a	0	0	0
4b	4.6	1.1	3.1
5	4.0	0	2.8
6	9.4	1.3	4.5
7a	2.1	0	1.0
7b	2.0	0	0.5
8a	3.3	1.9	2.5
8b	4.3	0	0.9
9	5.9	0	3.3
10	8.0	0	3.1
11	11.3	0	7.0
12	4.2	0	2.6
13	7.9	0	3.4
14	20.0	1.2	9.2
15	18.7	3.8	8.6
16	23.3	0	10.1
17	4.3	0	2.3
18	0	0	0
19	7.3	1.3	3.7
20	1.1	0	0.5
21	7.2	0	3.3
Average:	7.5	0.7	3.5

Cases 15 and 16 have an unusually high meat intake, in particular they both ate chicken. They were neighbours, and the mother of case 15 was said to brew illicit liquor, it is possible that poultry was offered in payment on occasion. Case 14, who earned a good salary, received support from the father of her child, and lived with her parents, she selected large helpings of meat.

Comparison with other surveys.

Reference	Subjects	Type of meat	oz. daily	Percentage families consuming.
			per capita	
(30)	a) Europeans Coloureds Asiatics	Meat Fish Egg	a) 6	-
	b) Urban Bantu		b) 4	
	c) Rural Bantu		c) 4	
			woman units	
(24,24a)	a) 373 Cingalese women	Meat	a) 0.1	
	b) 27 Cingalese women of British descent.		b) 17.81	
(32)	100 urban native families, Payneville, Springs	Beef	3.12	99
		Sausage	0.61	33
		Tripe	1.11	10
	rural			
(14)	a) 95 - 101 Bantu families, Keiskammahoek, E. Cape Province.	Meat	2.4 - 6.7	5.2 - 13.9
		Fowl	1.5 - 2.2	4.9 - 12.5
	b) 93 Bantu families, Transkei, E. Griqualand	Chicken	1.9	7.5
		Beef	9.8	25.8
		Mutton	5.5	7.5
		Offal (sheep)	3.3	5.4
		Pork	2.0	15.0
		Total meat (all types)	5.9	58.1
	c) 42 families Nongoma, Zululand	Beef	3.9	31.6
		Mutton	1.9	19.5
		Goat	3.3	46.3
	d) 111 families Letaba, N. Tvl.	Meat and Fowl	1.5	30.6
			women units	
(55)	50 urban families Alexandra Township	Beef		
		Meat 16% bone	3.5	86
		Roast beef	1.0	42
		Steak	1.0	30
		Total	5.5	
		Tripe & offal	0.8	24
		Liver	0.85	20
		Boerewors	0.5	12
		Mince	0.63	4
		Vienna sausage	0.2	2
		Mutton		
		edible portion	0.67	12

Comparison with other surveys. (Cont).

Reference	Subjects	Type of meat	oz. daily	Percentage families consuming
(55) (cont.)	50 urban families Alexandra Township	Pork	0.8	6
		Chicken	0.02	6
		All meats	3.2	100
			woman units.	
Present series	21 Bantu women Johannesburg	Beef	3.1	84
		Mince	0.47	16
		Liver	2.7	20
		Tripe	0.84	12
		Boerewors	0.21	8
		Sausage	1.0	20
		Mutton	4.6	52
		Pork	1.6	12
		Fowl	2.3	8
		All meats	3.5	92

Conclusion.

The women of the present survey were nearly all meat eaters. Comparing their intake with other values for women, their mean intake of 3.5 oz. daily is almost similar to the Alexandra Township value of 3.2 oz. (all types meat). It is not possible to compare values for other Bantu surveys, as they are not expressed in woman units.

Values for Ceylon women give a very low meat intake for Cingalese women (0.1 oz.) who live principally on fish. Women of European descent living in Ceylon have a very high intake (17.81 oz.)

There are some marked differences as regards the meat supply in urban and rural areas. Though Squires (111) has remarked that with the opening of butcheries in the rural areas, meat is becoming a more common article of the diet, formerly it was a luxury and as it did not keep well, it was eaten in excessively large amounts, but rarely. Now he records its consumption twice a week, mean daily intake 1.1 oz. (range 0.7 - 2.0 oz.). Urban supplies on the other hand then to be constant, with a wide selection and consequently though the town dweller may eat less at a meal,

he eats more often, in fact regularly.

The high proportion of poverty recorded for three of the present subjects must not be taken to be characteristic of the group as a whole. A fowl is considered a luxury in town, it is fairly easily obtained in the country.

FISH.

Fish is not generally eaten by the Bantu, though there are certain areas around lakes where it is the staple source of the diet.

In recent years the sale of ready cooked fish and chips in the towns, has grown steadily. Seven of the twenty one women in the survey had fried fish on from 1 - 3 occasions during the diet period. One woman ate curried fish. The fish used was stock fish, a dry variety which has a low fat content, and is the cheapest form on the market. Calculations are based on the values for McCance and Widdowson - fried cod, but the water content was calculated on the basis of local findings.

The following are the findings for the present survey and other Bantu surveys. No mention is made of fish in either the Janisch report (59) or the Dietary Surveys in Rural Bantu Areas (14).

Bantu fish consumption.

Reference	Subject	Type of fish	oz. daily	percentage families consuming
			per capita	
(32)	100 urban families Payneville, Springs	Tinned fish	0.31	10
		Fish oil	-	3
		Fresh fish	-	8
			per woman unit	
(55)	50 urban families Alexandra Township Johannesburg	Fried fish	0.39	22
		Tinned fish	0.36	2
		Sardines	0.17	2

Bantu fish consumption. (Cont.)

Reference	Subject	Type of fish	oz. daily	percentage families consuming
			per woman unit	
Present series	21 urban women Johannesburg	Curried	1.2	4
		Fried	2.31	24

Ceylon fish consumption.

Reference	Subject. Locality	Daily individual oz. fish
		per woman unit
(24)	373 women (Cingalese)	2.8
(24a)	27 women of European descent.	6.72

Conclusion.

Comparing the fish intake for the present survey with these women in Ceylon and other urban women, Johannesburg, the present subjects ate more fish than the Alexandra Township women, more than the true Cingalese women, but considerably less than European women born and living in Ceylon.

The proportion of women who ate fish, is similar to that in Alexandra Township.

VEGETABLES

The accompanying table sets out the different vegetables which were used, the number indicate their relative popularity.

TABLE NO: 23

Vegetables. Choice and Popularity. 21 Bantu Women.

Case No:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
No. days recorded	7	8	6	12	6	5	10	11	5	6	5	8	5	8	7	7	6	5	10	6	4
Potato	3	4	4	7	5	8	3	7	0	3	6	1	6	10	3	2	3	2	8	2	1
Imfino	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Tomato	1	2	2	0	3	3	4	0	0	1	0	2	0	1	5	1	0	1	0	0	0
Onion	1	2	1	0	2	0	3	0	0	0	0	0	1	1	0	0	0	1	0	0	0
Beetroot	1	1	0	1	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	2	0
Cabbage	0	1	1	2	2	1	0	1	0	1	0	0	1	2	1	0	0	4	3	0	0
Peas	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
Sweet potato	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Pumpkin	0	0	2	0	1	0	2	4	0	0	3	4	0	2	0	0	0	0	2	1	2
Green beans	0	0	0	1	0	2	0	2	0	1	0	0	0	1	0	0	0	0	0	0	1
Carrot	0	0	2	2	0	0	0	2	0	0	2	0	2	2	0	0	0	0	0	0	1
Parsnips	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Vegetables - Percentage popularity

Percentage	Vegetable
95	Potato
54	Tomato
50	Cabbage
46	Pumpkin
29	Beetroot, carrot, green beans
13	Sweet potato
8	Peas
4	Parsnips, imfino *

* Popularity restricted by supply.

Vegetables. Cooking methods.

The meat and all the vegetables were usually cooked together in a single pot, for about one and a half hours, the vegetables being added half way through. Sweet potato, beetroot and pumpkin are, however, boiled and served separately with the meat stew. Potato, sweet potato and pumpkin may be fried instead of boiled. Tomato and onion are added to the stew to help make the gravy. Carrot may be eaten raw, and is often taken from the greengrocer's shelf and eaten while awaiting his attention. It may also be boiled.

Case 9 was unusual in that she did not eat any fresh vegetables during the recorded period. She was given to cooking tripe and other meats and serving them with a cooked maize dish instead of fresh vegetables, the whole was frequently served cold, and looked most unappetising.

Though 95 per cent of the women used potato, there was a wide variation in the frequency of its use, with a maximum of ten times in seven days. Since the duration of the different dietary records varied, the vegetable usage is not strictly comparable.

A comparison is made with vegetable intakes in

other surveys:-

Vegetable consumption.

Ref.	Subject	Type of vegetable	oz. daily	percentage families consuming
	rural			
(14)	1) 5 - 101 families Keiskammahoek, E. Cape Province	Pumpkin	3 - 9.6	1.1 - 38.5
		Spinach (plus imfino)	1.4- 1.7	25 - 52.5
		Dried peas and beans	0.5- 2.2	63.2 - 92.7
	2) 93 families Transkei, E. Griqualand	Imfino	1.9	34.4
		Pumpkin	3.3	3.2
		Cabbage	1.4	3.2
		Potato and sweet potato	Trace	
		Dried beans	0.1-0.8	-
	3) 41 families Nongoma, Zululand	Dried peas) beans)	2.1	73.2
		Potatoes and Sweet potatoes	8.4	36.6
		Pumpkin	17.7	97.6
		Cabbage	3.1	2.4
		Onions	0.04	2.4
		Green jugo beans	2.0	7.3
		Total fresh veg. (without potato)	3.1	56.1
	111 families Letaba district N. Transvaal	Pumpkin	8.1	31.5
		Dried beans	1.3	8.1
		Sweet potatoes	5.2	3.6
		Onions	0.1	8.1
		Tomatoes	0.7	11.7
		Turnips	0.3	1.8
		Carrots	0.45	1.8
	urban			
(32)	100 families Payneville, Springs	Potatoes	4.82	95
		Onions	0.59	81
		Tomatoes	0.7	77
		Cabbage	1.77	47
		Dried beans	1.0	45
		Pumpkin	3.34	38
		Carrots	0.99	31
		Sweet potatoes	1.38	23
		Green beans	0.57	16
		Beetroot	0.59	13
		Peas	-	5
	estimated diet for:		a b c	
(30)	a) Europeans Coloureds Asiatics	Fruit & Veg.	16 8 10	—

Vegetable consumption. (Cont.)

Ref.	Subject	Type of vegetable	oz. daily	percentage families consuming
(30) Cont.	b) Urban Bantu c) Rural Bantu		a b c	
		Pulse	10 2 4	
	urban			
(55)	50 families Alexandra Township Johannesburg	Butter beans	0.76	16
		Haricot beans	0.99	2
		Tomatoes	0.82	84
		Onions	0.45	76
		Potatoes	2.39	70
		Cabbage	2.17	54
		Sweet potatoes	3.04	40
		Pumpkin	2.7	40
		Carrots	1.39	30
		Beetroot	0.99	18
		Green beans	0.69	10
		Spinach	0.29	10
		Turnips	0.01	2
		Parsnips	0.06	2
	urban		woman units	
Present Survey	21 women Johannesburg Witwatersrand.	Potato	3.3	95
		Tomato	1.79	57
		Onion	0.48	38
		Beetroot	1.08	33
		Carrot	0.51	33
		Dried beans (haricot & butter)	0.28	23
		Cabbage	0.66	57
		Sweet potato	0.37	14
		Pumpkin	1.18	48
		Parsnip	0.06	5
		Imfino	0.74	5
		Green beans	0.4	33
		Green peas	0.18	9

As previously, the only true comparison which can be made is with the values from the Alexandra Township Survey - after conversion to woman units (using factor 0.83). Complete agreement between the surveys is neither expected nor found, but the two sets of figures are interesting in themselves. In the original Alexandra Report it will be found that many more forms of vegetables were listed, than the selection recorded in the present survey. The principal types of vegetables are the same

in both, tomato and cabbage being among the most popular with parsnip and spinach (imfino) little favoured.

A good deal of seasonal variation probably prevails where some vegetables are concerned, but in neither survey were the records repeated at different seasons. Such variations are, however, amply shown in the Dietary Surveys by the Division of Nutrition (14). This factor is probably more in evidence in rural than urban areas.

A comparison with composite values for women in Ceylon are:-

Reference	Subjects	Type of vegetable	oz. daily. a	oz. daily. b
(24, 24a)	a) 27 women of British descent	Root	1.82	0.79
		Pulse	1.11	0.46
	b) 373 families women Cingalese	Greens	0.26	1.34
		Veg. and fruit		1.53
		Tubers (potatoes)	1.32	0.34

Free comparison cannot be made with these figures but it is seen that neither of the two groups of women in Ceylon ate as much potato as the Bantu women. The amount of pulses eaten by Bantu women lay between the quantities for indigenous Cingalese women and women of British descent in Ceylon.

FRUIT

Fruit may be eaten by the Bantu at any meal, but rarely breakfast. As this commodity cannot be stored easily, it is usually eaten as soon as possible, so that it may appear on the menu for several successive meals, and then not at all for a long period. Seasonal supplies naturally affect the selection, oranges and bananas which are the cheapest and most readily obtainable, are the most popular. Fruit is stated to be a luxury in the

Janisch Report (59), but an experimental distribution of good cheap vegetables and fruit in the municipal townships was described by this worker, these were drawn from Native Trust Lands, the Native producers receiving payment. Surplus produce was also distributed by the Citrus Board through the Government Native Affairs Department, so that over a million oranges were thus supplied to one hundred thousand Africans in townships, during October 1951.

During the present survey, boxes of tomatoes, 37 lb. pockets of oranges and potatoes were sold at the municipal townships in which the subjects lived, and could be bought at reduced prices. The general response was said to be only fair, however, though many of the survey subjects availed themselves. The urban survey (32), also mentions a market in the township where vegetables could be obtained at very reasonable prices, the people were stated, however, to prefer buying from vegetable carts at their houses.

The following table shows the individual selection of fruit by the subjects:-

TABLE NO: 24

Fruit Consumption. 21 Bantu Women.

Case No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Orange	0	4	0	0	2	3	1	2	1	0	0	0	0	2	0	1	1	0	7	1	0
Banana	0	0	1	2	2	1	0	1	0	0	0	0	0	0	1	0	0	1	3	0	2
Lemon	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0
Apple	0	0	0	3	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Guava	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Fruit salad	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	1
Paw paw	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
Peach	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pear	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2

Fruit - Percentage popularity.

Percentage	Fruit
46	Oranges
38	Bananas
17	Apple
13	Fruit salad *
8	Pear
4	Peach, pawpaw, lemon[x]

* Three varieties of fruit salad were used:- homemade, tinned, sold in carton.

[x] Used in black tea.

A comparison is made with fruit consumption and selection in other surveys:-

Fruit consumption.

Ref.	Subjects	Type of fruit	oz. daily			percentage families consuming
	Estimated diet for:		per capita			
(30)	a) Europeans Coloureds Asiatics b) Urban Bantu c) Rural Bantu	Fruit and vegetables (as purchased)	a 16	b 8	c 10	-
	urban		per capita			
(32)	100 families Payneville, Springs.	Pineapple	-			1
		Pawpaw	-			3
		Pears (canned)	-			1
		Peaches -do-	-			4
		Grape fruit	-			1
		Guevas	-			1
		Bananas	-			3
		Apples	-			3
		Oranges	0.49			19
	rural		per capita			
(14)	95 - 101 families Keiskammahoek, E. Cape Province.	Peaches	0.2			-
	93 families Transkei and S. Griqueland	Oranges	1.1			12.9
		Lemons	1.9			1.1
	41 families Nongoma, Zululand	Oranges	1.1			4.9
	111 families Letaba, N. Tvl.	Naartjies	1.42			1.8
		Oranges	1.2			6.3
		Paw-paw	0.7			0.9

Fruit consumption. (Cont.)

Ref.	Subjects	Type of fruit	oz. daily	Percentage families consuming
			woman units	
(55)	50 families Alexandra Township Johannesburg.	Oranges	0.97	44
		Apples	0.28	20
		Naartjies	0.3	6
		Bananas	0.3	4
		Grapes	0.31	2
		Pineapple	1.38	2
		Water melon	12.4	2
		Guavas	0.9	2
		Canned peaches	0.43	2
			woman units	
Present series	21 Bantu women Witwatersrand	Guava	0.06	4
		Orange	1.75	50
		Bananas	1.12	37
		Apple	0.45	17
		Fruit salad	0.2	12
		Pear	0.2	8
		Peach	0.1	4
		Paw-paw	0.25	4
		Lemon	not weighed	4

Converting the Alexandra Township values to woman units, comparison can be made for oranges, bananas and apples only. It will be found that the present series of women chose fruit more readily and ate more fruit than the women of the Alexandra Township survey. Calculations were based on the raw dressed equivalent weight for the present findings, whereas the weight purchased was used in the Alexandra Township survey, the difference in intake would therefore be even more marked if this were allowed for.

Comparison of fruit consumption.

Survey	per cent consumption	oz. daily
Alexandra Township	58	1.42
Present series	79	4.64

These intakes are influenced by the seasonal supply of fruit - the Alexandra Township study extended over two months i.e. May - June 1954. The present survey extended over more than a year - Jan. 1944 - June 1945. The

interest lies more in the variety of fruit chosen, than the actual amounts eaten or the proportion of subjects choosing fruit.

MISCELLANEOUS FOODSTUFFS

Chief in this group is sugar. This will be considered separately as unlike most items, it is not used occasionally, but forms an important contribution to the present day Bantu diet. There are two forms of sugar, but only the white is popular, despite the lower cost of the brown variety.

The following table gives the values for the sugar consumption of the twenty one Bantu women:-

TABLE NO: 25

Sugar Consumption - 21 Bantu Women

oz. per diem

Number	Mean	Range	Number	Mean	Range
1	5	0.5 - 6.63	10	2.3	0.5 - 7.3
2	1.4	0.25 - 2.0	11	0.4	0 - 1.2
3	2.1	0.63 - 3.1	12	2.3	0 - 3.5
4a	4.0	2.0 - 5.5	13	0.4	0.3 - 0.5
4b	10.4	6.4 - 13.7	14	4.7	1.5 - 7.0
5	1.3	0.5 - 1.5	15	3.7	1.5 - 8.0
6	1.3	1.0 - 1.75	16	2.0	0 - 4.2
7a	0.4	0 - 1.0	17	5.8	2.0 -10.0
7b	1.1	0.3 - 2.0	18	1.8	0.4 - 2.1
8a	2.0	0.6 - 4.7	19	1.2	0.5 - 1.8
8b	1.2	0 - 3.0	20	2.2	0.9 - 3.5
9	1.62	0.9 - 2.0	21	1.1	0.6 - 2.1

Average: Mean: 2.5

Range: 0 - 13.7

Values for sugar intake in the Bantu, are given by other investigators:-

Ref.	Description of subjects Locality	Proportion using (per cent)	Daily individual consumption ozs. Mean	Range
			per capita	
(97)	a) Probable diet for Bantu, Johannesburg at 6d. a day, 1939	-	3	-
	b) Benoni non European diet (Dr. Anning's data.	-	3	-
	c) 1931 scale for adult native paupers C.P.	-	-	-
	rural		per capita	
(14)	1) 95 - 101 families Keiskammahoek E. Prov.	92.7-96.9	0.9-1.14	
	2) 93 families, Transkei and E. Griqualand.	76.3	0.97	0.2 - 4.4
	3) 93 families, Nongoma Zululand.	26.8	1	0.1 - 3.1
	4) 111 families, Letaba N. Transvaal.	10.8	0.8	-
	urban		per capita	
(32)	100 families, Springs. a) white sugar b) brown sugar	a) 100 b) 14	2.93 1.12	0.91 - 9.21 0.2 - 3.8
	urban		woman units	
(55)	50 families, Alexandra Township, Johannesburg a) white b) brown	a) 100 b) 2	2.27 0.12	-
(55a)	12 families, Alexandra Township, Johannesburg a) white b) brown	a) 100 b) 0	2.72 -	-
	rural		child units	
(111)	731 children, Bechuanaland.	?	3	2.5 - 4.0

It will be seen that sugar is very widely used, but that the white variety is by far the more popular. It is universally used in the town, the mean intake of the present group 2.5 oz., is similar to that for the other urban surveys in Alexandra Township and Springs.

The consumption in country areas varies considerably, it is less commonly used and the intake varies from approximately ½ - 3 ozs. Except for the values of Squires (111) the intakes for country communities are small, less than 2 ozs. Squires suggests that the larger amounts i.e. 3 ozs. were probably used in part for beer making. He comments on the surprisingly high expenditure on sugar and ascribes it to the increasing purchasing power among the natives.

The following is a list of the remaining miscellaneous foodstuffs which, with the exception of jam, doughnuts and scones, were chosen by comparatively few of the women. They are items from European dietaries which the Bantu are learning to use and must still be regarded as luxuries.

For comparison, the miscellaneous foodstuffs from the Alexandra Township Survey 1954 (55), are also listed. These were recorded ten years after the present survey. The subjects are similar as they both lived in a native location on the outskirts of Johannesburg.

TABLE NO: 26

Selection of Foodstuffs 1944 1954
Comparison of two Johannesburg Bantu Surveys.

Food Item	Present survey E. & W. Native Townships. 1944 - 5 Proportion subjects using % 21 women	Alexandra Township 1954 Proportion subjects using % 50 families (55)	12 families (55a)
Cocoa	10	2	
Jam	20	30	
Doughnuts	23	2	
Scones	20	14	
Ice cream	5	8	
Vegetable soup (tinned)	10	8	
Marie biscuits	13	-	
Assorted biscuits	5	16	

TABLE NO: 26 (Cont.)
Comparison of two Johannesburg Bantu Surveys

Food Item	Present Survey E. & W. native Townships. 1944 - 5 Proportion subjects using % 21 women	Alexandra Township 1954 Proportion subjects using % 50 families (55)	12 families (55a)
Queen cakes	5	2	
Ginger cake	5	2	
Cheese	5	8	
Syrup	5	4	
Coca Cola	5	(	
Lemonade	5	(75	
		(	
Sweets	5	12	(55)
		50	(55a)
Jelly	5	4	
Custard powder	5	14	

General Discussion.

The following food consumptions by British urban working class households may be compared with the present figures for urban Bantu women. The former are recalculated from the report of the British National food Survey Committee (103).

TABLE NO: 27

Comparison of British and Bantu Urban Household Diets.
(Expressed per head per day)

Food Item	British			Bantu
	1942	1945	1949	1944 - 1945
Meat oz.	3.7	3.7	3.2	4
Fish oz.	0.9	1.3	1.2	1.75
Potatoes oz.	9.7	9.7	9.7	3.3
All other vegetables oz.	4.4	5.1	4.4	0.64
Fruit oz.	1.7	2.2	3.2	0.5
Milk oz.	8.7	10.0	10.7	18.5
Butter oz.	1.2	2.0	1.5	1.0
Eggs (1 egg 2 oz.)	1 - 1½ (week)			1 - 2 (week)
Bread oz.) Cereal oz.)	11.6	12.2	12.2	Bread 4.2 Maize 4.2
Sugar	1.2	1.3	1.4	2.5

Comparison shows that the Bantu eat slightly more meat and fish, less potato and vegetables. Bread and cereals together in the British intake are higher than bread and maize in the Bantu, but no allowance is made for cereals other than maize, so that the Bantu cereal total is probably higher than shown. The Bantu milk intake is nearly double, butter and eggs about similar, sugar twice as much, this includes the sugar used to make "sugar water" as a beverage.

Patwardhan (95) compares a number of tropical dietaries. These are not comparable with the present series owing to a different classification of the foodstuffs but are interesting to study.

	A	B	C	D	E
Staple cereal	471[*]	275 R	17 RM	436	36 M
Other cereals		25			
Roots tubers		100[=]	915[⊖]	4	553
Pulses tubers	64	20	-	80	17
Vegetables	142	100	114	1	-
Fruits	17	-	-	22	15
Meat, Poultry,) Fish)	26	10	45	51	38[x]
Eggs		-	-	6	
Milk	94	-	-	93	-
Fat	26	3	-	6	35
Sugar, Jam	20	-	-	89	-

R = Rice
M = Maize
[=] = Dry weight
[⊖] = Fresh weight
[*] = Cereal in India can be rice, wheat, millet
[x] = 35 g. dried fish + 3 gm. dried monkey.

A = India
B = North Annam (Indo-China)
C = New Guinea
D = Venezuela
E = Nigeria.

The figures are grams per head per day except for column A which is in terms of adult man units per day.

In comparison with these different countries, the diets chosen by the 21 Bantu women, have a more satisfactory choice of protective foods and not too great a preponderance of cereals or bread. It must be borne in mind that the present subjects were drawn from the less necessitous members of their community.

ANALYSIS OF THE DIETS.

A critical analysis of the quantitative Dietary Findings of a group of 21 urban Bantu housewives.

The discussion which follows is an attempt to analyse the information obtained from these women. Such information in its final calculated form is set forth in the accompanying tables. The formidable difficulties involved in obtaining an accurate picture of Bantu diet are sufficiently obvious, and it cannot be claimed that they have been entirely overcome. It is felt, however, that the present contribution will serve to bridge the present gap in our knowledge of the individual Bantu dietary intake. Consideration is given in turn to the various individual dietary components, the findings are discussed for the group as a whole, and individually where indicated. The average length of the periods of recording was 6 days. Three women, cases 4, 7, and 8, repeated their records, the former two when non-pregnant, the latter because she offered to do so. Case 19 recorded ten days at one stretch because she made a special occasion on which to do her record.

CALORIES

The mean calorie intake for the 21 Bantu women was found to be 1718, with a range of 413 - 4449. Since external temperature, body activity and age all influence the calorie requirement, it is necessary to define these factors in the group of subjects under consideration. An average temperature of 60° F has been used in drawing up the latest recommended minimum daily dietary standards. National Nutrition Council Pretoria (102). The women of this survey were from 20 - 75 years of age, with an average of 34 years. They were considered moderately active.

If ideal weight for height, activity and body surface could be determined for each individual, calorie requirements could be assessed more accurately, but as the

data for this is lacking, one can only make nominal adjustments using 25 years as the age of maturity. Working on the basis of the recommendation of the Food and Nutrition Board, Washington (101), the average requirement for 35, 45, 55 and 65 years would be 95, 90, 85 and 80 per cent respectively, of the calorie requirement at 25 years of age.

In terms of the S.A. National Nutrition Council's recommended minimum daily dietary standards (102), the weight of the average South African woman of 25 years, has been determined as 130 lb. (59 Kg.) Adjustments of calorie requirement for weights other than those of the reference women, are quoted from the above publication as follows:-

Relationship between calorie requirements and desirable weight.

x Reference woman 130 lb.

	Weight lb.	Calories.	Percentage of allowance for x
	200	3151	137
	190	3034	132
	180	2918	127
	170	2798	122
	160	2677	116
	150	2554	111
	140	2423	105
x	130	2300	100
	120	2170	94
	110	2036	88
	100	1900	83
	90	1759	77
	80	1614	70

The National Nutrition Council also enunciated the general principle that there is no evidence of racial differences in the requirements of nutrients; consequently no distinction between the standards proposed for Whites and non-Whites has been made in the table. These recommendations may therefore be applied directly to the members of the present survey i.e. Bantu women.

TABLE NO: 28

Comparison of the Calculated Desirable and Actual Calorie Intake - 21 Bantu Women.

Case No:	Weight	Calculated	Actual	Difference
1	132	2325	2423	+ 98
2	140	2423	933	- 1490
3	160	2677	1031	- 1646
4a P	-	2470	1684	- 786
4b	148	2528	2637	+ 109
5	120	2170	1552	- 618
6	137	2384	1775	- 609
7a P	-	2210	1570	- 640
7b	115	2103	1373	- 730
8a)	194	3081	1731	- 1350
8b)			1693	- 1388
9	151	2566	1219	- 1347
10	191	3045	2002	- 1043
11	147	2514	1429	- 1085
12	133	2336	1339	- 997
13 P	-	2470	932	- 1538
14	139	2411	2834	+ 423
15	100	1900	2882	+ 982
16	116	2128	2385	+ 257
17	143	2462	1805	- 657
18	125	2235	1323	- 912
19	188	3014	1636	- 1378
20	106	1981	1963	- 18
21	157	2638	1081	- 1557

The calorie intake of four of the women was above the expected value and one who recorded twice was above on one occasion, and below on the other. All the rest were below the expected value (18 - 1646 calories deficit.)

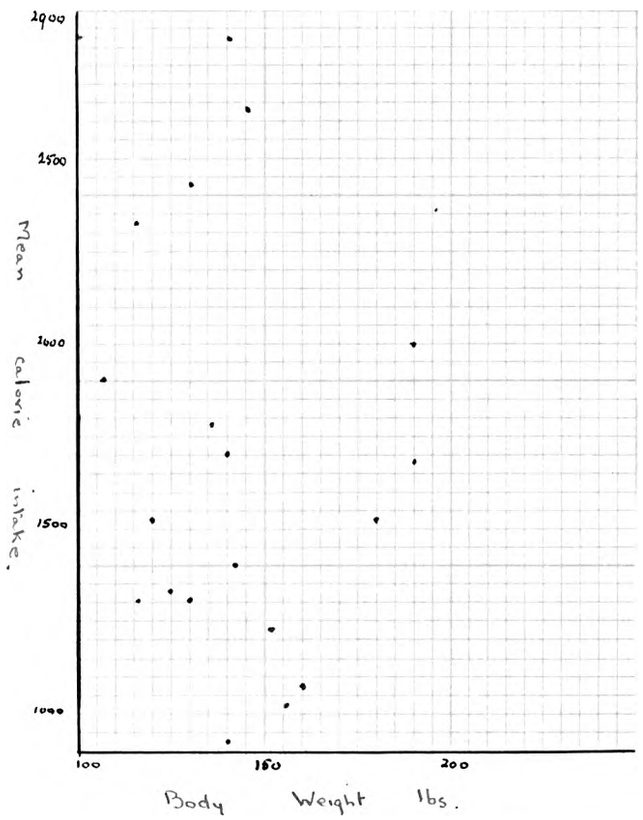
It will be recalled that the women of the present survey were well nourished as a whole, with a tendency to obesity. Their average height was 5' 1", their average weight 142 lb.

The following graph indicates that there is no

correlation between the calorie intake and the body weight. A similar conclusion has been reached by other workers: Widdowson (134), Youmans (139).

GRAPH 4

Correlation of weight and calorie intake.
21 Bantu women.



In view of the lack of correlation between body weight and the calorie intake, no purpose will be gained by a discussion of calories per Kg. body weight. Allowance is, however, made for age, an amount of 5 per cent is deducted for each decade after 25 years of age. Food and Nutrition Board (101).

The following values are given by other workers for the calorie intake for:

1. Women elsewhere.
2. Mixed populations - Africa.
3. Mixed populations - non-African.

1. Calorie intake - Women. Elsewhere.

Ref.	Relevant Details	Calorie Intake
(63)	American women	
	1. Sedentary moderately active	1. 2000 - 2400
	2. Non-emaciated normal	2.
	a. Toronto families	a. 1930
	b. U.S.A. low or mod. income	b. 1452
	c. N. Carolina 1) White	c. 1) 1577
	2) Negro	2) 1443
	d. U.S.A. mod. active college women	d. 2039
	e. Over 40 yrs. House and outside work	e. 1797
	f. 8 obese college girls, weight constant	f. 1690
	3. Few underweight - some overweight	3.
	(a) Low income 1. Anglo-American	(a) 1. 1248
	2. Latin-American	2. 1249
	3. Negro	3. 938
	(b) High income 1. Professor's wives	(b) 1. 1667
	2. Faculty women	2. 1720
	3. Students	3. 1920
	4. Classified in terms of body weight (Normal 130 lb.)	4.
	1. White 139 lb.	1. 1736
	2. Negro 145 lb.	2. 1315
	5. Carolina small or farm communities	5.
	A. White a) b)	A. 1954 1850
	B. Negro a) b)	B. 1744 1700
(24)	(1) European women living in Ceylon (27)	(1) 1910
(25)	(2) Cingalese women	(2) 1740
	American women	
(75)	(1) Cals. 24 hrs. - 8 hrs. working	(1)
	a. Seamstress - hand machine	a. 2000
	b. Seamstress - motor machine	b. 2100 - 2300
	c. Household servant	c. 2500 - 3200
	d. Washer woman	d. 2900 - 3700
	(2) Cals. requirement for age	(2)
	1. 20 - 30 yrs.	1. 2300 - 2750
	2. 30 - 40 yrs.	2. 2128 - 2578
	3. 40 - 50 yrs.	3. 1955 - 2405
	4. 50 - 60 yrs.	4. 1782
	5. 70 - 80 yrs.	5. 1610
	American women	
(115)	Fed. Proc. 30 - 90 yrs. (One day recall of diet)	1700 86% less than 2400 60% less than 1800
	Holland women	
(27)	Women with 3 children as an average, doing own housework.	1961
	American women	
(26)	Rural areas S.W. Virginia. 20 - 40 years old.	

1. Calorie intake - Women. Elsewhere (Cont.)

Ref.	Relevant Details	Calorie Intake
	American women	
(26)	Rural areas S.E. Virginia 20 - 40 years old	
	A. Spring	A. 1676
	B. Fall	B. 1809
	American women	
(141)	Age: Years.	
	1. 16 - 20	1. 1976
	2. 21 - 29	2. 2066
	3. 30 - 39	3. 2047
	4. 40 - 49	4. 1982
	5. 50 - 59	5. 1843
	6. 60 - 69	6. 1982
	7. 70 +	7. 1614
	Women in temperate zone	
(120b)	Age 25 years. Weight 55 Kg. Housewife, moderately active	2300
	British women.	
(134)	0.7 of man unit	
	English women 63	2187
(140)	Cornell University	1810

2. Calorie intake - Mixed populations Africa

Ref.	Relevant Details	Calorie Intake
(93)	Data collected by Lubbock for F.A.O.	
	1. Algeria	1. 1637
	2. Madagascar	2. 2074
	3. Mauritius	3. 2242
	4. Morocco	4. 2069
	5. Tanganyika	5. 2163
	6. Tunisia	6. 1554
	7. Union of South Africa	7. 2576
(55)	50 urban Bantu families	
	a) man unit	a) 2375
	b) woman unit (factor 0.83)	b) 1971
	c) woman unit (factor 0.65)	c) 1543
(55a)	12 urban Bantu families	
	a) man unit	a) 2713
	b) woman unit (factor 0.83)	b) 2251
	c) woman unit (factor 0.65)	c) 1763
(32)	100 urban native families	2935

2. Calorie intake - Mixed populations Africa (Cont.)

Ref.	Relevant Details	Calorie Intake
(14)	Rural Bantu 4 regions	
	a) Keiskammahoek	a) 2680
	b) East Griqualand	b) 3403
	c) Nongoma Zululand	c) 3700
	d) Letaba N. Transvaal	d) 2375
	Bechuanaland supplementary (Rural)	
(111)	A. Home diet	A. 2012
	B. Home diet with vegetables	B. 2148
	C. Home diet with vegs. and milk	C. 2495
	Calculated diets on basis 0.8 man unit	
(30)	Calculated diet:	
	A. European, Coloured, Asiatic	A. 2500
	B. Urban and rural Bantu	B. 2900
	Food Calculations for S.A. populations	

3. Calorie intake - Mixed populations non-African

Ref.	Relevant Details	Calorie Intake
(92)	Typical tropical diets:	
	1. New Guinea	1. 1700
	2. Indo China	2. 1690
	3. India	3. 2300
	4. South Nigeria	4. 2252
	5. Venezuela	5. 2300
(92a)	Five villages New Guinea	1223 - 1904

Discussion.

To recapitulate the recorded calories for the present survey were:- Mean: 1718 Range: 413 - 4449 There are two possible attitudes to these findings. Firstly one may consider them too low to be aceptable. The possibility has been recognised all along that food may frequently be obtained from sources which are difficult to record. These extraneous and irregular supplies of food may, therefore, have existed for these women without being recorded. Other workers with Bantu have made similar observations. Janisch (59). In appendix I of this work Dr. F.W. Fox comments as follows:- "A further and much more serious source of inaccuracy arises from the fact that

quite appreciable amounts of food are commonly obtained from sources which it was not found possible to deal with in any detail." Best (14) also found the food intakes generally low, a feature in common with other Bantu studies being the small number of families with a very high calorie intake. In the month when there was a plentiful supply of cereals, 67 per cent of the families were eating less than 3,000 calories per man unit. In the Alexandra Township surveys (55), (55a), the average calorie intake per woman unit was 1971 and 2251 respectively, they comment: "If the beer consumption could be taken into account, the calorie intake would be further increased."

While it is acknowledged that the records of the present series may have been incomplete, some surprise is felt at the intake level of case 3. Mean: 1031 Range: 717 - 1353. This subject was the trained social worker who was responsible for the choice of the other members of the survey, and who supervised each woman at the onset of food weighing and recording. She remained with me on a voluntary basis for more than a year and there is every reason to imagine that she appreciated the objects of the survey, and was unlikely to be untruthful or inaccurate when recording her own diet.

Bearing this in mind, the following additional facts may make it possible to adopt the second attitude and accept the low calorie intake of the present series. A study of the preceding table dealing with the calorie intake of women in general shows that intakes of 2000 calories or less are by no means uncommon, in women of various races including negroes. Many of these studies adopt a lower conversion factor in the calculation of women units i.e. 0.67 - 0.75 for white women, 0.65 for negro women. The formerly adopted figure of 0.83 is considered too high

Youmans (139). The statement has been made that normal women, who are neither losing weight or thin may subsist on relatively small calorie intakes. Winters and Leslie (136).

In the previous comparative tables one quarter of the subjects had a calorie intake equal to or less than 1718, the mean intake of the present group. These examples were chiefly drawn from American populations, in particular the Negro members, also members of tropical populations in Africa, many of whom are dark skinned persons. Included in these examples were the following members who had a low calorie intake without loss of body weight.

Ref.	Subjects	Calorie Intake
(63)	8 obese American girls (weight constant)	1690
(63)	American women mostly overweight.	
	a) Anglo-American	1248
	b) Latin-American	1249
	c) Negro	938
(63)	American women, normal and slightly over normal in weight.	
	a) White (139 lb.)	1736
	b) Negro (145 lb.)	1315

In connection with the last mentioned Negro intake of 1315, Youmans et al (139) comments:" In this study the body weight of Negroes in spite of the low calorie content of their diet, was about the same as that of the White population, and in both cases the body weights were not essentially different from the expected (normal) weight. The difference in diet between the White population and Negroes was explained by the difference in income. Judged by clinical estimations of subcutaneous fat, the number of overweight women (both Negro and White) was greater than the number of underweight subjects."

A similar state of affairs is noted by

Cullumbine (24) (24a) in comparing European women living in Ceylon, and Cingalese women.

Conclusion.

The mean calorie intake for the group of 21 Bantu women was 1718. It is recognised that this may be low due to omission of food items, but the figure is in good accord with values from surveys in America, Ceylon, Holland and tropical Africa.

It is possible that American Negroes, Cingalese peoples and Bantu may have adapted themselves to a changed level of nutrient intake, Yudkin J. (145). Certainly the Bantu are characterised by a leisureliness and a placidity of outlook which would do much to conserve their energy expenditure and make it possible for them to be overweight on a calorie intake below the theoretical level.

PROTEIN

The role of protein deficiency is receiving more and more attention in the planning of world health by such organisations as FAO and WHO. In Africa in particular, the incidence of protein undernourishment with its possible relationship to liver disease makes the matter of protein requirement of more than usual importance, especially with reference to the Bantu.

Although the view is gaining ground that less protein may be required than was formerly thought necessary, yet it is still agreed that protein is essential for body building, functioning, and protection against infection, and diets which are largely cereal e.g. maize should contain a high standard of protein from either animal or vegetable sources. It is generally accepted that one third of the protein should be obtained from animal sources, but this may be partly replaced by dry legumes. In diets low in calories, extra protein may be required to make up the deficit.

In the present survey the protein intake for the 21 Bantu women was :-

	Mean gm.	Range gm.
Total Protein	56	33 - 109
Animal protein	32	13 - 75

The following are the findings of other workers, comparison with which will be useful in discussing those of the present group.

Daily protein intake of women - irrespective of race, age and geographic location.

Reference	Relevant Details	Protein Intake gm.
	women units.	Total
(15a)	South India	55
	Japan	60
		Total
(24)	27 European women living in Ceylon	65.9 (40.5 - 117.9)
		Total
(142)	Nutritional status survey. New York.	
	Age. years. 16 - 20	65.1
	21 - 29	64.6
	30 - 39	65.5
	40 - 49	64.2
	50 - 59	63.2
	60 - 69	58.5
	70 +	52.7
		Total
(77)	American women	55
(115)	Women aged 30 - 90 yrs. (one day dietary recall 1,072 women.)	57 (60% ate less than 60 gm. daily)
	women units,	
(91)	Two African tribes: a) Kikuyu	a) 82 - 140
	b) Masai	b) 165
(26)	Rural areas S.W. Virginia	
	Aged 20 - 40 yrs. a) Spring	a) 60 (25-110)
	b) Fall	b) 56 (32-86)
(132)	American women	70

Daily protein intake of women. (Cont.)

Reference	Relevant Details	Protein Intake gm. Total	Animal
(144)	5 women students, one staff (+ member 5, 5/12 pregnant) Consecutive days for 4 weeks 1948 - 1949	1 81 2 65 3 84 4 77 5 57 + 6 84	53 52 56 55 70 + 66

Protein intake - Non-African

Reference	Relevant Details	Protein Intake gm.	Total
	man units.		Total
(63)	Standard dietaries: Man Kg. 70 a) Sedentary b) light work c) moderate work. 1. Voit 1881 2. Atwater 1891 3. Rubner 1902 4. Cathcart et al. 1934 5. Stiebeling Phipard 1939 6. Nat. Research Council A. 1943 1945 B. 1948	1c) 2b) c) 3a) c) 4b) c) 5a) b) c) 6Aa) b) 6Ba) b)	118 100 125 123 127 37 50 67 70 70
(1)	Inventory method. Income over 12 months. White Negro Georgia A Farming B Non farming Ohio C All families	AW AN BW BN C	100 75 90 85 93
(24a)	Poor class families and day survey - Ceylonese man quoted:		65
(105)	West Berlin - housewives, record of 291 persons over 3 months (food purchased. Means)		62.4
(106)	a) 38 families 1947 - 8 b) 65 families 1948	Total 90 90 85	Animal 38 32 35
(57a)	8 families - Sardinian fishermen	109.2	18.4

Protein intake - Non-African (Cont.)

Reference	Relevant Details	Protein Intake gm.	
(31)	per capita Previous and present consumption food in N.Z. compared to U.K. and India.	Total	Animal
	1. New Zealand 1949	1. 101	66
	2. U.K. 1948 - 49	2. 90.5	45.2
	3. India 1949 - 49	3. 42.5	5.8
(94)	British West Indies, Average wt. 60 Kg.	Total 60	
(45a)	Food balance sheets. Venezuela	Total 64.3	Animal 28.1
(103)	Urban working class households 1940 - 9 Britain. 4,723 households, 16,586 persons	78	38.9
(118b)	Paris population. Winter 1950 - 51 (Nov.- Feb.) 398 workmen, professional and retired persons (1,068)	107	58
(92)	Study of typical tropical dietaries Table II	Total	
	I New Guinea	I 19	
	II Indo-China	II 34	
	III India	III 53	
	IV South Nigeria	IV 43	
	V Venezuela	V 77	
(113)	Average daily protein intake for U.S. population. Dec.1934 - Feb. 1937.	Aa 63	
	A White B Negro	Ba 70	
	a) low income group	Ab 91	
	b) higher income group	Bb 111	
(92b)	Quote:		
	1. British dietary standard 1950	1. 66	
	2. Canadian " " 1949 - 50	2. 67	
	3. U.S. army minimum for sedentary man	3. 100	
(7a)	Two zones of north coast Brazil	50	
(12b)	Venezuela 1949	63.2	
	Middleclass families (49) Caracas	86.6	
	36 families Pureto la Cruz	88.7	

Protein intake - Non-African (Cont.)

Ref.	Relevant Details	Protein Intake gm.	
	per capita	Total	
(107)	180 families Strasbourg - half professional, half workmen. Did not differ appreciably	107	
		Total	Animal
(92a)	5 villages in New Guinea	19.2-41.3	2.1 - 22.4
(118a)	Questionnaire 1946 - 1950 of 900 agricultural families in 24 districts in France	83 - 114	32 - 57

Protein intake - Africa

Ref.	Relevant Details	Protein Intake gm.	
	per capita	Total	Animal
(93)	Data collected by Lubbeck 1950 for FAO. Available foodstuff in supply		
	A Algeria F Tunisia	A 50.7	9.9
	B Madagascar G Union of S.A.	B 57.3	24.7
	C Mauritius H Ethiopia	C 48.6	11.4
	D Morocco I Egypt	D 69.8	21.4
	E Tanganyika	E 59.2	12.3
		F 43.6	8.4
		G 72.3	26.7
		H 63.5	20.9
		I 71.9	11.0
	Special feeding trial		
(67)	Bantu boys 10 - 17 years. Witwatersrand 1951 - 1952		
	A Nutrition adequate	A 116.4	46.4
	B Diet common to rural and urban Bantu	B 66.8	4.1
(59)	African diet Jenisch & Fox 1941		
	A As purchased	A 65	50%
	B Marginal	B 50	-
	Quote:-		
(120)	Anderson diet: 1943 Dietary survey East Africa	104	-
(32)	100 native families (urban) Payneville locations Springs.	64	25
		Total	
(30)	Food balance sheet for the Union of South Africa.		
	A) European B) Bantu Coloured Asiatic	A) 66	
		B) 66	

Protein intake - Africa (Cont.)

Ref.	Relevant Details	Protein Intake gm.	
	Rural	Total	Animal
(14)	1) 95 - 101 families Keiskammahoek, Eastern C. Province. a) June '48 b) Oct. '48 c) February '50.	1) a) 71.5 b) 64.6 c) 59.9	18.0 11.9 7.7
	2) 93 families, Transkei E. Griqueland.	2) 71.8	30.2
	3) 42 families Mongoma Zululand	3) 112.8	19.1
	4) 111 families Letaba N. Tvl.	4) 63.6	9.9

	0.8 of man unit.	Total
(111)	School feeding over 2 years allowing for waste and absenteeism	
	Home diet	59
	Home diet with veg. supplement	66
	Home diet with veg. and milk supplement	84

	man units	Total	Animal
(55)	50 families Alexandra Township Johannesburg	64	25
(55a)	12 families Alexandra Township Johannesburg.	73	37

Discussion.

The South African National Nutrition Council (102) recommends a daily allowance of 55 gm. total protein and 18 gm. animal protein, for a moderately active adult female (weight 130 lb., age 25 years) and 80 gm. during the third trimester of pregnancy. A consideration of the three pregnant women in the series will be dealt with separately case 4a, 7a, and 13, but nine of the remaining women had a total protein intake of less than 55 gm., but of these only three had an animal protein intake of less than 18 gm.

The following table gives the details of the protein intake of each of the 9 women:-

TABLE NO: 29

Mean Daily Intake of Protein for Nine Bantu Women

Case No:	Total	Animal
2	33	18
3	35	19
8a)	51	21
)		
8b)	51	13
9	42	21
12	39	17
17	48	28
18	38	15
19	47	29
21	35	26

The underlined figures are not below standard. It will be noted then, that even among the subjects with a low total protein, only a few (3 in number) had a low animal protein. Recent information suggests that the balance of amino acids is of more significance than the total quantity of protein. Animal protein is of particular value owing to the combination of amino acids which are components. Present information suggests that physiological requirements are appreciably less than the recommended allowances. In view of this, only three of the present subjects can be said to suffer from a protein deficiency i.e. cases 8b, 12 and 18, and this is so on the grounds of their reduced animal protein intake. Dry legumes, however, can replace animal protein in the diet, but only case 12 ate legume, 1.23 oz. over an eight day period. Her animal protein intake was 17 gm. per diem, which is only just below the minimum of 18 gm. per diem, so that with the addition of legume in the diet, her animal protein intake was satisfactory.

Case 8b repeated her diet twice, on the other

occasion her animal intake was adequate. She weighed 194 lb. and can scarcely be said to be undernourished, it is probable that had her diet been recorded for a long enough consecutive period, she would have been found to have an adequate all over animal protein intake.

Case 18 must be accepted then as the only subject with a low protein intake, she weighed 125 lbs., her mean calorie intake was 1323, and her serum proteins were normal. She was only moderately well off.

These women have been classed as moderately active, but an intimate knowledge of their daily activities shows them to be leisurely, so that they probably lie somewhere between a sedentary worker and a moderately active individual.

The protein intake - 3 pregnant subjects.

Cases 4a, 7a and 13 were pregnant at the time of the survey.

Their protein intake was as follows:-

Case No:	Weight lb.	Mean Total Protein gm.	Mean Animal Protein gm.
4a	148	55	22
7a	115	45	14
13	150	36	26

The recommended minimum allowance, National Nutrition Council S.A. (102) is 80 gm. total protein per diem for a pregnant woman, with a 40% allowance of animal protein i.e. 32 gm. All three women were below the recommended allowance for all forms of protein. The weights quoted were for the non-pregnant state in the first two cases, two of the women are overweight - but case 13 was pregnant at the time and due allowance must therefore be made.

The following low protein diets have been

collected from widely separated countries, and only one is African.

Low protein dietaries General

Reference	Relevant Details	Daily protein Total	Animal
	per capita		
(92a)	5 villages New Guinea	19.2-41.3	2.1-22.4
(31)	India 1948 - 49	42.5	5.8
(7a)	North coast Brazil	50	
(92)	New Guinea	19	
	Indo China	34	
	India	53	
	South Nigeria	43	
(93)	Algeria	50.7	9.9
	Mauritius	48.6	11.4
	Tunisia	43.6	8.4
(59)	Estimated marginal diet. Johannesburg.	50	

A comparison of the range of the mean daily protein of these countries, and the values for the nine Bantu women with a low protein intake in this survey is as follows:-

Protein gm.	Low protein dietaries	Diet present survey
Total	19 - 53	33 - 51
Animal	5.8 - 25	13 - 29

Phillips (93) gives a per capita (all races) value for the Union of South Africa as:- Total protein: 72.3 gm. Animal protein: 26.7 gm. It is evident that in some of these countries the protein intake is considerably lower than the intake of the nine Bantu women. Patwardhan (92) states that the diets of tropical areas such as India, Indo-China, New Guinea, Venezuela etc., gain their main bulk of calories from roots and tubers, and are liable to

be poor in protein, especially animal protein.

Aykroyd and Krishnan (7) Murthy (82) describe similar diets based on cereals and millets which contain only small amounts of pulse, vegetable oils, milk and fat, and are deficient in protein of high biological value.

Morris (79) in a review of slightly more than 75 per cent of the total world population stated that half had less than 71 gm. total protein and 8 gm. animal protein per day. Phillips (93) in a review of available food supplies in 58 countries with accurate records, stated that in only 18 of them was the daily consumption of animal protein equal to or greater than 30 gm. The most striking range was from 4.7 gm. per person in Indonesia to 83.69 in Iceland.

The following table sets forth the main sources of protein which were found for the present survey, it would suggest that there was no undue preponderance of cereal, in particular maize, and that the protective foods were well represented.

TABLE NO: 30

Main Sources of Protein Supply. 21 Bantu Women.

Type of foodstuff	Mean oz. Daily Animal	Vegetable
Meat all types	3.5	-
Maize	-	4.2
Milk fresh	5.5	-
Milk sour	13.0	-
Bread	-	4.2

This compares favourably with the sources of protein which are common to low income groups elsewhere in the world. It must be kept in mind, however, that the present subjects were drawn from the fairly well to do Bantu, and not the poorer members of their community.

Summary

1) The protein intake for 21 Bantu women was:-

	Mean	Range
Total	56	33 - 83
Animal	32	13 - 65

2) Three of the 21 women were pregnant, two of whom had a low animal protein intake in accordance with the extra allowance which is desirable in pregnancy.

3) One non pregnant subject had a low animal protein intake.

4) The group as a whole compares favourably with low income groups in other parts of the world, the calorie source is drawn from protective foods, with no undue preponderance of cereals, in particular maize.

FAT

The few dietary surveys carried out in recent years on groups of Bantu, have demonstrated a low fat intake. This is of considerable interest in view of the current hypothesis that a high fat intake promotes blood artery disease. Walker and Arvidsson (128) have studied the fat intake/ blood cholesterol relationship in Bantu subjects, and Higginson and Pepler (56) showed that severe atherosclerosis and coronary disease were less common among Bantu than among Europeans in Johannesburg.

No blood cholesterol determinations were carried out in the present series, as interest had not then arisen in this relationship.

The daily fat intake (ether extract) of the present series of 21 subjects, was found to be:-

Mean: 51 gm. Range: 24 - 79 gm.

The following fat intakes have been recorded in surveys a) African b) non African.

Fat Intake. African

Reference	Relevant Details	Fat Intake gm.
	Urban	per capita
(67)	30 Bantu boys, Witwatersrand 10 - 17 years old, two diets.	
	A. adequate (calculated theoretical)	A 86.1
	B. common to rural and urban	B 23.5
(120)	500 African railway workers.	per capita
	Quote: Anderson diet 1943	75
		woman unit
(91)	Two African tribes (Kenya)	
	A. Masai - carnivorous	A 90
	B. Kikuyu - vegetarian	B 20
	I. Native civil hospital	I 36.8
	II. Long term prison	II 53.4
	III. Prison hospital	III 48.5
	(calculated theoretical)	per capita
(30)	A. European, Coloured, Asiatic.	A 70
	B. Bantu rural, urban	B 65
	Urban	man unit
(55)	50 families, Alexandra Township	37
(55a)	12 families, Alexandra Township	54
	Urban	per capita
(32)	100 Bantu families	27.28
		per capita
(59)	987 families in Johannesburg	
	A. Diet as purchased	A 34
	B. Marginal requirement (calculated theoretical)	B 50
		per capita
(92)	South Nigeria	43
		per capita
(128)	Quote: Bantu urbanised diet with higher fat content	65 - 80

Fat Intake. Non African

Reference	Relevant Details	Fat Intake gm.
		man unit
(63)	Quote: Neumann. Minimum energy protein requirement 2 yrs. Self observation.	106
		man unit
(105)	94 families (291) persons) Housewives records 3 months	85
		per capita
(107)	180 families, Strasbourg. Half workers, half professional class	53
		per capita
(31)	Comparison of New Zealand, United Kingdom and India. A. U.K. 1948 - 9 B. India 1948 - 9 C. New Zealand 1949	A 105 B 22.7 C 140
		per capita
(45a)	Food balance sheets. Venezuela	45.9
		per capita
(103)	Urban working class. 1940 - 49 Households 4,723 Persons 16,586	1943 86 1944 94 1945 92 1946 86 1947 82 1948 88 1949 95 101
		per capita
(64, 64a)	Depressed class Palamau. 25 families in 2 regions. Mining polulation Jharia coal fields (Bihar) 4 income groups	15.2 19.8 24.2 23.9 21.6 18.2
		per capita
(118b)	Paris population. 393 workers, professional and retired persons (1,068 persons)	115
		woman unit
(24)	European subjects living in Ceylon (27 women	74.8 57 - 161range

Fat Intake. Non-African (Cont.)

Reference	Relevant Details	Fat Intake gm.
(61a)	Typical northern Indian village 10 families.	per capita 17 - 42
(12a,67a)	49 working families in Caracas	per capita 94
	Venezuela 1949	42.3
(57a)	8 Sardinian fishermen's families	man unit 44
(111)	Supplementary school feeding over 2 years.	0.8 man unit
	A. Home diet	A 20
	B. Home diet with veg. supplement	B 21
	C. Home diet with veg. & milk "	C 39
(134)	English women (63)	woman unit 103
(92)	Typical tropical dietaries	per capita
	A. India	A 36
	B. Indo-China	B 10
	C. New Guinea	C 9
	D. Venezuela	D 43

In terms of the S.A. National Nutrition Council's recommendation, the fat intake should provide 20 - 30 per cent of the total calories for an average adult. It is considered undesirable to exceed 30 per cent in middle age, or for sedentary workers.

On this basis the mean daily fat intake of the present group of women may be compared:-

TABLE NO: 31

Comparison Calculated and Actual Fat Intake
21 Bantu Women

Calculated desirable mean cals 1718		Actual gm.
20%	30%	Mean daily
38.1	57	51 Range 24 - 79

From this it will be seen that the fat intake of the present subjects was adequate, the mean value lying between the desirable calculated level of 20 - 30 per cent of the calorie intake. Sixteen out of the twenty one subjects had a mean intake equal to or greater than 38 gm. daily. Their all over range was very wide 5 - 157 gm. daily, and those members who had very high intakes drew their main fat supply from meat (case 6, fried fish). other sources were dairy products such as milk and butter, and to a lesser extent maize products.

Reports by other workers on the Bantu fat intake vary considerably, as will be seen from the preceding references. They may be summarised as follows:-

Low intake (less than 38 gm. daily)

Reference	gm. daily Intake
(67)	23.5
(91)	20.0
(32)	27.8
(55)	37.0

High Intake (greater than 57 gm. daily)

Reference	gm. daily Intake
(128)	65 - 80
(120)	75.0
(91)	90.0

Orr and Gilks (91) give both a high and a low intake in their survey. It is explained by the fact that two tribes were studied, the one meat eating, the other vegetarian.

Dietary surveys in rural Bantu areas carried out by workers in the Division of Nutrition, Union Department

of Health, Pretoria (14), make no mention of a fat intake in the calculation of their diets but this is no doubt an omission.

In reaching a conclusion as to the general fat eating habits of the Bantu, it is important to realise that fat, unlike carbohydrate, protein etc., is subject to far greater fluctuation in the diet. This is due to the personal tastes of the subjects, and seasonal and economic factors which alter its availability. Especially in short term dietary records, no great store must be set by fat intake values, which may be radically altered by the sudden introduction or withdrawal of certain foodstuffs. The Bantu are particularly subject to sudden spells of plenty or scarcity, and will treat the purchase of European food novelties in much the same way, i.e. case 20 of the present series ate 4½ ozs. of butter at one sitting, and on another occasion ate ½lb. of marie biscuits at one meal. Case 15 ate 4 eggs in one day. These items might not appear in their diet for some time. The foodstuff most particularly responsible for the fat content of the Bantu diet is meat. Its fat content varies according to the type of meat, and the type of cut. In the present dietary calculation, beef has been reckoned on a compound basis which has the lowest fat content - mutton on a combined all grade value which may therefore give an unduly high fat value. Pork similarly, but it is possible that the urban native would tend to be served with the fattiest least popular cuts of pork.

Rural natives are subject to surfeit and scarcity where meat is concerned, slaughtering is at intervals and the whole carcass is then eaten, poor and good together, as speedily and in as great quantities as is physically possible. The fat content of a rural diet depends therefore,

on the time of its recording. No true picture could be obtained without repeated long term study. The prevalent idea that sophisticated Bantu eat higher fat diets will be true, only if the meat content of the diet is high. The adoption of European foods such as eggs and butter also increases the fat content of the diet, but are less important or fundamental than the meat content.

The difference in fat content between the present survey diets and those of other observers in Africa cannot, however, be explained by differences in meat consumption, as is shown by the following table:-

TABLE NO: 32

Comparative Meat Intakes in Bantu Diets.

Date	Investigators	Region	Relevant Details	Daily meat consumption oz.
1931	(91)	Kenya	a) Civil hospital diet b) Prison diet (Special diets study)	6 8
1940	(59)	Witwatersrand	Urban family 4 and baby	4 - 5
1944-5	Present survey	"	Urban women	4
1952-3	(32)	"	Urban families	3.12
1954	(55)	"	Urban families	3.9
	(55a)	"	" "	6.1

A comparison of some of the other fat containing foodstuffs is as follows:-

TABLE NO: 33

Comparative Butter Egg Milk Intakes in Bantu Diets

Date	Investigator	Region	Relevant	Daily consumption oz. Milk	Butter	Eggs
1940	(59)	Witwatersrand	Urban family, 4 and baby	2¼ pts. ie. 7 oz. each	-	-
1944-5	Present survey	"	Urban women	5.5	1	2 - 8 (1 - 4 eggs.)
1952-3	(32)	"	Urban families	6.35	0.26	0.29
1954	(55)	"	Urban families	3.2	0.23	-
	(55a)	"	" "	5.2	0.21	-

From a study of these two tables, it appears that the present survey differs chiefly in the relatively high consumption of eggs and butter. The lower consumption of butter in the 1952 - 3 and 1954 surveys (32) (55, 55a) may be explained on the rising cost of butter. Milk which also rose during this period, is considered more in the nature of a necessity by the people as a whole, and would still continue to be used.

The popularity of eggs in the present survey is surprising, they were formerly hardly ever used by Bantu women, and a strong prejudice still remains.

The relative rise in cost of these foodstuffs is set out:-

Item	1944-5 (Present survey)	1952 - 3	1954
Butter lb.	1/10d.	-	3/4d.
Eggs each	3d.	-	3d.
Milk pt.	4½d.	4½d.	6d.

Conclusion.

1. The fat intake of the 21 Bantu women was:-

   Mean: 51 gm. Range: 24 - 79 gm. per day.

2. The chief source of the fat was meat (usually beef,

mutton) with butter, milk, eggs and to a lesser extent maize.

3. The present diets differ from other Bantu diets, only in the higher consumption of butter and eggs.

4. It is felt that the fat intake may fluctuate widely, so that short term surveys are apt to be unreliable or misleading.

CARBOHYDRATE

Whereas in the Western diet, less than half the calories are usually derived from carbohydrate, as much as three quarters may be derived from carbohydrate in diets in the tropical and sub-tropical areas where cereal forms a large proportion of the diet. Maize, wheat and in certain areas "kaffir corn" or sorghum form the staple sources of calories for the Bantu of South Africa.

The daily carbohydrate intake for the 21 Bantu women was:- Mean: 259 gm. Range: 173 - 355 gm. Fifty nine per cent of the calories was derived from carbohydrate.

The following values have been determined by other workers, a comparison will assist in evaluating the present series.

Comparative Carbohydrate Intake - Africa

Reference	Relevant Details	Carbohydrate Intake gm.
		per capita
(67)	30 Bantu boys 10 - 17 yrs. old Two dietary groups: A. Nutrition adequate B. Diet common to rural and urban Bantu (calculated nutritional)	A 560 B 621
		woman units
(91)	Two tribes: A. Kikuyu (vegetarian) B. Masai (carnivorous) a. common basis diet b. irio basis (thick porridge)	Aa 400 Ab 220 B 245

Comparative Carbohydrate Intake - Africa (Cont.)

Reference	Relevant Details	Carbohydrate Intake gm.
		per capita
(92)	Typical tropical diet. South Nigeria	424
		per capita
(59)	Diet of 987 urban native families	
	A. As purchased	A 334
	B. Theoretical marginal diet	B 570
	C. Theoretical optimal diet	C 485
		man units
(55)	50 urban Bantu families Witwatersrand	442
(55a)	12 urban Bantu families Witwatersrand	474

Comparative Carbohydrate Intake - Non African

Reference	Relevant Details	Carbohydrate Intake gm.
		per capita
(64, 64a)	Depressed classes	
	A. Chairo B. Dusadh	A 334 B 388
	Mining population Jharia	1. 607
	Four income groups.	2. 631 3. 633 4. 613
		man unit
(24a)	Poorest economic level adult Cingalese man. (7 consecutive day study.) 56.8% carb. in rice	442 - 446
		woman unit
(24)	27 women of British descent living in Ceylon.	226
		per capita
(12a)	49 families in Caracas	380
		man unit
(57a)	8 families of Sardinian fishermen	396
		per capita
(92)		
	A. India	A 440
	B. Indo-China	B 365
	C. New Guinea	C 385
	D. Venezuela	D 400

Comparative Carbohydrate Intake - Non African (Cont.)

Reference	Relevant Details	Carbohydrate Intake gm.
		man unit
(63)	Self observation 2 years. Light activity.	164
		per capita
(107)	180 families Strasbourg. Half professional, half workmen.	488
		man unit
(118b)	Paris population. Winter Nov. 1950 - Feb. 1951 393 workmen and professionals (1,068 persons in all)	400
		per capita
(103)	U.K. food consumption levels.	
	A. Pre-war	A 377
	B. 1940 - 47	B 397
	C. 1948 - 1st half 1949	C 409
		woman unit
(134)	63 English women	238

Comparison with the carbohydrate figures for African races shows that the present mean value of 259 gm. is nearest to the value for Masai women Kenya (chiefly carnivorous.) i.e. 245 gm. which is moderate. The values recorded for all investigators range from 442 gm. (urban Bantu Johannesburg (55)) to 220 gm. (Kikuyu women Kenya, who are vegetarians using a thick gruel i.e. irio (91)).

The following table shows the main sources of carbohydrate in each of the 21 women of the survey.

TABLE NO: 34

Source of Carbohydrate - 21 Bantu Women

Case No:	1	2	3	4a	4b	5	6	7a	7b	8a	8b	9	10	11	12	13	14	15	16	17	18	19	20	21	Total
Sugar	34	28	33	42	61	18	21	5	11	22	11	24	21	7	29	15	36	24	18	51	21	18	24	21	(6)
Maize	39		19	11	11	31	11	50	42	58	37	73	28	53	27	10	19	57	57	14	17	14	19	1	(7)
Bread	15	27	19	30	9	32	33	9	24				18	20	8	41	15	4		27	2	31	34	3	
Wheat		6			10					6	30		21			9	5	5	13		7	7	10	21	
Bread + Wheat	15	33	19	30	19	32	33	9	24	6	30		39	20	8	50	20	9	13	27	9	38	44	24	(6)
Milk	5	4	2	8	4	6	9	2	4	2	2	2	3		2	7	2	3	2	3	6	11	3	11	
Potato	2	6	10	3	3	7	12		6	9	4		3			17	9			3	4	5	3	2	
Rice															10								4	11	
Mabela														18											
Fruit						8																8			
Rye															13		4				30			44	(2)

Expressed as percentage of total carbohydrate intake.

From the table it is evident that the 21 Bantu women were not predominantly maize eating, in fact only one third were so. Wheat (mostly as standard bread) and sugar were each the major sources of carbohydrate for 28 per cent of the women and for the remaining 10 per cent rye bread was the staple.

Discussion of the separate sources of Carbohydrate.

Sugar. The average intake daily for the present subjects was:- Sugar 2.5 oz. Jam 0.9 oz. Combined 3.4 oz. The adoption of sugar as a foodstuff is strong evidence of European influence on the Bantu. A glance at the following table will make it clear that there is a considerable rise in sugar consumption in the urbanised native. It has the easy appeal of sweets to the child, and not only is it used in beverages (tea and coffee drinking is now a common habit among Bantu) but it is sometimes dissolved in plain water and taken as a beverage.

Comparative sugar intakes. Rural - Urban - General

Ref.	Relevant Details	No. families	% families using	Mean consumption oz.	Range oz.
(14)	per capita				
	4 rural areas.				
	A) Keiskammahoek E. Cape Province	96	92.7	0.9	-
	B) East Griqualand	93	76.3	0.97	0.2 - 4.4
	C) Nongoma Zululand	41			
	a) Sugar b) Jam		a)26.8 b) 2.4	1.0 1.9	-
			a + b	2.9	-
	D) Letaba Northern Transvaal	111	10.8	0.8	-
	urban families				
(59)	Johannesburg	987	?	4	-
	urban families				
(55)	Alexandra Township Johannesburg	50			
	a) White sugar		a) 100	2.73	-
	b) Brown sugar		b) 2	0.15	
	c) Jam		c) 30	0.24	
			a+b+c	3.1	

Comparative sugar Intakes. Rural - Urban - General (Cont.)

Ref.	Relevant Details	No. families	% families using	Mean consumption oz.	Range oz.
(55a)	Urban families. Alexandra Township Johannesburg.	12	100	3.28	-
Present survey	Urban women. Johannesburg a) Sugar b) Jam	21	a)100 b) 28	2.5 0.9 a+b 3.4	0 - 13.7 0.0- 2.3
(92)	Tropical diets A. India B. Venezuela a) Sugar + jam	? ?	a) ? a) ?	0.7 3.1	- -

Combining jam and sugar intakes the difference between the consumption by urban and rural Africans is seen to be marked.

Rural Bantu 0.8 - 2.9 oz. per diem.

Urban Bantu 3.1 - 4.0 oz. per diem.

The sugar intake for the present survey is average in amount.

Maize. The mean daily maize consumption (all types) was 4.1 ozs.

The following values are given for maize intake by other workers:-

Comparative Maize Intakes. - Rural Urban General

A = Mealie meal + maize grain B = samp. C = Total

Reference	Relevant Details	No: families	Mean consumption oz.
(14)	Rural		
	1) Keiskammahoek C.P.	95 - 101	A 10.6 B 3.7 C 14.3
	2) Transkei. East Griqualand	93	A 15.3 B 8.7 C 24.0
	3) Nongoma. Zululand	41	A 18.0 B 0.6 C 18.6
	4) Letaba. N. Transvaal	111	A 16.2 B 1.9 C 18.1

Comparative Maize Intakes - Rural Urban General (Cont.)

A = Mealie meal + maize grain. B = Samp. C = Total.

Reference	Relevant Details	No: families	Mean consumption oz.
	Urban		
(32)	Springs	100	A 10.7 B 1.56 C 10.85
	Urban		
(55)	Alexandra Township. Johannesburg.	50	A 10.7 B 1.26 C 11.96
(55a)	Alexandra Township Johannesburg.	12	A 8.98 B 0.64 C 9.62
	Urban		
Present	Women Johannesburg	21	A 3.37 B 0.7 C 4.07
	general population		
(92)	Tropical diets. A. New Guinea (Rice & Maize) B. Nigeria (Maize)	?	A) 0.5 B) 1.2

From this it will be seen that the intake of maize (all forms) by the present series is far less than values recorded by other workers on the Bantu. Calculations in the present survey are founded on analyses of the actual foodstuffs. The water content of the cooked prepared maize varied from 45.9 to 86.9 per cent, depending on the degree of "stiffness", but the common varieties of maize preparations used by the women, had the following water contents:-

Soft porridge: 86.9 percent. Stiff porridge:66 per cent. Putu: 45.9 per cent. It is not known what allowances were made by other investigators, but Higginson and Oettle' (55) state that they based their calculations on the following water content:- Soft porridge ratio 1: 3.5 (88.7 per cent water content). Stiff porridge

ratio 1:7 (79.9 per cent water content). Comparing the calculations of maize intake for the two surveys then, there is agreement in regard to soft porridge, but for stiff porridge there would be a larger maize intake for the present survey.

As regards the relative size of portions which were served to the subjects, the following are recorded:

Survey	Soft porridge	Stiff porridge	Putu
Alexandra Township	14 oz.	20 oz.	-
Present survey	4 - 16 oz.	10 - 14 oz.	6 - 11½ oz.

The main difference in these two surveys lies in the measurement of the stiff mealiemeal. Further investigations are needed to clarigy this matter.

Bread - Wheat. In the present series this includes boermeal made into dumplings and generally eaten with the stewed meat, but sometimes baked as scones. The mean intake for all forms of wheat in the 21 Bantu women was:-

Mean:9.0 Oz. Range: 0 - 15.7 oz. daily.

The following are the findings of other workers:-

Comparative Wheat-Bread Intakes Rural - Urban

a) = wheat b) = bread c) = Boermeal
b1 brown
b2 white
b3 rolls

Ref.	Relevant Details	No. families using	% families	Mean consumption oz.	Range oz.
	rural				
(14)	1) Keiskammahoek E. Cape Province.	95 - 101			
	a + c		15.5-48.5	1.8-2¼	-
	b		1.0-13.8	0.7-1.4	-
	Total			2.5-3.8	-
	2) Transkei East Griqualand	93			
	a		33.2	1.5	tr - 4.2
	b2		22.6	1.9	tr - 6.3
	c		1.0	16.0	-
	Total			19.4	

Comparative Wheat-Bread Intakes Rural - Urban (Cont.)

Ref.	Relevant Details	No. families	% families using	Mean consumption oz.	Range oz.
(14)	3) Nongoma Zululand	42			
	a		4.9	1.6	1.0-2.7
	b		14.6	1.0	0.2-2.3
	Total			2.6	
	4) Letaba N. Tvl.	111			
	b		5.4	2.2	0.4-3.0
	urban				
(32)	Springs	100			
	a		55	2.01	0.01-13.7
	b2		94	3.72	0.76-10.28
	b1		20	1.73	0.38- 6.65
	Total			7.46	
	urban				
(55)	Alexandra Township Johannesburg.	50			
	a		34	4.21	-
	b1		38	0.61	-
	b2		98	4.42	-
	b3		4	0.18	-
	Total			9.42	
(55a)	Alexandra Township Johannesburg.	12			
	a		66	2.31	-
	b1		58	0.49	-
	b2		100	4.42	-
	b3		25	0.46	-
	Total			7.68	
	urban				
Present survey	Women. Johannesburg	21			
	a		83	4.1	0 - 15.7
	b1		79	4.9	0 - 14.0
	Total			9.0	

The total wheat intake for the subjects of the present survey is higher than the intake of most rural areas, it is equal to the intake of one Alexandra Township survey - but greater than the other, and also greater than the Springs survey.

It is of interest to compare the three main sources of carbohydrate in the three urban surveys:-

TABLE NO: 35

Comparison of the Main Sources of Carbohydrate in three Witwatersrand Surveys.

Source of Carbohydrate oz.	Alexandra Township (55)	(55a)	Springs (32)	Present survey
Sugar	3.1	3.28	3.5	3.4
Maize	12.0	9.4	10.0	4.2
Wheat	9.4	7.12	7.5	9.0
Comparison of Total carbo-hydrates gm.	442	474	not stated	259

Conclusion.

1. The 21 urban Bantu women derived 59 per cent of their calories from carbohydrates.
2. The mean daily intake of carbohydrate was 259 gm. with a range of 173 - 355 gm.
3. Maize was the major carbohydrate constituent in the diet of 33 per cent of the women, sugar and wheat in 28 per cent each.
4. Comparison with other Bantu surveys shows:-
   1) Urban sugar intake is higher than rural.
   2) Rural maize intake is higher than urban.
   3) The maize intake for the present survey is markedly less than values given by two other Bantu surveys.

CALCIUM

Before assessing the calcium intake and serum calcium levels of the women of this survey, it is as well to take the following factors into consideration:-

(1) There is no evidence of racial difference in the requirement for calcium (Sherman (108), (102)).

(2) The South African Bantu, in common with populations dwelling in the tropics and subtropics, have a habitually low calcium intake, but are exposed to a high available radiation. (Walker, Arvidsson and Polotzer (130), Walker

and Arvidsson (129)).

(3) The requirement of vitamin D is influenced by the amount of calcium ingested i.e. a high calcium intake required less vitamin D to facilitate its absorption, Morris (78), Harris (50).

(4) Some authorities hold that a dark skin militates against the production of vitamin D from radiation, Hess (53).

(5) The dark skin of the Bantu does not prevent the formation of bone with normal mineral composition, nor does the supposedly poor calcifying diet, Walker and Arvidsson (129).

(6) A low calcium intake per se, does not cause rickets, Walker (124).

(7) There appears to be no evidence that differences in height of children or of adults are influenced by differences in calcium intake, Walker (122).

(8) It is as well to remember that some loss of minerals occurs in the cooking of vegetables where the water is discarded after boiling.

(9) The drinking water in certain parts of South Africa contains a high content of calcium, sufficient to supplement the dietary intake. The women of the present survey drank water which was chemically treated or "softened".

(10) Stone (114) states that both Rhodesian and South African mealies are low in calcium and phosphorus. He bases this, however, on analysis of a single specimen from each source. The calcium content of maize of various extractions, Fox and Golberg (39) varies from 13 - 21 mgm. per 100 gm., this is appreciably lower than the 21 mgm. given by Sherman (108), so that support is lent for the statement of Stone.

According to the South African National Nutrition Council (102) there is a tendency for a negative calcium balance to occur if the intake is below 10 mg. calcium per Kg. of body weight per day.

Calculating on this basis, the following table compares the actual and the recommended requirements of the subjects of the present survey, on the basis of their weight. The recommended minimum daily allowance is 600 mg. for a woman of about 25 years of age, weighing 130 lbs.

TABLE NO: 36

Actual and Recommended Calcium Intakes mgm. per diem 21 Bantu Women.

Case No:	weight lb.	weight Kg.	Recommended	Actual	Surplus or deficit
1	131	59.5	595	370	- 225
2	140	63.6	636	228	- 408
3	160	72.7	727	155	- 572
4	148	67.2	672 Preg.	665	- 7
5	121	55.0	550	526	- 24
6	137	64.2	642	312	- 330
7	115	54.2	542	440	- 102
8a	194	89.1	891	270	- 621
8b				375	- 516
9	151	68.6	686	154	- 532
10	191	86.8	868	287	- 581
11	147	66.8	668	151	- 517
12	133	60.4	604	202	- 402
13	150	68.1	681	276	- 405
14	139	63.1	631	513	- 118
15	100	45.4	454	521	+ 67
16	116	52.7	527	319	- 208
17	143	65.0	650	~~437~~ 347	- 213
18	125	56.8	568	525	- 43
19	188	85.4	854	388	- 466
20	106	48.1	481	291	- 190
21	157	71.3	713	328	- 385

The actual intake is the mean daily intake for the period of record, with one exception (case 15) it was found to be below the recommended level. The mean actual

intake was 356 mgm. per day, with a range of 56 - 1107 mgm per day. The chief source of calcium in the diets, was milk.

The following are the values reported for other African and non-African surveys:-

Calcium Intake of African Peoples

Reference	Relevant Details	Calcium Intake mgm per diem.
		woman unit
(91)	Two African tribes (Kenya) a) Masai - carnivorous b) Kikuyu - vegetarian 1. Common diet 2. Irio basis (thick porridge)	a) 2030 b) 1. 460 2. 1860
		man unit
(120)	500 African railway workers (Anderson diet.)	400
		man unit
(67)	Diepkloof Nutritional study of Bantu boys. Witwatersrand. Planned diets: A. Nutrition adequate B. Diet common to rural and urban Bantu	A 795 B 272
		per capita
(59)	Diet in urban locations Johannesburg. A. As purchased B. Marginal requirement (calculated predicted) C. Optimal requirement "	A 225 B 750 C 1000
(30)	Predicted diets in study of Union food balance. A. European, Coloured, Asiatic B. Bantu - urban and rural	A 1000 B 1000
(14)	Dietary surveys in rural Bantu areas. a) Keiskammahoek b) East Griqualand c) Nongoma, Zululand d) Letaba, N. Transvaal	a) 420 b) 210 c) 620 d) 390
(32)	100 native families, Payneville location Springs.	328

Calcium Intake of African Peoples (Cont.)

Reference	Relevant Details	Calcium Intake mgm per diem
(55)	50 families, Alexandra Township Johannesburg.	291
(55a)	12 families, Alexandra Township Johannesburg.	305
(92)	Typical tropical diet, South Nigeria	664

Calcium Intake of Non-African Peoples

Reference	Relevant Details		Calcium Intake mgm per diem
			per capita
(92)	Typical tropical dietaries.		
	1. New Guinea	1	690
	2. Indo-China	2	400
	3. India	3	510
	4. Venezuela	4	310
(92b)	Differences in American, Canadian and British standards.		
	A. British, weight neglected	A	800
	B. U.S.A. weight neglected	B	1000
	C. Canadian weight adjusted	C	700
	D. U.S. Army (sedentary)	D	700
			per capita
(102)	Food expenditure of wage earners in Strasbourg. 180 families, professionals and workers.		1149
			per capita
(118a)	900 agricultural families in 24 districts of France. Questionaire method.		522 - 1450
			per capita
(92a)	Four villages in New Guinea		300 - 600
			per capita
(118b)	Population Paris. 393 workmen and professionals. (1068 persons).		1130
			per capita
(94)	Nutrition in British West India		800

Calcium Intake of Non-African Peoples (Cont.)

Reference	Relevant Details	Calcium Intake mgm per diem
(12b)	36 families in Puerto la Cruz	per capita 630
(1)	Slightly sub economic people Georgia and Ohio. 7 day record. A. Georgia I. Farming II. Non-farming a. White a. White b. Negro b. Negro B. Ohio	per capita I II Aa 1000 700 b 700 800 B 1200
(26)	Rural areas South West Virginia U.S.A. 1. Spring 2. Fall	per woman 1 1032 2 960
(24)	27 women of British descent living in Ceylon. Calcium intake depends on milk consumption.	woman units 623 Range 243 - 1168
(142)	Groton Township New York. Age: 16 - 20 a 21 - 29 b 30 - 39 c 40 - 49 d 50 - 59 e 60 - 69 f 70 + g	woman units a 910 b 702 c 714 d 669 e 680 f 640 g 705
(24a)	7 day consecutive study	Ceylonese man 500
(27a)	Survey of agricultural region (modeartely active male)	man unit 307 - 525
(64)	Dietary habits of depressed class in Palamav. 25 families a) and b) 2 regions	per capita a) 161 b) 145
(64a)	Population Jharia coal fields. 4 income groups.	400 all groups

Calcium Intake of Non-African Peoples (Cont.)

Reference	Relevant Details	Calcium Intake mgm per diem
(61a)	Northern Indian village (10 families)	220 - 820
(103)	Urban working class households 1940 - 49	1941 605 1942 672 1943 855 1944 868 1945 875 1946 912 1947 996 1948 1012 1949 1030
(12a)	Working and middle class families in Caracas (49 families)	940
(67a)	Venezuela during 1949	700

Discussion.

The low calcium intake of the present series is in accord with the majority of calcium intakes reported on African people.

The following values for surveys in Africa are classified as examples of low or normal calcium intake in terms of whether they were found to have an intake of under or over 600 mgm. per diem.

Low Calcium Intakes - Africa

Ref.	S.A. Region	Type of diet	Calcium mgm per diem
(91)	Kenya	Common to carnivorous people	460
(59)	Johannesburg	As purchased urban Bantu	225
(120)	Kenya	Anderson diet	400
(14)	(Keiskammahoek	Rural	420
	(East Griqualand	"	210
	(Letaba	"	390
(32)	Springs	Urban Bantu diet	328
(55)	Johannesburg	" " "	291
(55a)	"	" " "	305
Present survey	"	Urban Bantu women	356

Normal Calcium Intakes - Africa

Ref.	S.A. Region	Type of diet	Calcium mgm per diem
(91)	Kenya	Women's irio diet Vegetarian diet (kikuyu)	1860 2030
(12)	South Nigeria	Tropical diet	664
(14)	Nongoma	Rural Bantu	620

It will be seen from this that it is more usual for the African diet to contain less than the recommended calcium requirement, than sufficient or an excess.

Serum calcium. This test was carried out on seven cases, ~~yet~~ all without exception had a calcium intake below the recommended level, the deficit ranged from 43 to 405 mgm.

TABLE NO: 37

Comparison of Serum Calcium and Calcium Intake 7 Bantu Women.

Case No:	Serum calcium mg per 100 cc	Recommended allowance in terms of weight.	Actual allowance	Deficit in daily calcium intake mgm
7	10.2	542	440	102
13	9.0	681	276	405
14	10.4	631	513	118
16	10.0	527	319	208
17	10.5	650	437	213
18	10.2	568	525	43
21	11.0	713	328	385

Since there are no clinical or pathological stigmata of calcium deficiency in these subjects, their current intakes cannot be regarded as deficient in the true sense of the word. It must be concluded that they have become "adapted" to a much lower intake. Other workers have, however, reported lowered blood calcium values in Bantu (91), (114) and (130), these lowered calcium levels have been raised in certain cases by the administration of calcium salts, whereas the normal level cannot be so

raised, suggesting that the lowered level is the evidence of deficiency of supply, and Orr and Gilks (91) conclude that it is the result of a diet deficient in calcium with a relative excess of phosphorus.

Stone and Fox (114) comment on the absence of clinical signs of tetany in natives who have been found to have serum calcium values below 7.0 mg. per 100 cc., and Stone suggests that a low calcium diet during a lifetime or even several generations, may tend to develop a resistance to tetany. There are no grounds for maintaining that White populations could not likewise become "adapted."

Conclusions.

1. The 21 Bantu women had a mean daily intake of 356 mg, with a range of 177 - 600 mg.
2. Serum calcium values for seven of these women were normal, mean 10.1 mg. per 100 cc.
3. No abnormality of bone growth or height was noted.
4. Only one of the twenty one women had an intake of calcium slightly in excess of the minimum recommended requirement, the remainder were below, in most cases considerably so.
5. A deficient calcium intake has been reported by the majority of investigators among the Bantu. It may be due to the small amount of milk in their diet, or the lowered calcium content of South African maize. It is suggested they have become adapted to this.

PHOSPHORUS

Phosphorus is a constituent of so many of the South African foods, that an intake deficiency would arise only if many of the essential foods were drastically short. It is more efficiently absorbed from the gastrointestinal tract than calcium. Previously the ratio of calcium to phosphorus was discussed in the evaluation of dietary

intakes, but no direct importance of this ratio has as yet been demonstrated in human nutrition. If it is estimated as 1: 1 in adult life and 1:1.5 in growth, pregnancy and lactation, then the minimum daily requirement of phosphorus would be from 600 to 900 mgm. daily in terms of a woman weighing 130 lbs. and 25 years of age.

All protein foods are rich in phosphorus - as has been previously discussed, the present survey subjects have an adequate protein intake, their phosphorus intake is therefore assured. The mean daily intake for the present group of 21 women was 908 mgm, the range was from 564 mgm to 1371 mgm. daily. This intake is adequate both for maintenance and growth periods, and as was expected there is no evidence of deficiency.

Phosphorus Intakes I Bantu

Reference	Relevant Details	Mean mgm.	Range mgm.
	per capita		
(59)	(A) Diet as purchased. 987 Johannesburg African families.	907	
	(B) "Marginal calculated requirement.	1000	
	(C) "Optimal"calculated requirement	1500	
(67)	Diepkloof Bantu boys.		
	A. Calculated standard diet	2073	
	B. Calculated Bantu rural and urban diet.	1075	
(91)	3 planned diets Kenya:		
	1. Native civil hospital	290	
	2. Long term prison	300	
	3. Prison hospital	346	
	women unit		
	4. Kikuyu (vegetarian)		
	a. Common basic diet	4a 440	
	b. Women's iric (thick gruel)	b 219	
	5. Masai (carnivorous)	5 319	
	man unit		
(55)	50 native families Alexandra Township, Johannesburg.	845	

Phosphorus Intakes I Bantu (Cont.)

Reference	Relevant Details	Mean mgm	Range mgm
	woman unit		
Present survey.	21 native women. Johannesburg	908	564 - 1371

Phosphorus Intakes II General

Reference	Relevant Details	Mean mgm	Range mgm
	woman unit		
(26)	Farm people rural area. S.W. Virginia.		
	1) Spring - 28 women 20 - 40 yrs.	1154	472 - 2001
	2) Fall - 30 women	1085	615 - 1560
	per capita		
(64)	Diet of depressed class in Palamcv. 25 families, 2 regions.	A. 1640	
	A. Chairo B. Tusaoh	B. 1560	
	Mining population Jharia coal fields. 4 income groups	1) 1700	
		2) 1900	
		3) 1900	
		4) 1900	
	women unit and per capita		
(24,24a)	a) 27 Cingalese women	1073	
	b) 373 Cingalese families		
	A. Economic level 1	1383	
	B. Economic level 2	1160	
	man unit		
(27a)	Fairly active adult male Agricultural region.		763 - 1208

Conclusion.

1) The phosphorus intake of all 21 Bantu women was not only adequate, but made provision for extra demands such as growth or lactation.

Values were: Mean: 908 mgm per diem

Range: ~~564~~ 108 - ~~1371~~ 3807 mgm per diem.

2) The ratio calcium:phosphorus for the 21 diets was 1:1.5

3) Mean values for actual Bantu dietary surveys range from: 219 - 908 mgm per diem. 600 mgm and over may be said to be adequate.

4) Mean intakes of diets elsewhere than Africa i.e.

India, Ceylon and America are even higher, 1073 - 1900 mgm. per diem.

IRON

The question of adequate iron intake in women is of greater importance than in men. The long term effects of menstruation, parturition and lactation, make them liable to iron deficiency and hypochronic anaemia. There is in addition gross malnutrition and frequent parasitization in many Bantu, so that iron deficiency states might be expected among them. Recent work has, however, thrown new light on the subject. Walker (125) has stated that the South African Bantu diet is exceptionally rich in iron, which is mainly taken up from iron utensils during the preparation of food. Walker and Arvidsson (126, 127) quote a daily iron intake sometimes as much as 200 mg. per diem. They discuss the possible relationship of oral iron overload and the disease siderosis in the Bantu. They also note that the haemoglobin values for Bantu, despite their being prone to inadequate diet, malnutrition and frequent parasitization, lie within or are very little below normal limits. They suggest the high iron intake may act as a 'brake' on the depression of haemoglobin values.

According to the South African Recommended Minimum Daily Dietary Standard (102) 12 mg. iron are necessary daily for the non-pregnant woman, and 15 mg. for the pregnant woman. The daily intake for the present series of 21 women was:- Mean: 16 mg. Range: 9 - 24 mg. This is an adequate intake even allowing for the extra demands of pregnancy, lactation or menstruation, as the majority of the women were married and of child bearing age. The cooking utensils were enamel or aluminium and were not unduly rusted or chipped.

Iron Intake mg. per diem I African

Ref.	Relevant Details	Mean mg.	Range mg.
	per capita		
(66)	Diepkloof nutrition and health study on Bantu boys. Witwatersrand.		
	A. Calculated standard diet	33.5	
	B. Calculated rural and urban Bantu diet.	22.5	
(127)	Daily diet of various Bantu.		
	1. Gaols	-	48 - 110
	2. Hospitals	-	35 - 85
	3. Mine compounds	-	45 - 190
	4. S.A. Medical Institute	-	40 - 215
	5. Urban homes	-	35 - 185
	6. Rural homes	-	30 - 150
	rural		
(14)	1. Keiskammahoek. E.C. Province	25.2	7 - 51
	2. Transkei. E. Griqualand	31.7	7.8 - 118.7
	3. Nongoma. Zululand	37.0	10 - 67
	4. Letaba. N. Transvaal	18.0	5 - 70
	urban		
(32)	100 native families. Springs.	19.9	7 - 36
	urban		
(55)	50 families, Alexandra Township Johannesburg.	11	
(55a)	12 families, Alexandra Township Johannesburg.	12	6 - 20
	woman units.		
Present survey.	21 urban Bantu women, Johannesburg	16	9 - 24

Iron Intake mg. per diem II Non-African

Ref.	Relevant Details	Mean mg.	Range mg.
	per capita		
(103)	Britain. Urban working class population.	1941 12.4	
		1942 13.5	
		1943 13.3	
		1944 13.5	
		1945 12.1	
		1946 14.4	
		1947 14.3	
		1948 14.2	
		1949 13.6	

Iron Intake mg. per diem II Non-African

Ref.	Relevant Details	Mean mg.	Range mg.
(107)	180 families Strasbourg.	22.5	
(118b)	Paris population. Nov. 1950 - Feb. 1951	23	
(92b)	A. British standard	12	
	B. U.S.A. safety margin	12	
	C. Canadian	6	
	D. U.S. Army	10	
	man unit		
(1)	America:		
	Farm people in Georgia White	16	
	Negro	18	
	Ohio White	18	
(27a)	Agricultural region		14.7 - 20.5
	woman unit		
(26)	Rural population , South West Virginia.		
	1. 28 women Spring	10	4 - 17
	2. 30 women Fall	10	6 - 16
(24)	1) 27 women of British descent living in Ceylon	10.9	7 - 20.6
(24a)	per capita		
	1) 373 families in Ceylon	11.5	-
	Man unit		
	2) Cingalese man	15.0	-
	per capita		
(142)	Groton Township N.York women		
	1. 16 - 20 yrs.	11.1	
	2. 21 - 29 yrs.	12	
	3. 30 - 39 yrs.	11.7	
	4. 40 - 49 yrs.	12.5	
	5. 50 - 59 yrs.	12	
	6. 60 - 69 yrs.	12.5	
	7. 70 + yrs.	10	
(94)	Nutrition in British West Indies.	20	
(12a)	36 families. Puerto la Cruz	13.2	
	Middle class families in Caracas.	19.4	

Iron Intake mg. per diem II Non-African (Cont.)

Ref.	Relevent Details	Mean mg.	Range mg.
(67a)	Venezuela during 1949	12.4	
(64a)	Mining population, Jharia coal fields (Bihar) 4 income groups	29.2 30.3 27.7 27.4	

Conclusion.

The range of iron intake in the Bantu is very wide, 6 - 200 mgm. per day. The mean daily intake for the present survey was 16 mgm., with a range of ~~9~~ 1 - 82 - ~~24~~ mg.

Walker and Arvidsson (127) report a startingly high intake which they attribute to iron uptake from the utensils which are used in the preparation of fermented maize porridge. These utensils may be iron Kaffir pots, or rusty paraffin tins, which are left for several days while the contents mature undisturbed at a ph of 3.0 - 3.5 or so. Iron uptake from utensils has also been reported in the preparation of western foods, but the amount of addition is not likely to be of much importance in these cases, McCance and Widdowson (72), (74).

The iron intakes of the women in this survey were calculated from the tables of Fox and Golberg (39) and these do not include the enrichment described by Walker in cooked and fermented foods, consequently there may be a considerable shortfall in the calculated intake values. The present survey subjects, used cooking utensils which appeared to be in good condition. Soured porridges were made in enamel pots or basins, which were often flaked off and chipped.

One may conclude, however, that the women of the present series did not suffer from iron deficiency.

This is confirmed by the haematological findings discussed earlier.

Vitamin A

Both Vitamin A and its precursor carotene may be present in the diet, but as the degree of conversion of carotene to Vitamin A is uncertain, it is advisable that as much as one third of the intake should be as Vitamin A. One I.U. (International Unit) of vitamin A is equivalent to 0.3 micrograms vitamin A alcohol or 0.6 micrograms of B carotene, and it is recognised that this vitamin is well stored by the body, provided the liver is healthy. Consequently, though the daily intake may be subject to wide variations, the blood levels of vitamin A and carotene may decrease very slowly in adults, and even in children. The latter in whom the fall is quicker, may still only show the effect in 2 - 4 months. Consequently it is possible by absorbing an erratic ~~and~~ but adequate supply of vitamin A and carotene, to maintain the liver storage and the level of the vitamin in the blood, and no conclusions should be drawn therefore, from short survey periods. An alteration in the blood level may sometimes be a reflection of liver disease rather than an indication of vitamin A deficiency.

The intake of the 21 Bantu women in the present series, which was calculated on a Vitamin A basis only, was found to be:- mean: 3182 I.U. per day,

range: 0 - 52920 I.U. per day.

It is regretted that blood estimations of vitamin A and carotene were not possible on the subjects of the present survey.

The recommended minimum daily allowance of the S.A. National Nutrition Council (102) is calculated on the

basis of a woman of 130 lbs. in weight and 25 years of age. It is given as:-

Sedentary worker: 4000 IU (½ as carotene)

Moderately active women: 5000 IU (½ as carotene)

Pregnant, either active or sedentary. 5000 IU (½ as carotene)

The following are the vitamin A intakes of other surveys:-

Vitamin A Intakes per diem I African

Ref.	Relevant Details	Mean I.U.	Range I.U. per diem
	per capita		
(59)	987 urban Bantu families, Johannesburg.		
	1) Diet as purchased	607	
	2) Calculated marginal	2500	
	3) Calculated optimal	5000	
	urban and rural	A + carotene	
(67)	Diepkloof Bantu boys. Johannesburg. Calculated planned diets		
	A) Standard	3037	
	B) Rural and urban Bantu	3250	
	general		
(30)	Calculated diet for Union of South Africa, per capita:		
	A. Europeans, Coloureds, Asiatics.	3250	
	B. Rural and urban Bantu	3250	
	rural		
(111)	Kanye nutrition experiment, Bechuanaland Protectorate. Supplementary native school feeding estimations:-		
	A. Home diet.	-	
	B. Home diet + veg. supplement	2400	
	C. Home diet + veg. + milk "	2825	
	rural		
(14)	1) Keiskammahoek. E.C.P.		
	a) June 1948	5620	253 - 28490
	b) October 1948	3260	tr. - 29198
	c) February 1950	2960	4 - 13837
	2) Transkei. East Griqualand	3640	25 - 30811
	3) Nongoma. Zululand.	15280	1033 - 42000
	4) Letaba. N. Transvaal	9960	23 - 28000

Vitamin A Intakes per diem I African (Cont.)

Ref.	Relevant Details	Mean I.U.	Range I.U. per diem
	urban		
(32)	100 native families. Springs	2010	187 - 11268
	urban		
(55)	50 native families. Alexandra Township, Johannesburg.	5668	
(55a)	12 native families. Alexandra Township, Johannesburg.	7720	1400 - 12763
	urban. woman unit.		
Present survey.	21 Bantu women. Johannesburg	3182	0 - 52920
	per capita		
(97)	Typical S.A. diets:-		
	V. Probable Bantu diet Johannesburg locations	960	
	VI. Benoni non-European diet (Dr. Anning.)	2530	
	VII. Planned adult native pauper diet. Cape Province. 1931	1360	

Vitamin A Intake per diem II Non-African

Ref.	Relevant Details	Mean I.U.	Range I.U. per diem
	per capita		
(103)	Urban working class households 1940 - 49. Britain.	1942 2982 1943 3071 1944 3173 1945 2908 1946 2926 1947 2929 1948 3143 1949 3146	
	America		
(1)	I Georgia a. White b. Negro II Ohio a. White	I. Farm population a) 5800 b) 5100 Non farm pop. a) 7200 b) 6800 IIa. 6600	
(75)	I. Minimum protective II. Safety margin III. Optimum (Food and Nutrition Board of the Nat. Research Council)	1300 2500 5 - 6000	

Vitamin A Intake per diem II Non-African (Cont.)

Ref.	Relevant Details	Mean I.U.	Range I.U. per diem
(63)	Requirement at starvation level	1600	
	per capita		
(12b)	36 families in Puerto la Cruz.	2638	
(12a)	Working and middle class families in Caracas.	3685	
(67a)	Venezuela 1949	2842	
	per capita		
(107)	180 families in Strasbourg.	1135	
(118b)	Paris population.	900	
(94)	Nutrition of British West Indies	5000	
	America woman unit		
(26)	Rural area, South West Virginia.		
	I. 28 women. Spring	6318	1544 - 17697
	II. 30 women. Fall	5186	1452 - 14814
(140)	Cornell University women	5351	
		A + carotene	
(144)	1948 - 49 5 women students and one woman staff member.	1. 3170 2. 3970 3. 3340 4. 3660 5. 3588 6. 5440	
	woman unit.	A per diem	
(44)	Daily requirement for health. Young woman.	2500 Carotene 7500	
	per capita		
(92b)	Comparison of standards.		
	A. British	5000	
	B. U.S.A. margin safety	5000	
	C. Canadian	5000 as carotene	
	D. U.S. Army sedentary man	5000	
	E. U.S. Army minimum requirement.	4000	

Vitamin A Intake per diem II Non-African (Cont.)

Ref.	Relevant Details		Mean I.U.	Range I.U. per diem
	man - woman unit. and per capita			
(24)	(Cingalese man		8660	
	(Cingalese woman		7610	
(24a)	(Cingalese families		2744	
	(Cingalese man		10000 as carotene	
	woman unit	years		
(142)	Groton Township New York	16 - 20	6541	
	Women of various ages.	21 - 29	7404	
		30 - 39	7052	
		40 - 49	10051	
		50 - 59	7950	
		60 - 69	6124	
		70 +	7508	
(64)	Depressed class in Palamau.		253	
	2 regions.		60	
(64a)	Mining population Jharia coal fields.	1.	910	
	4 income groups	2.	810	
		3.	793	
		4.	777	
(61a)	Northern Indian village (10 families)		2/10 families had more than 3000	

Comparing the vitamin A intake of the present subjects with values for other African surveys, it will be found that the mean daily intake is equal to or greater than the similar value for most of the rural Bantu surveys (14), (111) and some of the urban surveys (32), (97), it is less, however, than the recommended South African requirement of between 4 - 5000 I.U. for a sedentary or moderately active woman. African surveys are characterised by a great range of intakes, the present survey being one of the widest i.e. 0 - 52920 I.U. daily. Considerable differences are reported from other countries i.e. India - mean daily intake: 60 I.U.

Ceylon - mean daily intake: 8660 or 10000.

The main sources of vitamin A for the present

survey are:-

Dairy products; meat - especially beef, liver; vegetables - imfino (wild spinach), pumpkin, sweet potato, carrot, tomato and cabbage; fruit - pawpaw.

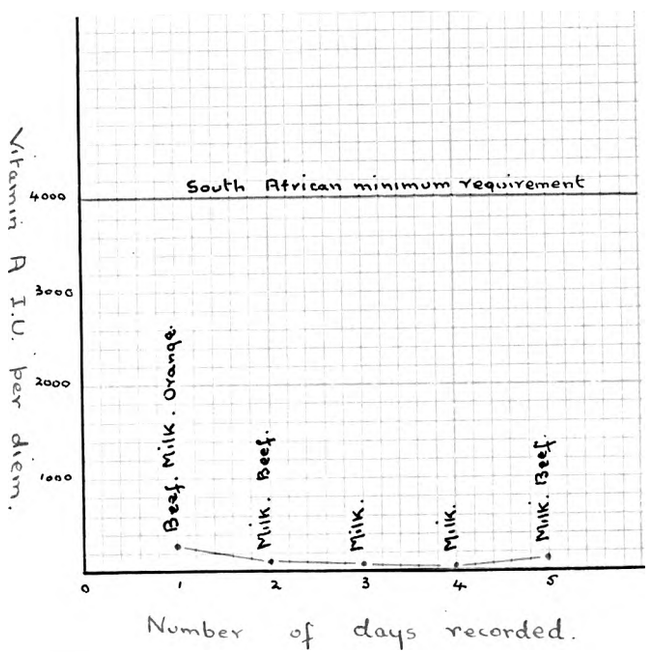
While imfino or wild spinach is becoming more difficult to obtain, even among country natives, pumpkin which is very popular is grown in location gardens or in mealie patches near country huts, it is easily procurable in town shops, both have a very high vitamin A content.

A study of the following three examples of extremes of vitamin A intake, shows that no one predominant foodstuff is responsible for the vitamin A intake. Only 50 per cent of the women ate pumpkin. This is in contrast to Best et al (14) who state that the vitamin A is mainly provided in the form of carotene by pumpkin, imfino and other vegetables, but the adequacy of the diet varies with the pumpkin intake.

GRAPH 5

LOWEST VITAMIN A INTAKE (Case 9)

Mean daily intake I.U. 110
Range daily intake I.U. 68 - 213.

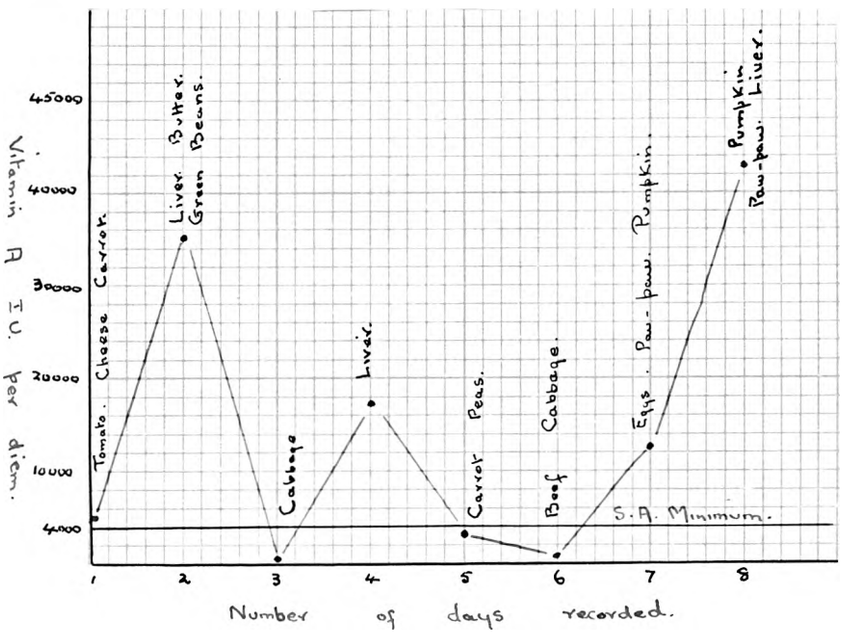


GRAPH 6

HIGHEST VITAMIN A INTAKE (Case 14)

Mean daily intake I.U. 14777

Range daily intake I.U. 643 - 42959

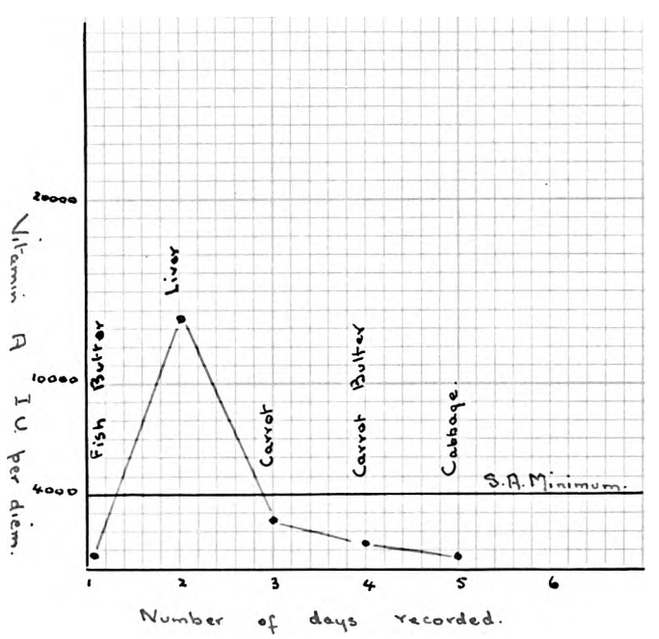


GRAPH 7

AVERAGE VITAMIN A INTAKE (Case 13)

Mean daily intake I.U. 3860

Range daily intake I.U. 868 - 13238



Conclusion.

1) The Vitamin A intake for 21 urban Bantu women was:- Mean: 3182 I.U. per diem.
Range: 0 - 52920 I.U. per diem.

2) This is below the South African minimum daily allowance (102) i.e. 4000 I.U. per diem.

3) In comparison with other known vitamin A intakes for African peoples, the value of 3182 for this survey is an average finding.

4) No one foodstuff constitutes the main source of vitamin A in the diet.

5) Vitamin A intakes fluctuate widely from subject to subject and from day to day.

6) It is advisable to remember that provided there is no gross liver disease, vitamin A storage is very considerable in the liver, and an irregular supply of vitamin A may enable adequate liver storage, provided the total intake is sufficient for long term demands.

7) Various studies have shown that no clinical stigmata of vitamin A deficiency have been noted in population groups consuming considerably less than the recommended allowances.

THE VITAMIN B COMPLEX.

Thiamin.

Thiamin is an essential component for the oxidation of carbohydrate, and the intake should be adjusted to the total calorie intake. The latest South African recommended minimum daily allowance is 0.23 mg. of thiamin per 1000 calories, but to allow for tissue storage or provide for the extra demands of pregnancy and lactation, it is advisable to allow 0.35 mg. per 1000

calories, especially as the body stores are not large and are quickly reduced by stresses.

A moderately active woman would therefore require, according to the American Medical Association Handbook of Nutrition (3) :-

$$\frac{2300 \times 0.35}{1000} = 0.8 \text{ mgm. per diem.}$$

The daily thiamin intake of the 21 Bantu women of this survey was:- Mean: 0.7 mgm. Range: 0.1 - 4.5 mgm.

Generally speaking, thiamin requirement is easily met, provided the diet contains unprocessed or enriched cereals, and a reasonable amount of high grade protein. Though the above mean intake is a little below the minimum requirement of 0.8 mg. per diem, there is good reason to suggest it is an underestimation of the thiamin of the women's diet.

There are a number of factors which would make for an adequate thiamin intake in the Bantu. It has previously been shown by Golberg and Thorp (43) that African cereals provide an adequate level of thiamin, and though it is realised that processing tends to have a deleterious effect on their vitamin content, yet the vitamin content is much enhanced by the natural processes of germination and fermentation widely practised by the Bantu.

In the brewing of kaffir beer significant increases of all three vitamins occur at the stages of souring and fermentation - the final beer contains roughly twice as much thiamin as was present in the original meal and malt. Though the women denied its use, it is common knowledge that the "small" beers, in particular the watery 'third' beer may be consumed by the women and children, and though this concoction is lacking in body

and flavour, it is not entirely lacking in thiamin. Fermented porridge such as marewu and mdogo show a slight loss of thiamin owing to their preliminary boiling.

Another factor tending to increase the thiamin content of the diets of the 21 women, was the compulsory rationing of standard (war) bread at the time of the survey. Despite the fact that they prefer white bread, 28 per cent of the women chose standard bread and wheat as their main source of carbohydrate. The possible availability of thiamin synthesized by the bacterial flora of the gastrointestinal tract must not be overlooked, though it would appear that less thiamin is produced than some of the other vitamins of the B group. Diets rich in fat have a definite sparing action on the requirement of thiamin, as fat metabolism does not require cocarboxylase. The present diets have a normal fat content - the change would have to be very wide before the thiamin requirement was materially affected however.

Thiamin determinations were carried out by Dr. Colberg of the South African Institute for Medical Research on many of the more typical foodstuffs, and beverages, fermented and unfermented. These values have been used in arriving at the thiamin intake for the subjects, and if so, have been marked * in the food tables.

TABLE NO: 38

Thiamin Content of the More Typical Foodstuffs Collected during the Survey.

1000 microgram = 1 mg.

3 microgram = 1 I.U.

Foodstuff	% water	micrograms per 100 gm.	International units
Mabela prepared:			
1. Porridge cooked 1 hour	68.9	155	52
2. Porridge fermented 24 hours then boiled	82.7	33	11
Boermeal			
1. Boiled homemade dumplings.	55.4	30	10
Legumes II			
Prepared:			
1. White beans boiled 3 hours.	63	74	25
2. White beans boiled 2 hrs. skins & cooking water discarded.	64.8	102	34
Discarded bean skins	51.1	116	39
Discarded cooking water	-	66	22
3. Speckled bean boiled	67.6	112	37
4. Samp and speckled beans boiled.	72.7	10	3
Beverages III			
Milk 1. Fresh	87.8	23	-
2. Sour (Amaas)	84.1	56	19
Fermented mealie meal			
1. Marewu	92.3	75	25
2. Kaffir beer			
a) Unstrained	-	70	23
b) Strained	-	26	9
c) Made with brown sugar not white	-	14	54
Meat IV			
Beef a) raw	67.4	19	6
b) boiled	68.7	33	11
Mutton - roast	48.3	69	23
Liver - fried	59.2	820	273
Fish V			
Stockfish a) raw	81.3	-	-
b) fried	56.8	-	-

The following daily thiamin intakes are reported by other investigators:-

Thiamin (B_1) Intake mgm. per diem Africa

Ref.	Relevant Details	Mean	Range
	per capita		
(59)	987 African families. Johannesburg.		
	1. Diet as purchased	113	
	2. Calculated "marginal"	330	
	3. Calculated "optimal"	700	
(97)	V. Probable Bantu diet, Johannesburg locations.	216	
	VI. Benoni. Non-European diet (Dr. Anning)	223	
	VII. Planned adult native pauper diet. Cape Province 1931	340	
	urban		
(67)	Diepkloof Bantu boys. Johannesburg. Planned diets:-		
	A. Standard	1.98	
	B. Rural and urban Bantu	1.25	
(120)	500 African railway workers. Quote: Anderson diet.	1.5	
(30)	Calculated diets: based on S.A. food resources.		
	A. Europeans, Coloureds, Asiatics.	1.28	
	B. Rural and urban Bantu	1.28	
	Rural. man unit		
(111)	Kanye nutrition experiment - Native school feeding, supplement estimations.		
	1. Home diet	1.6	
	2. Home diet + veg. supplement	2.3	
	3. Home diet + veg. + milk "	2.5	
	per capita		
(14)	Rural Bantu areas:		
	1. Keiskammahoek. Eastern C. Prov.	2.14	0.73 - 4.58
	2. East Griqualand	1.93	0.2 - 5.68
	3. Nongoma. Zululand	2.98	1.11 - 4.85
	4. Letaba. N. Transvaal	0.7	0.25 - 2.5
	urban		
(32)	100 native families. Payneville location, Springs.	1.034	0.34 - 1.91

Thiamin (B_1) Intake mgm. per diem Africa (Cont.)

Ref.	Relevant Details	Mean	Range
	urban. man unit		
(55)	50 native families, Alexandra Township. Johannesburg.	0.9	
(55a)	12 native families, Alexandra Township. Johannesburg.	1.1	

Thiamin Intake mgm. per diem. II Non-African

Ref.	Relevant Details	Mean	Range
	woman unit.		
(75)	Food and Nutrition Board of the Nat. Research Council 0.5 mg. per 1000 cals.		
	A. Woman 56 Kg.	1.5	
	B. Minimum level		0.13 - 0.17
	America.		
(137)	1. Professors' wives. High income	0.72	
	2. Faculty women. High income	0.95	
	3. Students. High income	1.01	
	4. Low income	0.49	
	per capita		
(107)	180 families in Strasbourg.	2.1	
(92a)	4 villages in New Guniea		0.7 - 1.7
(94)	British West Indies	1.5	
(118b)	Population Paris. 393 persons.	2.038	
(63)	Starvation level	1.3	
(12b)	36 families, Puerto la Cruz.	0.99	
	I / II		
(1)	Georgia / Ohio	Ia 3.2	
	a. White / a. White	b 2.8	
	b. Negro	IIa 1.9	
	woman unit		
(44)	"Recent Advances in Nutrition" 0.25 mg. - 0.3 mg. per 1000 cals. for healthy young woman		0.25 - 0.3

Thiamin Intake mgm. per diem. II Non-African (Cont.)

Ref.	Relevant Details	Mean	Range
	per capita		
(92b)	Comparison of standards.		
	A. British	0.9	
	B. U.S.A. with safety margin	1.2	
	C. Canadian	0.75	
	D. U.S. Army active man	1.6	
	E. U.S. Army minimum requirement	1.0	
	woman unit.		
(24)	27 women of British descent living in Ceylon.	0.93	
(142)	Groton Township, New York. Women various ages.	Years	
		16-20	1.03
		21-29	1.2
		30-39	1.13
		40-49	1.06
		50-59	1.08
		60-69	1.11
		70 +	0.99
	per capita		
(64)	Depressed class, Palamau. 2 regions - a. b.	a. 7.05 b. 7.61	
(64a)	Mining population, Jharia coal fields. 4 income groups.	1. 2.0 2. 2.3 3. 2.2 4. 2.1	
(103)	Urban working class 1940 - 49	year	
		1941	1.18
		1942	1.40
		1943	1.55
		1944	1.52
		1945	1.47
		1946	1.55
		1947	1.52
		1948	1.57
		1949	1.53
(12a)	49 families, middle class Caracas.	1.38	
(67a)	Venezuela 1949	0.86	

According to the South African recommended minimum daily dietary standards (102), the thiamin intake for a woman weighing 130 lbs. is:-

0.8 mg. per diem (moderately active).

0.7 mg. per diem (sedentary).

The mean daily intake of the 21 Bantu women was 0.7 mg., which is adequate, as they are classed as only mildly active and one was sedentary.

The following table compares the calculated thiamin intake for each woman on the basis of 0.35 mgm. per 1000 calories per day, with the actual thiamin intake as recorded during the survey.

TABLE NO: 39

Comparison of Calculated and Actual Thiamin Intake mgm. per diem

Case No:	Calculated	Actual
1	0.85	1.4
2	0.33	0.5
3	0.36	0.54
4a	0.6	0.5
4b	0.92	0.5
5	0.54	0.7
6	0.65	1.3
7a	0.55	0.5
7b	0.48	0.5
8a	0.61	0.6
8b	0.59	0.8
9	0.43	0.2
10	0.7	0.6
11	0.5	0.6
12	0.47	0.5
13	0.33	1.2
14	0.99	2.2
15	0.99	0.8
16	0.83	0.54
17	0.63	0.48
18	0.5	0.7
19	0.58	1.0
20	0.69	0.8
21	0.38	0.3

From this it is seen that 66 per cent of the subjects had an ample intake of thiamin, cases 4b and 9

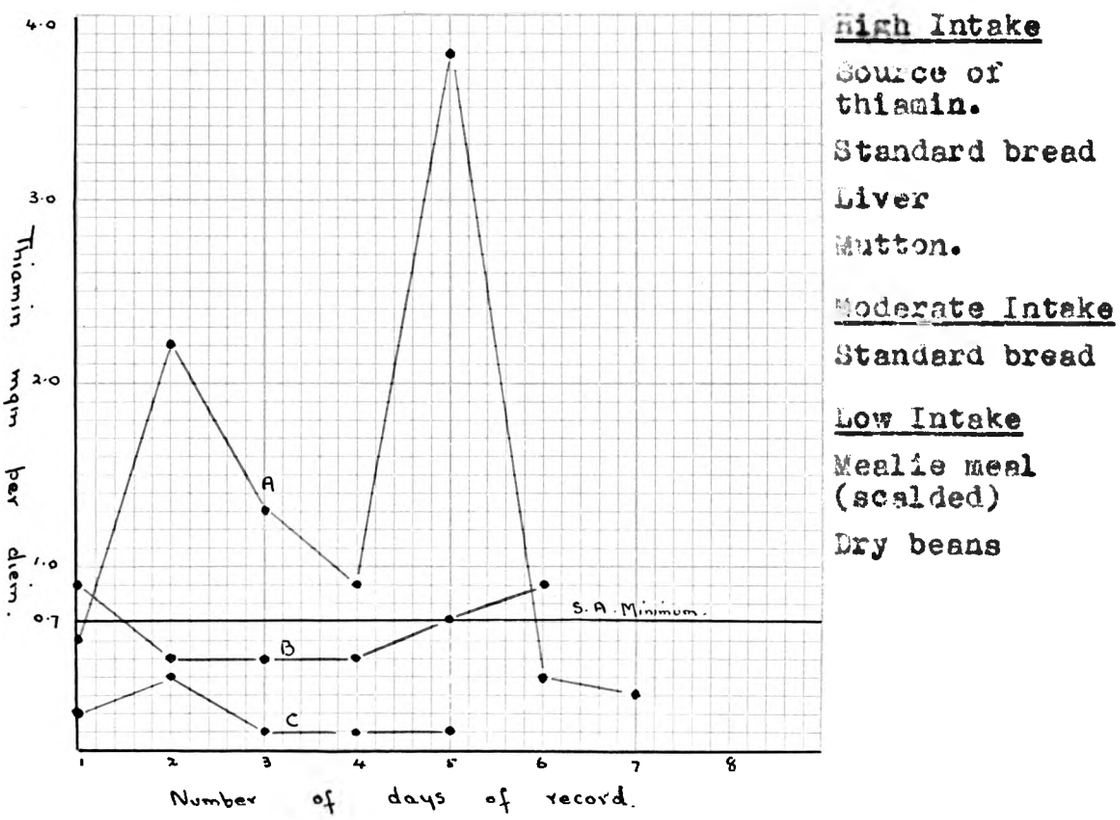
showed the largest deficits, their intakes being roughly half the recommended amounts.

Unlike vitamin A, the storage capacity of the body for thiamin is limited, and it is of interest therefore, to determine whether the daily supply of these women was erratic or regular, the most satisfactory mode of supply would be one which was adequate and regular.

The following graphs demonstrate the variations in daily supply of thiamin for three of the women:-

GRAPH 8

The Thiamin Intake of 3 Bantu Women in Relation to the South African Requirement.



It will be seen from this that the daily intake of the subjects was fairly constant at whatever level they might be, but that the level of intake varied very widely from subject to subject. On the basis of a minimum requirement of 0.7 - 0.8 mgm. thiamin daily, the subject with the highest intake had an ample supply of thiamin,

the subject with the moderate intake barely met the requirement at the level 0.7 mgm. The subject with the lowest intake had a thiamin supply which was totally inadequate.

A more satisfactory evaluation of the individual intake, is based on a minimum allowance of thiamin per 1000 calories of the subjects' intake. In the following 3 graphs each individual variation in intake is shown in relationship to the minimum level of intake for that subject. In all cases, the minimum level was based on the more ample allowance, 0.35 mgm. per 1000 calories, but in C an example of the lowest intakes, it was based on an allowance of 0.23 mgm., in addition, this is considered to be the bare minimum requirement however.

GRAPHS 9, 10, 11.

The Thiamin Intake of 3 Bantu Women in Relation to Their Own Minimum Daily Requirement.

GRAPH 9

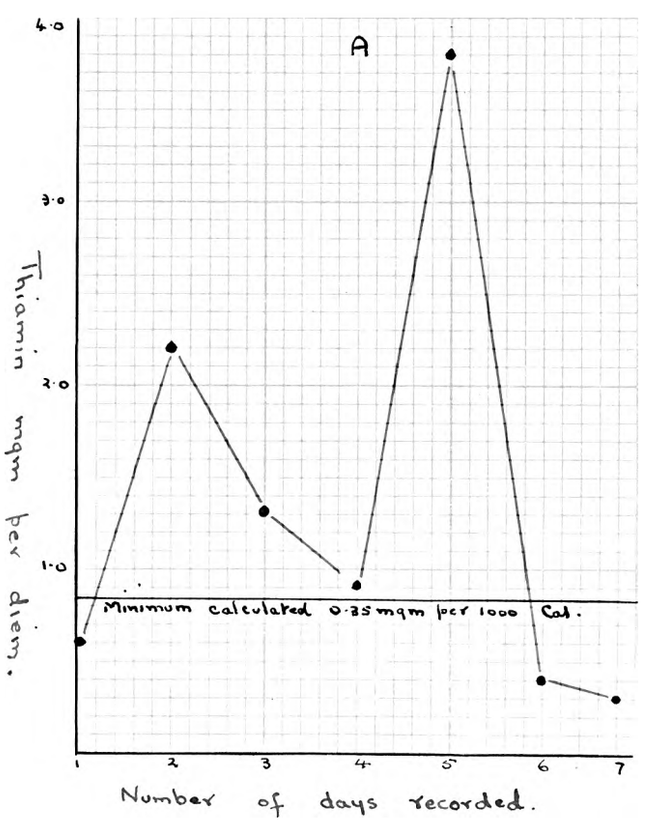
Case 1

Calories 2423

High Intake

Mean thiamin: 2.2 mgm. per diem

Range: 0.5 - 4.5 mgm. per diem.



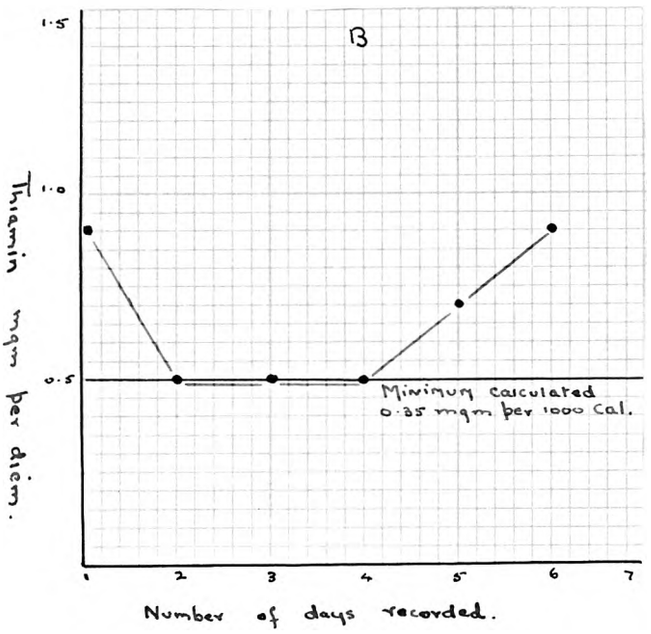
GRAPH 10

Case 5

Moderate intake

Calories 1552

Mean thiamin: 0.7 mgm. per diem.
Range: 0.5 - 0.9 mgm. per diem.



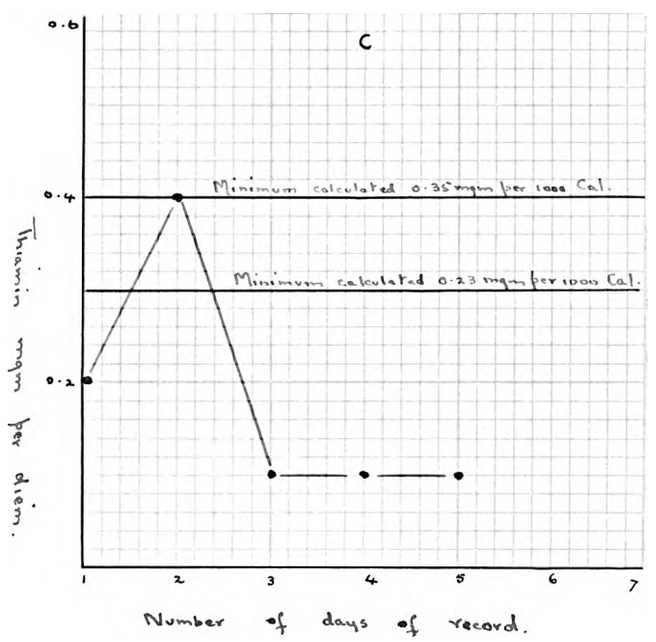
GRAPH 11

Case 9

Low intake

Calories 1219

Mean thiamin: 0.2 mgm. per diem
Range: 0.1 - 0.4 mgm. per diem.



Conclusion.

1) The mean thiamin intake for the 21 Bantu women of this survey was 0.7 mgm. per diem, with a range of 0.1 - 4.5 mgm. per diem.

2) The recommended South African minimum allowance for a woman of 25 years of age, weighing 130 lbs. is 0.7 - 0.8 mgm. per diem, depending whether she is sedentary or moderately active.

3) The women of the present survey were classed as mildly active, one was sedentary.

4) The calculated intakes for each women have been made on the basis of individual calorie intakes. 0.23 mgm. thiamin per 1000 calories is the minimum allowance. 0.35 mgm. thiamin per 1000 calories makes allowance for tissue storage in addition.

5) 87 per cent of the women had an actual intake greater than or equal to the calculated allowance on the 0.23 mgm. basis.

66 per cent of women had an actual intake greater or equal to the calculated allowance on the 0.35 mgm. basis.

6) Only a small proportion of the subjects did not receive the minimum recommended daily allowance of thiamin. In all probability, the daily intakes of these women are higher than appears, as the recording of fermented beverages such as the watery forms of beer may have been omitted by them, for fear of the law.

7) The chief sources of thiamin in these women's diets were: a) Unsifted enriched cereal e.g. Standard bread.

b) Meat, in particular liver.

c) Mealie meal porridges and beverages which had undergone fermentation with consequent ennoblement of their thiamin content.

Riboflavin.

This vitamin which is a constituent of flavoproteins functions as an important enzyme in tissue respiration. The chief sources of riboflavin in food are liver, milk and green leafy vegetables. Although it has not been established that its requirement is directly related to the protein requirement, recent national dietary standards are equating 0.025 mgm. riboflavin per gram of protein in calculating the individual daily allowance. S.A. Nutrition Council (102). Calculated on this basis the recommended minimum daily allowance for the reference woman (130 lb. - 25 yrs.) would be 55 gm. protein x 0.025 = 1.4 mg. per diem riboflavin.

The intake of riboflavin for the 21 Bantu women was found to be:- mean: 1.2 mg. per diem, range: 0.2 - 12 mg.

The following table compares the actual daily riboflavin intake of each woman with:-

(A) Recommended minimum South African daily level (1.4 mg.)

(B) Calculated mean individual intake (mean daily protein intake x 0.025 mg. = riboflavin mg.)

TABLE NO: 40

Comparison of Calculated and Actual Mean Riboflavin Intakes. 21 Bantu Women. mgm. per diem.

Case No:	Calculated	Actual
1	1.8	3.3
2	0.8	0.7
3	0.9	1.3
4a	1.8	1.2
4b	1.4	1.4
5	1.4	1.1
6	1.1	0.8
7a	1.1	0.8
7b	1.1	0.7

TABLE NO: 40 (Cont.)

Comperison of Calculated and Actual Mean Riboflavin Intakes. 21 Bantu Women. mgm. per diem

Case No:	Calculated	Actual
8a	1.3	0.8
8b	1.3	1.1
9	1.1	0.4
10	1.5	0.7
11	1.9	0.5
12	1.0	0.6
13	1.1	1.4
14	2.4	5.0
15	2.7	1.9
16	2.6	0.9
17	1.2	0.8
18	1.0	1.1
19	1.3	0.8
20	1.7	0.7
21	0.9	0.6

These comparisons show that 24 per cent of the subjects had a mean riboflavin intake equal to or greater than the minimum South African allowance of 1.4 mgm. per diem. Only 29 per cent of the subjects had a mean riboflavin intake equal to or greater than the individual mean daily requirement based on the protein intake.

The following table gives the riboflavin intakes recorded in various surveys in Africa or elsewhere.

Riboflavin Intake mg. per diem Africa

Ref.	Relevant Details	Mean	Range
	rural. man unit		
(111)	Supplementary school feeding for natives.		
	I. Home diet	0.5	
	II. Home diet with vegetable supplement.	0.54	
	III. Home diet with veg. and milk	1.7	
	urban. man unit		
(55)	50 native families, Alexandra Township, Johannesburg.	0.9	
(55a)	12 native families, Alexandra Township, Johannesburg.	1.3	0.5 - 2.6

Riboflavin Intake mg. per diem Africa (Cont.)

Ref.	Relevant Details	Mean	Range
	urban. per capita		
(66)	Diepkloof Nutrition Study Bantu boys, Johannesburg. Planned diets		
	I. Standard	1.91	
	II. Rural and urban Bantu	0.71	
(120)	500 African Railway workers (Anderson diet)	2.16	

Riboflavin Intake mg. per diem Non-African

Ref.	Relevant Details	Mean	Range
	per capita		
(103)	Urban working class households 1940 - 1949. Britain	1941 1.4 1942 1.54 1943 1.64 1944 1.76 1945 1.58 1946 1.65 1947 1.64 1948 1.65 1949 1.64	
(1)	Farm families in Georgia and Ohio. Georgia I a. White	Ia 2.7	
	b. Negro	b 2.1	
	Ohio II	II 2.4	
(26)	Rural area of South West Virginia.		
	I. Spring	2.136	0.868 - 3.247
	II. Fall	1.968	1.038 - 3.120
(142)	Groton Township, New York. Woman various ages	years 16-20 1.67 21-29 1.51 30-39 1.49 40-49 1.44 50-59 1.46 60-69 1.42 70 plus 1.49	
(137)	woman unit.		
	Groups women - Austin Texas.		
	1. Professors' wives - high income	1.71	
	2. Faculty women - high income	1.93	
	3. Students - high income	2.47	
	4. Low income	0.78	
	per capita		
(107)	180 families in Strasbourg.	2.12	

Riboflavin Intake mg. per diem Non-African (Cont.)

Ref.	Relevant Details	Mean	Range
(118a)	France. 900 families agricultural		1.54 - 2.35
(118b)	Paris population. Winter Nov. 1950 - Feb. 1951	1.99	
(94)	British West Indies	1.8	
(63)	Starvation level	0.6	
(12b)	36 families in Puerto la Cruz	1.14	
(44)	Recent advances in Nutrition. Requirement for resting adult		1.1 - 1.6
(92b)	Comparison of various standards.		
	I. British	1.4	
	II. American - with safety	1.8	
	III. Canadian	1.2	
	IV. U.S. Army minimum requirement.	2.0	
	man and woman unit.		
(24)	1) Cingalese man	1.2	
(24a)	2) 31 men of British descent living in Ceylon.	2.9	
	3) 27 women of British descent living in Ceylon.	2.06	
	per capita		
(12a)	Middle class families in Caracas (49)	1.42	
(67a)	Venezuela 1949	0.91	
(92)	1) India	0.64	
	2) Indo-China	0.28	
	3) New Guinea	0.23	
	4) Venezuela	0.77	

Values for riboflavin intakes for surveys in Africa are limited, they range from 0.5, the home diet of Bechuanaland Bantu children, or 0.9, the man unit intake of a Johannesburg location population, to 2.16 for African railway workers in Kenya. The present survey value 1.2 mg. per diem, is midway between these two extremes. A study

of the detailed food tables shows that small amounts are derived from maize and wheat products, moderate amounts from dairy and green leaf foods such as imfino, while the occasional helping of beef liver provided large amounts.

The present survey mean value of 1.2 mg. per diem is similar to the finding for a Cingalese man, Cullumbine H. et al (24a) and the Canadian Standard (92b).

Conclusion.

1) The 21 Bantu women of the survey had the following riboflavin intake, mean: 1.2 mg. per diem.
range: 0.2 - 12 mg.
The minimum South African daily allowance for a moderately active woman weighing 130 lbs. and 25 years of age, is 1.4 mgm. riboflavin daily.

2) Of the present series about three quarters of the women had a deficient riboflavin intake.

3) The main sources of their intake were maize and wheat in small amounts, milk, especially in the fermented state (amaas) and green leaf vegetables such as imfino in moderate amounts. The daily intake was thus mainly the sum of small amounts from a number of items of the diet. The one exception was the large amount occasionally obtained from helpings of liver.

4) It is probable that as for thiamin, the intake was greater than it appears to be. A number of fermented drinks, omitted from the records because their preparation and sale is illegal, may have made appreciable additions.

Nicotinic Acid (Niacin).

It is difficult to establish an exact figure for the nicotinic acid requirement of human beings, as even when large doses are administered, only 30 - 40 per cent of the dose can be accounted for. There is a close relationship between the nicotinic acid requirement and the

protein in the diet, for the amino acid tryptophan may in part be converted to nicotinic acid in the body. It has been found that pellagra producing cereal diets are not only low in nicotinic acid but also zein, the main protein in maize is very low in tryptophan.

Goldsmith et al (45) prepared wheat and maize diets containing equal though relatively small amounts of nicotinic acid and tryptophan (4.7 and 190 mgm. per diem respectively). When fed to human subjects, only those consuming the maize diet developed pellagra. It must be realised therefore, that maize eating populations are likely to suffer from a lack of tryptophan as well as nicotinic acid.

Wheat, maize and sugar provided about equal parts of carbohydrate for the women of this series and as a group they cannot be described as predominantly maize eating. The use which they make of milk and eggs is important, for though these foods are low in nicotinic acid, they are rich in tryptophan.

The nicotinic acid intake for the 21 women of the present survey was:-

Mean: 14 mgm. per diem

Range: 1 - 92 mgm. per diem.

This would appear to be ample judged both by the older allowance of ℔ 10 thiamin intake (0.7 - 0.8) = 7 or 8 mgm. or by the more recent recommendation of the South African Nutrition Council (102) which states the following allocation for a woman of 25 years of age, weighing 130 lbs., 12 mgm. per diem if moderately active, and 11 mgm. if sedentary.

It has been stated Walker (123) that though the nicotinic acid intake per day of the adult Bantu is often greater than that of the European, part of the nicotinic

acid in cereals, at least in maize, is bound and therefore less available for metabolism, consequently nicotinic acid deficiency may be a very real problem among these people where maize forms the staple diet. As an example, the nocotinic acid concentration of Bantu breast milk may be lower than that of European milk, despite the higher intake of the Bantu mothers.

The following nicotinic acid (niacin) intakes are reported by other investigators:-

Nicotinic Acid (Niacin) Intake mg. per diem I Africa

Ref.	Relevant Details	Mean	Range
	man unit		
(111)	Kanye Nutrition Experiment Supplementary native school feeding.		
	I. Home diet	14.0	
	II. Home diet with vegetable supplement.	14.8	
	III. Home diet with veg. and milk	15.5	
	planned diets per capita		
(66)	Diepkloof Bantu boys. Johannesburg		
	I. Standard diet	22.1	
	II. Rural and urban Bantu diet	7.2	
(120)	500 African railway workers (Anderson diet).	22.5	
	urban. man unit		
(55)	50 native families, Alexandra Township Johannesburg.	11	
(55a)	12 native families, Alexandra Township Johannesburg.	17	9 - 27
	per capita		
(92)	South Nigeria	9	

Nicotinic Acid (Niacin) Intake mg. per diem II Non-Africa

Ref.	Relevant Details		Mean	Range
(1)	America			
	Georgia I	Ohio II		
	a) White	all persons	Ia 25	
	b) Negro		b 21	
			II 16	

Nicotinic Acid (Niacin) Intake mg. per diem II Non-African (Cont.)

Ref.	Relevant Details	Mean	Range
	per capita		
(103)	Britain - urban working class households. 1940 - 49	1941 11.9 1942 11.9 1943 12.7 1944 13.9 1945 13.2 1946 14.5 1947 12.9 1948 12.8 1949 12.7	
	America woman unit		
(26)	South West Virginia women A. Spring B. Fall	 7 8	 2 - 24 4 - 15
	per capita		
(92)	I. New Guinea II. Indo-China III. India IV. Venezuela	6 6 9 11	
(12b)	36 families in Puerto la Cruz	12.6	
	woman unit		
(137)	America A. High income group 1. Professors' wives 2. Faculty women 3. Students B. Low income group	 A. B.	 9.07 8.71 9.49 4.13
(44)	Nicotinic acid requirement for men	7	
	per capita		
(94)	British West Indies	12	
(92b)	Comparative standards. I. British II. U.S. Recommended with safety margin. III. Canadian IV. U.S. Army minimum requirements.	 9.0 12.0 7.5 16.0	
(24) & (24a)	Cingalese men 27 women of British descent living in Ceylon. 31 men of British descent living in Ceylon.	12.0 7.7 10.4	

Nicotinic Acid (Niacin) Intake mg. per diem Non-African (Cont)

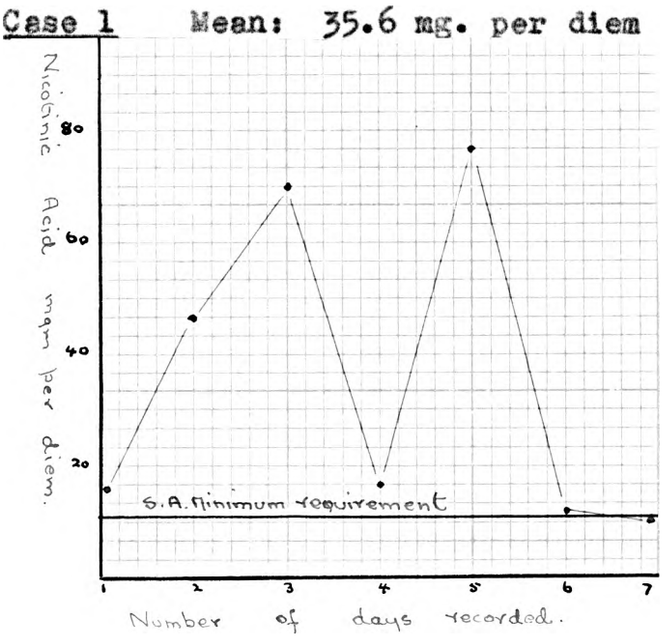
Ref.	Relevant Details		Mean	Range
	America. woman unit	years		
(142)	Groton Township, New York. Different ages.	16-20	10.9	
		21-29	12.2	
		30-39	12.4	
		40-49	11.6	
		50-59	11.8	
		60-69	11.3	
		70 plus	9.3	
		per capita		
(12a)	Middle class families in Caracas		12.6	
(67a)	Venezuela 1948		9.7	

A study of these tables shows that most African diets have an ample supply of niacin, only the intake in South Nigeria and the planned Bantu diet of the Diepkloof nutrition study were too low. The diets of the present series were also found to be adequate in this respect. The main sources of niacin in the diet are meat, the richest being liver. Other sources were the standard war bread, unsifted boermeal, used for dumplings or bread, but these supplied moderate amounts only. Those subjects who consumed large amounts of mealie meal, were able to obtain a small supply from that source.

The following three cases are typical of a high - low and moderate intake.

GRAPH 12

Case 1 Mean: 35.6 mg. per diem High Intake

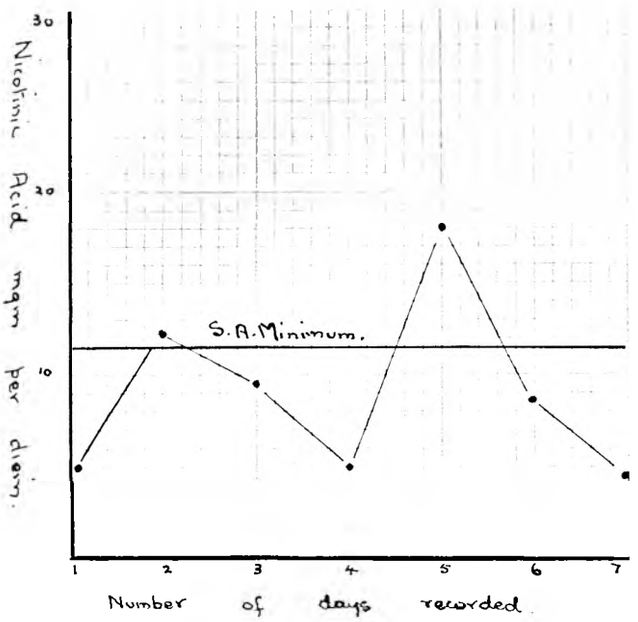


Source of nicotinic acid (niacin)

Liver
Beef
Mutton
Standard bread.

GRAPH 13

Case 2 Mean 7.8 mg. per diem Low Intake

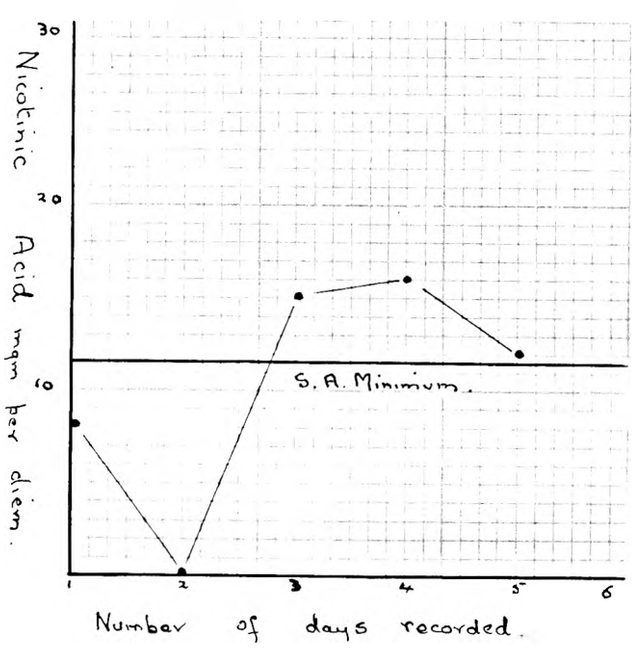


Source of nicotinic acid (niacin)

Beef
Boermeal
Standard bread

GRAPH 14

Case 8b Mean: 11.0 mg. per diem Moderate Intake



Source of nicotinic acid (niacin)

Mutton
Pork
Unsifted boer-meal
Mealie meal

Conclusion.

1) The nicotinic acid (niacin) intake for the 21 Bantu women of the present survey was:-
Mean: 14 mgs. per diem range: 1 - 92 mgm. per diem.

2) 11 - 12 mgm. per diem nicotinic acid (niacin) is adequate according to the minimum South African requirements.

3) The nicotinic acid (niacin) intake for African diets in general, is adequate, but that which is from a cereal source, in particular maize is bound, so that deficiency may arise in subjects who are largely maize eating, whose intake appears to be adequate.

4) Wheat, maize and sugar provided about equal parts of the carbohydrate supply of these women, they would therefore, appear to have had an adequate nicotinic acid (niacin) intake.

5) The main sources of nicotinic acid (niacin) in these diets were: liver, beef, mutton, pork, standard bread and unsifted boermeal. Large intakes of maize made smaller contributions.

ASCORBIC ACID

A considerable amount of evidence has been collected with regard to the human requirement of this vitamin. It has been possible to study the effect of graded doses of the vitamin on the blood plasma content and the urinary excretion rate. Ascorbic acid plays an essential part in the maintenance and repair of tissue, including new red cell formation in the blood. Owing to its high sensitivity to oxidation and heat, a considerable loss results during transportation, storage and cooking, consequently it is advisable to set the minimum recommended allowance at a higher level than would otherwise have been

the case. Due allowance must also be made for the fact that its supply is subject to seasonal fluctuations.

There is considerable clinical evidence for recommending allowances of ascorbic acid well above the level for prevention of scurvy, and for increasing the intake during infection, when it acts as a measure of protection against toxin formation. At the same time there is no critical evidence, clinical or otherwise, that intakes of vitamin C greater than will prevent scurvy are of value.

The South African National Nutrition Council (102) gives a minimum recommendation of 40 mg. ascorbic acid per diem in terms of a woman weighing 130 lbs., age 25 years, whether active or sedentary.

The ascorbic acid intake of the 21 Bantu women of the present survey was: Mean: 45 mgm. per diem. Range: 0 - 343 mgm. per diem. Their supply is therefore adequate. A wide day to day variation of intake is noticeable. The following ascorbic acid intakes have been reported by other investigators.

Ascorbic Acid Intake mg. per diem I African

Ref.	Relevant Details	Mean	Range
	per capita		
(97)	V. Probable Bantu diet Johannesburg locations.	54	
	VI. Benoni, non-European diet (Dr. Anning)	63	
	VII. Adult native paupers Cape Province Admins. Order 1931	-	
	urban		
(59)	987 native families. Johannesburg.		
	1. Diet as purchased	37	
	2. Calculated "marginal"	25	
	3. Calculated "optimal"	75	
	urban		
(66)	Diepkloof Nutrition Study Bantu boys. Planned diets.		
	I. Standard diet	81	
	II. Bantu rural and urban diet	14	

Ascorbic Acid Intake mg. per diem African (Cont.)

Ref.	Relevant Details	Mean	Range
	man unit		
(111)	Report on Kanye Nutrition Experiment. Supplementary rural Bantu school feeding.		
	I. Home diet	-	
	II. Home diet with veg.supplement	33	
	III. Home diet with veg. and milk	36	
	urban. per capita		
(32)	100 native families Payneville location, Springs.	43.2	3.6 - 151
	rural		
(14)	1. Keiskammshoek Eastern Cape Province. 3 seasons.	13.6-41.7	tr.- 128
	2. East Griqualand	32.7	0.09- 367
	3. Nongoma Zululand	54	11 - 154
	4. Letaba N. Transvaal	23	0.2 - 170
	urban		
(55)	50 native families, Alexandra Township, Johannesburg.	57	
(55a)	12 native families, Alexandra Township, Jonannesburg.	39	8 - 101
(38)	Native mine labourers. Witwatersrand		
	Human requirements		
	1) Physiologically indispensable (15 is sufficient)	15-30	
	2) Usual mine diet - strenuous work	12.25	
	3) Luxus consumption level - athlete	300	
	4) Adequate level	150-60	
(92)	South Nigeria	30	
	per capita		
(120)	500 African railway workers Quote: Anderson diet.	62.7	
(30)	Calculated planned diets:		
	A. Europeans, Coloureds, Asiatics.	36	
	B. Rural and urabn Bantu	36	

Ascorbic Acid Intake mg. per diem II Non-African

Ref.	Relevant Details		Mean	Range
	per capita			
(103)	Britain. Urban working class households. 1940 - 49	1941	76	
		1942	76	
		1943	83	
		1944	87	
		1945	86	
		1946	89	
		1947	77	
		1948	96	
		1949	90	
	America			
(1)	Georgia Ohio	Ia	120	
	I a) White II All	b	95	
	b) Negro persons	II	105	
	America. woman unit.			
(26)	1. Spring		45	5 - 110
	2. Fall		36	10 - 111
	America			
(140)	Cornell University women		108	
	per capita			
(92b)	Comparative standards.			
	a) British		20	
	b) U.S.A. safety allowance		75	
	c) Canadian		30	
	d) U.S. Army minimum allowance		30	
	America	years		
(142)	Women all ages	16-20	63	
	Groton Township. New York	21-29	72	
		30-39	67	
		40-49	77	
		50-59	86	
		60-69	59	
		70 plus	55	
(107)	180 families Strasbourg		110	
(92a)	New Guinea 1947. 5 villages			137 - 244
	per capita			
(94)	British West Indies		30	
(118b)	Population Paris. Winter Nov. 1950 - Feb. 1951		159	

Ascorbic Acid Intake mg. per diem II Non-African (Cont.)

Ref.	Relevant Details	Mean	Range
	Tropical dietaries		
(92)	1. New Guinea	30	
	2. Indo-China	30	
	3. India	65	
	4. Venezuela	8	
(63)	Starvation level	83	
(64b)	Daily allowance	30	
(94a)	"Vitamin C requirement for human adults". No basis for more than 30 mg.	30	
	man and woman unit.		
(24) & (24a)	1) Cingalese man	40	
	2) 27 women British descent living in Ceylon.	108.5	
	3) 31 men of British descent living in Ceylon.	133.2	
	per capita		
(12b)	36 families Puerto la Cruz	29	
(64a)	Mining population Jharia coal fields.	25	
	4 economic groups	17	
		12	
		13	
(12a)	Middle class families Caracas	80	
(67a)	Venezuela 1949	76.2	

The previous African surveys record daily ascorbic acid intakes which are commonly below the South African minimum standard of 40 mgm. per diem. The rural studies in particular show a wide range of intakes i.e. 4 - 54 mgm. per diem in four separate country areas (14). To account for this, special mention is made of seasonal influences such as a drought, which affects the wild fruit and berry supply, and so may change the ascorbic acid intake profoundly.

The urban Bantu are less likely to suffer from marked variations in the supply of ascorbic acid, and both the present survey and those in Alexandra Township (55, 55a), and the Rayneville location (32) show intakes above 40 mgm. per diem.

Although it is felt advisable to advocate such an ample daily intake, it is known that healthy people have voluntarily submitted to extreme privation of Vitamin C (ascorbic acid) for 100 days and more with no subjective or clinical disturbance of any kind, Rietschel and Mensching quoted by Fox (38). In this publication the case of a Bantu prisoner is described, who due to his dislike of vegetables and fruit, ate only a small ascorbic acid intake in his cooked meat ration. He was moderately active, and in fair health at the end of ten months. On the other hand, 30 Bantu cases of frank scurvy have been reported, Orusin and Kincaid-Smith (48), also 32 Bantu adults with clinically obvious scurvy and an associated anaemia, (Bronte - Stewart (19a).

With due regard to all these facts it may be said, however, that the women of the present survey, had an ample provision of ascorbic acid.

Their chief sources of supply of ascorbic acid were:- liver, if eaten in large amounts, potato, cabbage, orange, beetroot and tomato.

Day to day fluctuations were very wide in the same subject.

It should be understood that the calculations were not corrected for losses incurred in cooking and storage, so that in point of fact the ascorbic acid intake of these subjects is lower than it appears to be. Nevertheless, there appears to be a wide margin of safety as has been borne out by the women's clinical state.

Conclusion.

1. The ascorbic acid intake of the 21 Bantu women of the survey was, Mean: 45 mgm. per diem
   Range: 0 - 343 mgm. per diem.
2. The South African minimum recommended allowance is 40 mgm. per diem.
3. Previous African surveys show a variable and often reduced rate of intake for rural people, but an adequate and more consistent intake for urban people.
4. Though the margin of safety is probably wide, as no clinical ill effects have been observed in subjects after undergoing prolonged deprivation of ascorbic acid, yet frank cases of scurvy are observed among the Bantu.
5. The women of the present survey had an adequate intake of ascorbic acid, and there was no evidence of deficiency on examination.

GENERAL SUMMARY, DISCUSSION AND CONCLUSIONS

Before proceeding to a discussion of the survey, and drawing up the final conclusions, it is as well to set down as breifly as possible the facts which have been determined during the course of the survey.

The group of 21 Bantu women lived in two townships near Johannesburg, under the control of the municipality. The two roomed houses provided , represented luxury by comparison with most quarters in the uncontrolled Native districts, or the temporary accomodation in the newly arising settlements further away on the outskirts of the city. Their ages ranged from 20 - 75 years, but most of them were middle aged and had families. Nearly all were supported by the man of the family, and had lived almost all their lives in the town where their children had been born. As might be

expected, they represented many of the tribes of Southern Africa and were not representative of any one group. An accurate account of their financial state was not possible, as apart from the fact that the Bantu men do not disclose their earnings in full to their wives, the contributions are often erratic, and the money the women themselves earn is apt to fluctuate abruptly. Generally speaking, they were drawn from the moderate to well to do families.

Most of the women had enough education to enable them to read and write. They were characterised by a placid temperament, and could not be described as more than mildly active. This easy going outlook is reflected in the manner in which they live, the resources of the moment are used in full without thought or any provision for the future. Hardship or comfort are accepted with equal complacency, and it is a reflection of their good tempered kindly spirit that many homes include extra members, the old or young of less fortunate members of their community.

In build they were of moderate height, with a tendency to obesity. On superficial inspection, there was no frank evidence of malnutrition, or any other disease, but fifteen of the women showed mild thickening and colour changes in the more exposed portions of the bulbar conjunctivae. These changes might possibly have been ascribed to ariboflavinosis, but were so slight as to be unconvincing. Mouth examination showed that two thirds of the women had a gingivitis and one third had caries of the teeth, neither of these findings of themselves are a reflection of the general state of health of the women.

In six cases there was pigmentation of the tip or sides of the tongue, but this finding is possible in dark skinned people, especially where there is oral

irritation e.g. dental caries, gingivitis. Three of the women had fissured tongues, and it is just possible that this finding may suggest a mild form of pellagra, but this was unlikely in view of the normal niacin intake, and the absence of any of the other signs of the condition.

One subject who was normal in every respect was found to have a palpable liver. It was of normal consistency and there was no evidence clinically of upward enlargement. Such a solitary finding in a normal person must not be judged to be the evidence of disease. Six of the subjects suffered from hypertension, this condition is said to be prevalent among the Bantu and is largely primary in type. Of the pregnant subjects, a possible cause was found in all the cases ranging from a cardiac condition to obesity, and including one case of syphilis with vascular changes.

To summarise therefore, the majority of the women of this survey were lacking in stigmata of malnutrition, as the slight evidence of ariboflavinosis was unconvincing. They showed a tendency to develop obesity and hypertension.

The average duration of the dietary records was 6 days, and the periods ranged from 4 - 10 days, and were a reflection of the excellent co-operation of the women. A few offered to repeat their records, and the subject with a ten day record took the trouble to make special arrangements to comply and deliberately extended the period. It must be accepted that not all were on consecutive days, days were suddenly omitted or incomplete, the explanation given that the subjects had been to town on those occasions, must be accepted with reservation. It is a well recognised characteristic of the Bantu, that

they sometimes avoid truthful explanations where the European is concerned.

It is felt also, that even the most co-operative and dependable members, may have measured the small items such as sugar on a few occasions only, and then listed the same quantities automatically thereafter. This is the natural reaction of a somewhat indolent individual. It is as well to reiterate at this stage, that the original number of subjects in the survey was 35, but that for just such discrepancies, no less than fourteen were deemed unsuitable for inclusion in the final report.

A study of these diets shows that proximity of the European has already brought about considerable changes in the choice and preparation of food by the Bantu, this influence is more evident in some than in others, and in addition, the households display individual ideas in the selection and the preparation of their food. Consequently, it is not possible to describe any one diet as representative of their choice. Two extremes are distinct however, at one end those in which fermented porridge and beverages, mostly made from maize, form the major part, together with the consumption of soured milk and dry legumes. Traditional wild green leaf plants, cooked as as a form of spinach, are becoming more and more difficult to obtain so that urban Bantu who may wish to use them, are unable to do so. At the other extreme, the diet is that of the Europeanised Bantu, who makes boiled unfermented mealie meal porridge the main component of breakfast, while the stiff form of unfermented mealie meal is used as a vegetable with the meat, and fermented forms of maize such as marewu are not usually prepared. Kaffir beer is probably among them, though the subjects denied its use.

Meals ~~are~~ tend~~ing~~ to be taken more frequently, and in addition, the habit of drinking morning and afternoon tea is spreading, chiefly amongst the women who stay at home. Since as much as two to four teaspoonfuls of sugar may be added to each cup of tea, sugar is assuming prominence in some urban Bantu diets. Bread or potato are often used in place of maize, and occasionally Indian rice is cooked with the meat.

Luxuries such as confectionery, doughnuts, ginger cakes, buns, currant cake and marie biscuits, are sometimes purchased, and coloured flavoured syrup drinks are also becoming increasingly popular. Green vegetables such as peas and beans, which are not usually eaten in the country, are slowly being accepted by the urban Bantu, but jam and golden syrup are still only occasionally used. It is not usual to prepare puddings, but raw fruit or a fruit salad is occasionally eaten after the meal.

Soured milk, usually prepared in a wild gourd or calabash in the country, is prepared in ordinary kitchen utensils by townsfolk, and is not as commonly taken by the more sophisticated among them.

The comprehensive detailed study of all the 21 Bantu diets gave the following information:-

The mean daily food nutrient per woman per day was:-

Nutrient		Mean	Range
Calories		1718	413 - 4449
Protein - Total gm.		56	33 - 109
	Animal gm.	32	13 - 75
Fat (Ether extract) gm.		51	24 - 79
Carbohydrate gm.		259	173 - 355
Calcium mgm.		356	56 - 1107
Phosphorus mgm.		908	108 - 2807
Iron mgm.		16	1 - 82
Vitamin A	I.U.	3182	0 - 52920
Vitamin B	Thiamin	0.7	0.1 - 4.5
mgm.	Riboflavin	1.2	0.2 - 12.0
	Niacin	14	1 - 92
Vitamin C	Ascorbic acid mgm.	45	0 - 343

The mean daily intake of nutrients of these women is adequate in all its components except calcium and riboflavin. The calorie intake, though lower than that usually ascribed to the Bantu, is comparable with similar findings for communities in Ceylon, America and Holland. It may be surprising that these women who were generally obese, could maintain their weight on a fairly low calorie intake. It must be remembered, however, that they are not very active, and that similar findings are reported in America for Negroes, the suggestion has been made that there has been some degree of adaptation to the lowered intake by these people. A similar suggestion is put forward with regard to the low calcium content of the Bantu diet, no ill effects appear to result as far as can be judged clinically.

One is left then with but one possible form of deficiency, namely aribоflavinosis. If present, this can only be mild, but support is given to this by the mild

colour and texture changes in the bulbar conjunctivae of many of the subjects though these can also be ascribed to exposure to a dusty dry climate, and the effects of strong radiation. In view of the dietary findings, however, it is just possible they may be a mild form of ariboflavinosis.

Again, however, it must be recollected that these women are not representative of the location population as a whole, but are drawn from the more prosperous levels. While this survey shows that it was possible to maintain an adequate level of nutrition, the findings should not be used to suggest that the status of these people as a whole is satisfactory.

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REFERENCES

1 Adelson, S.F. and Blake, E.C., 1950. Misc. Pub. U.S. Dept. Agric. 704.

2 Adolfson, M., 1955. Personal Comm.

3 American Medical Assoc., 1951. Council on foods and nutrition Handbook of Nutrition. 2. ed.

4 Ahmed, B. and others, 1945. Ind. J. Med. Res. 33. 105.

5 Andresen, M.I. and Mugrage, E.R., 1936. Arch. Int. Med. 58. 136.

6 Arens, L. and Brock, J.F., 1954. S. Afr. J. Clin. Sci. 5. 20.

7 Aykroyd, W.R. and Krishnan, B.G., 1937. Ind. J. Med. Res. 25. 367.

7a Barreto, J. de B. and Cavalcanti, I.A. de A., 1948. Mem. Inst. Oswaldo Cruz. 46. 531. Quoted Nutr. Abst. and Rev., 1950. 20. 164.

8 Batson, E., 1950. S. Afr. J. Sci. 46. 212.

9 Batson, E., 1941. Social Survey of Cape Town, Report No. SS3. University of Cape Town, Department of Social Science.

10 Becker, B.J.P., 1946. S. Afr. J. Med. Sci. 2. 107.

11 Beet, E.A., 1948. East Afr. Med. J. 25. 433.

12 Beet, E.A., 1951. Arch. Dis. Childh. 26. 119.

12a Bengoa, J.M., 1950. Arch. venezol. Nutricion. 1. 347.
Quoted Nutr. Abst. and Rev., 1951. 21. 451.

12b Bengoa, J.M. and Saldivia, F., 1951. Arch. venezol. Nutricion. 2. 327.
Quoted Nutr. Abst. and Rev., 1952. 22. 503.

13 Bersohn, I. and others, 1954. S. Afr. J. Clin. Sci. 5. 35

13a Bessey, F.A., 1949. Key to interpretation of blood levels in terms of adequacy of nutrition. Pierce and Lamden. Quoted Odendaal (89)

14 Best, P.C. and others, 1952. Union (of South Africa) Division of Nutrition. Dietary surveys in rural Bantu Areas.

15 Best, C.H. and Taylor, N.B., 1937. Physiological Basis of Medical Practice. Bailliere. London.

15a Bigwood, E.J., 1939. League of Nations Health Organisation. Quoted by: Cullumbine (24).

16 Boshoff, P.H., 1946. Leech. 17(1). 25.

17 Ballantyne, A.J., 1950. Brit. Encyclopaedia Med. Practice 2nd. edt., 3. 613

18 Brock, J.F. and Latzky, J.M., 1942. S. Afr. Med. J. 16. 255

19 Brock, J.F. and Latzky, J.M., 1943. S. Afr. J. Med. Sci. 40. 271

19a Bronte - Stewart, B., 1953. Quart. J. Med. 22. 309.

20 Buchanan, G., 1935. S. Afr. Med. J. 9. 597

21 Chatfield, C. and others, 1950. Milbank Mem. Fund Quart. 28. 103

22 Chen, K.P., and others, 1951. Mem. Fac. Med. Taiwan Univ. 1. 163

23 Committee on haemoglobin surveys, 1945. Med. Res. Council. London. Spec. Rep. Series. 252.

24 Cullumbine, H., and others, 1949. Ceylon J. Med. Sci. 6. 186

24a Cullumbine, H. and others, 1949. Ceylon J. Med. Sci. 6. 255

25 Cullumbine, H. and others, 1950. J. Appl. Physiol. 2. 640

25a Culwick, G.M., 1951. Sudan Survey Dept. No. 304. 228. Quoted Nutr. Abstr. and Res., 1952. 21. 949.

26 Dean, W.T., 1950. J. Am. Dietet. Assoc. 26. 517.

27 De Langen, C.D., 1949. Ned. Tyd. v. Geneesk. 93. 3247.

27a de Mira, F., 1949. Arch. portugaises Sci. biol. 10. 42. Quoted Nutr. Abst. and Res., 1950. 20. 434.

28 Dieckman, W.J., 1942. The Toxaemias of Pregnancy. Henry Kimpton. London.

29 Donnison, C.P., 1929. Brit. Med. J. i. 478. Lancet, i. 6.

30 du Plessis, A.J. and others, 1951. S. Afr. Med. J. 25. 955.

31 During, C., 1951. New Zealand J. Agric. 83. 115.

32 du Toit, D., 1953. S. Afr. J. soc. sci. 4. 1.

33 Eisenberg, L., 1954. Quoted by Bersohn, I. and others (13).

34. Fleming, P.W., 1945. Unpublished data.

35 Fleming, P.W., and Barnes, H.D., 1944. S. Afr. J. Med. Sci. 9. 51.

36 Fox, F.W., 1936. S. Afr. Med. J. 10. 25.

37 Fox, F.W., 1939. S. Afr. Med. J. 13. 87.

38 Fox, F.W. and others, 1940. Proc. Transvaal Mine Med. Off. Assoc. 19. 17.

39 Fox, F.W. and Golberg, L., 1944. S. African Food Tables. S.A. Inst. for Medical Research. Johannesburg.

41 Gelfand, M., 1947. The Sick African. Stewart Printing Co., Cape Town. 2nd. edt.

42 Gillman, J. and Gillman, T., 1951. Perspectives in Human Malnutrition. Grune & Stratton, N.Y.

43 Golberg, L. and Thorp, J.M., 1943. S. Afr. J. med. Sci. 10. 1.

44 Goldsmith, G.A. and Gibbens, J., 1951. Arch. Int. Med. 88. 93.

45 Goldsmith, G.A. and others, 1952. J. Clin. Invest. 31. 553.

45a Gonzalez, Puccini, A. and others, 1951. Arch. Venezol. Nutrit., 2. 369.
Quoted: Nutrit. Abst. and Rev., 1952. 22. 511

46 Gorvy, V., 1941. The physiological variations and relationships of the normal haematologic values of young adult males and females living on the Witwatersrand. Thesis. University of the Witwatersrand.

47 Great Brit. Ministry of Food, 1949. London HMSO (cmd. 7842).

47a Greig, H.B.W., 1955. Personal comm.

48 Grusin, H. and Kincaid-Smith, P.S., 1954. Am. J. Clin. Nutr. 2. 323.

49 Handbook of Biochem. Tests, 1950. South African Institute for Medical Research. Johannesburg.

50 Harris, L.J., 1949. Brit. J. Nutrit. 2. 362

51 Harrison, G.A., 1947. Chemical Methods in Clinical Medicine. 3rd. edt. Churchill, London.

51a Harvey, D. and Titman, W.L., 1951. Colony and Prot. of Kenya Med. Dept. Res. Lab. II. 4.
Quoted: Nutr. Abst. and Rev., 1952. 22. 139.

52 Heimann, H.L. and others, 1929. Brit. Med. J. i. 344.

53 Hess, A.F., 1929. Rickets, including Osteomalacia and Tetany. H. Kimpton. London.

54 Heyns, O.S. and Hirsch, C.S., 1944. S. Afr. J. Med. Sci. 9. 33.

55 Higginson, J. and Oettle, A.G., 1954. Unpublished data. Report on dietary survey conducted in Alexandra Township during May and June 1954. (50 families)

55a Higginson, J. and Oettle, A.G., 1954. Unpublished data. Report on dietary survey conducted in Alexandra Township during March and April, 1954. (12 families)

56 Higginson, J. and Pepler, W.J., 1954. J. Clin. Invest. 33. 1366

57 Holmes, E.G. and others, 1951. Trans. Roy. Soc. Trop. Med. and Hyg. 45. 371

57a Isgro, L., 1949. Quad. Nutrizione. 10. 388

58 Jaffe, H.L. and Bodansky, A., 1943. Jl. Mt. Sinai Hosp. 9. 901

59 Janisch, M., 1941. A study of African Income and Expenditure. Non-European and Native Affairs Dept. City of Johannesburg.

60 Jex-Blake, A.J., 1934. East Afr. Med. J. 10. 286

61 Keen, P., 1955. Personal Comm.

61a Kehar, N.D. and Ray Sarker, B.C., 1951. Ind. J. Physiol. and Allied Sci. 5. 1. Quoted Nutr. Abst. and Rev., 1952. 21. 715

62 Kemsley, W.F.F., 1950. Ann. Eugenics. 15. 161

62a Kemsley, W.F.F., 1952. Ann. Eugenics. 16. 316

63 Keys, A., and others, 1950. Biology of Human Starvation. Univ. Minnesota Press. Minneapolis.

64 Lal, S.S., 1950. Ind. J. Med. Res. 38. 369.

64a Lal, S.S., 1950. Ind. J. Med. Res. 38. 401.

64b League of Nations Technical Commission on Nutrition, 1938. Bull. Hlth. Org. L o N. 7. 461.

65 Le Riche, H., 1943. A health Survey of African children in Alexandra Township. Witwatersrand Univ. Press. Johannesburg.

66 Le Riche, H. and others, 1952. S. Afr. Med. J. 26. 207 and 233.

67 Le Riche, H. and others, 1953. S. Afr. Med. J. 27. 103.

67a Liendo Coll, P.L. and Bengoa, J.M., 1950. Arch. venezol. Nutircion. 1. 305. Quoted Nutr. Abstr. & Rev., 1951. 21. 454.

68 Linder, G.C. and Massey, P.J.H., 1939. J. Obst. and Gynaec. Brit. Emp. 46. 885.

69 Loewenthal, L.J.A., 1935. Ann, Trop. Med. and Parasit. 29. 407.

70 Lokre, R.J., 1949. Ind. Med. Gaz. 84. 98.

71 Lurie, H.I., 1945. Quart. J. Exper. Physiol. 33. 91.

72 McCance, R.A. and Widdowson, E.M., 1943. Nature. 152. 326.

72a McCance, R.A. and Widdowson, E.M., 1942. The chemical composition of Food. Gr. Britain Med. Res. Council Spec. Rept. Series No. 235.

73 McCulloch, 1929. Thesis, Aberdeen University. Quoted Orr & Gilks, (91).

74 Mackay, H.M.M. and others, 1945. Arch. Dis. Childhood 20. 56.

75 McLester, J.S. and Darby, W.J., 1952. Nutrition and Diet in Health and Disease. 6th edt. Saunders, Philadelphia.

75a McNab, G., 1955. Personal comm.

76 Magee, H.E., 1946. Brit. Med. J. i. 475.

76a Mirone, L., 1954. J. Clin. Nutrit. 2. 38. Quoted Nutr. Abst. and Rev., 1954. 24. 907

77 Mitchell, H., 1935. J. Am. Dietet. Assoc. II. 28.

78 Morris, H., 1944. Proc. Nutrit. Soc. I. 148

79 Morris, J.N., 1945. Lancet. i. 743.

80 Mull, J.W. and Bill, A.H., 1934. Am. J. Obstet. and Gynec. 27. 510.

81 Murnaghan, M., 1946. Irish J. Med. Sci. 1. 21.

82 Murphy, H.B.N. and others, 1955. Brit. J. Nutrit. 9. 203.

84 Myers, V.C. and Eddy, H.M., 1939. J. Lab. clin. Med. 24. 502.

85 Nicholls, L., 1936. Ceylon J. Med. Sci. 4. 1.

86 Nicholls, L., 1951. Tropical Nutrition and Dietetics. 3rd. ed. Balliere, London.

87 Nicol, B.M., 1949. Brit. J. Nutrit. 3. 25.

88 Oberst, M.F. and Plass, E., 1932. J. Clin. Invest. 11. 123.

89 Odendaal, W., 1951. The Assessment of Nutritional Status. Dept. of Physiology, Univ. of Pretoria.

90 Ordman, B., 1948. Clin. Proc. 7. 183.

91 Orr, J.B. and Gilks, J.L., 1931. Studies of Nutrition: The Physique and Health of two African Tribes. Spec. Rep. series med. res. coun. London. 155.

92 Patwardhan, V.N., 1955. Voeding 16. 223.

92a Langley, D., 1950. Report of the New Guinea Nutrition Survey Expedition, 1947. Govt. Printer, Sydney. Austr.

92b Pett, L.B., 1951. J. Amer. Dietet. Assoc. 27. 28.

93 Phillips, R.W., 1951. Nutr. Abst. and Rev. 21. 241.

94 Platt, B.S., 1946. Nutrition in the British Indies H.M.S.O. (Colonial Office No. 195) London.

94a Preliminary Report by the Vit. C Subcommittee of the Accessory Food Factors Committee. M.R.C., 1948. Lancet. 1. 853.

95 Quinton, M.F. and Barnes, H.D., 1942. S. Afr. J. Med. Sci. 7. 42.

96 Radnakrishna Rao, M.V., 1938. Ind. J. Med. Res. 25. 661.

97 Radloff, E.M. and Osborn, T.G.B., 1939. "Malnutrition in S.A." Witwatersrand University Press. Johannesburg.

98 Radna, R., 1939. Ann. Soc. belge de med. trop. 19. 61.

99 Ramsay, J. and others, 1938. Brit. Med. J. i. 1199.

100 Rauch, J.H., 1954. Personal Comm.

101 Recommended daily dietary allowances of the Food and Nutrition Board, 1953. National Research Council. Pub. 302. Washington D.C.

102 Recommended minimum daily dietary standards, 1955. S. Afr. National Nutrition Council, Pretoria.

103 Report No. 1. National Food Survey Committee, 1951. Great Britain. H.M.S.O. London.

104 Roper, A.B., 1948. East Afr. med. J. 25. 245.

105 Ronge, A., 1952. Arch. Hyg. (Berlin) 136. 21.

106 Schultz, T., 1950. Bull. Inst. Statistics (Oxford) 12. 99.

106a Scroggie, H.M., 1946. "The Sociology of Ngwakerse Diet." Thesis, Rhodes Univ. College, Univ. of S. Afr.

107 Serville, Y. and others, 1951. Bull. Inst. Nat. Hyg. (Paris). 6. 612.

108 Sherman, H.C., 1941. Chemistry of Food and Nutrition. MacMillan Co., New York.

109 Slutzkin, L., 1943. Leech. 14. 13.

110 Squires, B.T., 1941. S. Afr. J. med. Sci. 6. 53.

111 Squires, B.T., 1946. The feeding and health of African school children. University of Cape Town.

112 Squires, B.T., 1955. Personal Comm.

113 Stiebeling, H.K. and Phipard, E.F., 1939. Circular

U.S. Dept. Agric. No. 507. 140.

114 Stone, W., 1936. Tr. Roy. Soc. Trop. Med. and Hyg. 30. 165.

114a Suzman, M.M., 1942. Clin. Proc. 1. 205.

115 Swanson, P. and others, 1952. Fed. Proc. 11. 457.

116 Symons, P.H., 1939. S. Afr. J. med. Sci. 4. 18.

117 Thomson, A.M. and Duncan, D.L., 1954. Nutrit. Abst. and Rev. 24. 1.

118 Tobias, P., 1955. Personal Comm.

118a Tremolieres, J. and others, 1952. Rec. Trav. Inst. Nat. Hyg. 4. 495. Quoted Nutr. Abstr. and Rev., 1952. 22. 500.

118b Tremolieres, J. and Vinit, F., 1952. Bull Inst. nat. Hyg. (Paris). 7. 613. Quoted Nutr. Abstr. and Rev., 1953. 23. 155.

119 Trowell, H.C., 1948. East. Afr. med. J. 25. 236.

120 Trowell, H.C., 1948. East Afr. med. J. 25. 311.

120a Trulson, M.F. and Stare, F.J., 1951. Fed. Proc. 10. 397.

120b U.N. - FAO, 1950. Ann. Nutr. Aliment. 4. 183. Quoted Nutr. Abstr, and Rev. 20. 707.

121 Van Loon, 1948. Quoted by Walker and others (130).

122 Walker, A.R.P., 1954. Am. J. clin. Nutr. 2. 265.

123 Walker, A.R.P., 1955. Personal Comm.

123a Walker, A.R.P., 1956. Personal Comm.

124 Walker, A.R.P., 1955. Am. J. clin. Nutr. 3. 114.

125 Walker, A.R.P., 1955. S. Afr. J. Lab. and clin. Med. 1. 36.

126 Walker, A.R.P. and Arvidsson, U.B., 1950. Nature 166. 438.

127 Walker, A.R.P. and Arvidsson, U.B., 1953. Trans. roy. Soc. trop. Med. Hyg. 47. 536.

128 Walker, A.R.P. and Arvidsson, U.B., 1954. J. clin. Invest. 33. 1358.

129 Walker, A.R.P. and Arvidsson, U.B., 1954. Metabolism. 3. 385.

130 Walker, A.R.P., Arvidsson, U.B. and Politzer, W.M., 1954. S. Afr. Med. J. 28. 48.

131 West, H.D. and Jefferson, N.C., 1941. J. Lab. and Clin. Med. 26. 1644.

132 Wheeler, R. and Malloy, R., 1935. J. Am. Dietet. Assoc. 10. 453.

133 Whitby, E.H. and Britton, C.J.C., 1953. Disorders of the Blood. 7th ed. Churchill, London.

134 Widdowson, E.M. and McCance, R.A,, 1936. J. Hyg. 36. 13.

135 Williams, H.H. and others, 1951. J. Am. Dietet. Assoc. 27. 215.

136 Winters, J.C. and Leslie, R.E., 1943. J. Nutrition. 26. 443.

137 Winters, J.C. and Leslie, R.E., 1944. J. Nutrition. 27. 185.

138 Woodhill, J.M., 1952. Med. J. Australia ii. 145.

138a Yanagi and others, 1951. Ann. Rep. Nat. Instit. of Nutr. Tokyo. 1.

139 Youmans, J.B. and others, 1943. Amer. J. publ. Hlth. 33. 58.

140 Young, C.M., 1946. J. Am. Dietet. Assoc. 22. 25.

141 Young, C.M., 1950. J. Am. Dietet. Assoc. 26. 517.

142 Young, C.M., 1950. J. Am. Dietet. Assoc. 26. 776.

143 Young, C.M. and others, 1952. J. Am. Dietet. Assoc. 28. 124.

144 Yudkin, J., 1951. Brit. J. Nutr. 5. 177.

145 Yudkin, J. Nutrition - Dietetics Catering. Vol. 2; No. 2. Quoted. Best, Brinton and Drysdale (14).