

strap the part for a day or two. The number of injections and the interval varies with each individual case, which has to be judged on its merits.

Finally, the treatment of rheumatism is the treatment of the cause. Rest, diet, physiotherapy and attention to the general health of the patient, all have a place in the treatment. The addition of X-rays (local and wide field) and local analgesia to our armamentarium provides us with very powerful weapons, and marks a great advance in our fight for the relief of pain and restoration of function in the rheumatic disease.

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A Health Study of South African Bantu School-Children.

BY SIDNEY L. KARK, M.B., B.CH. (*Polela Health Unit, Union Health Department*), AND H. LE RICHE, B.Sc., M.B., CH.B. (Wit.).

THE work was carried out during 1938-39. In all, three urban and six rural areas were visited, namely: Transvaal—Pretoria, Bochem, Letaba; Orange Free State—Bloemfontein, Witzieshoek; Natal—Pietermaritzburg, Nqutu; Cape Province—Transkeian Areas, Qumbu, Kentani.

Approximately 800 school-children were examined in each area, making a total of over 7,000. Each child had a physical examination, including somatometric and clinical findings. In addition, various laboratory tests were made on a random sample of children in each area.

THE SKIN.

The Bantu child with a dry, lustreless skin frequently exhibits other abnormal findings, and the assumption that this sign is suggestive of malnutrition is justified by the fact that more marked specific deficiency skin diseases are often associated with this general lack of lustre. Apart from the frequency with which phrynodermis (follicular keratosis) and pellagra-like dermatitis are found in patients who also evidence a lustreless skin, there are several less advanced abnormalities, such as ichthyosis of the skin of the legs, cutis anserina (which is considered by most authorities to be but an early manifestation of phrynoderma), mild exfoliation resembling large powder granules or flakes, and wrinkling of the skin. These latter conditions were all so common in children whose skin was dry and lustreless that they are best considered together with this finding.

The main deficiencies causing these conditions are those of vitamin A, riboflavin and nicotinic acid. Tropical ulcer has not been specifically related to a deficiency in diet, but work in other countries suggests a relationship to diet—more especially the absence of animal foods.

The higher incidence of scabies and/or impetigo in the rural children as compared with the urban groups is of interest. Standards of personal cleanliness as well as that of clothing were found to correspond roughly with the incidence of these diseases, the standard in the towns being of a very much higher order than that in the rural areas.

THE MOUTH.

1. *Stomatitis* (includes stomatitis of the body of the lips, angular stomatitis of the muco-cutaneous junction of the angles of the lips, and changes in the buccal mucous membrane). The commonest finding was a dry, cracked, and often red-rare condition of the lips.

2. *Glossitis*, including the extremes of a minor marginal glossitis to that of a complete denudation of the dorsum.

3. *Gingivitis*—soft, spongy gums which bled easily on pressure were noted, as well as the incidence of pyorrhœa.

4. The teeth—gross caries and irregularities were recorded. Table 2 indicates the incidence of these lesions.

The etiology of 1 and 2 (Table 2) is probably related to that of pellagra, the main factors being riboflavin and nicotinic acid deficiency. Soft, spongy gums (No. 3) were possibly caused by vitamin C deficiency. These three lesions are also more common in boys than in girls (*cf.* skin findings).

Bochem, the district which had the lowest incidence of caries, was found to be the worst district in so far as irregularities were concerned. No definite relationship between the occurrence of caries and irregularities could be established. The urban areas of Pretoria and Bloemfontein had the highest number of children with caries in all nine areas. "Shop" foods, such as refined cereals, sugar, sweets and biscuits, may have a close relationship to the extent of this condition. In the case of irregularities, the main etiological factor might have been syphilis.

THE TONSILS, CERVICAL GLANDS AND EARS.

The exact definition of what constitutes an enlarged tonsil is extremely difficult, and there are very few observers whose findings would agree in a survey of this nature.

TABLE I.—INCIDENCE OF VARIOUS SKIN ABNORMALITIES.

	Mean (per cent.).		Range (per cent.).			
	Boys.	Girls.	Boys.		Girls.	
1. Dry, lustreless skin (with minor deficiency signs) ..	37.49	24.14	10.59 — 62.13	3.31 — 44.66	(Qumbu) (Bochem)	(Qumbu) (Bochem)
2. Well-defined phrynoderma	12.69	8.05	2.63 — 28.71	1.03 — 20.00	(P.M.burg) (Bochem)	(Qumbu) (Bochem)
3. Pellagra-like dermatitis	1.84		nil		14.83	
4. Tropical ulcer	Found in only one area.		(P.M.burg) 12.11		(Bochem) 6.67	
5. Scabies and/or impetigo	13.73	8.91	6.03 — 31.63	3.86 — 20.05	(Pre-toria) (Kentani)	(Pre-toria) (Kentani)

TABLE 2.—THE INCIDENCE OF MOUTH LESIONS.

	Mean (per cent.).		Range (per cent.).			
	Boys.	Girls.	Boys.		Girls.	
1. Stomatitis	18.43	9.61	7.65 — 25.37	2.69 — 15.83	(Qumbu)	(Kentani)
2. Glossitis	6.75	3.77	nil — 13.42	nil — 8.57	(P.M.burg)	(Bochem)
3. Soft, spongy gums	3.16	1.59	1.05 — 8.41	0.21 — 4.52	(P.M.burg)	(Nqutu)
4. Grossly carious teeth	18.65	20.07	8.01 — 35.34	8.87 — 32.61	(Bochem)	(Witzieshoek)
5. Irregular teeth	14.87	11.83	8.14 — 23.16	6.03 — 19.88	(P.M.burg)	(Bochem)

TABLE 3.—THE INCIDENCE OF ABNORMALITIES OF THE TONSILS, CERVICAL GLANDS AND EARS.

	Mean (per cent.).		Range (per cent.).			
	Boys.	Girls.	Boys.		Girls.	
Enlarged and/or septic tonsils	40.98	43.24	24.41 — 57.97	26.03 — 54.03	(Letaba)	(Witzieshoek)
Palpable cervical glands	76.35	70.80	59.32 — 81.17	49.25 — 84.72	(P.M.burg)	(Bochem)
Discharge from one or both ears	3.25	1.70	1.41 — 10.40	0.21 — 5.01	(Nqu u)	(Kentani)

Cervical gland abnormalities were noted by inspection and palpation, the main glands palpated being the anterior group—the superficial and anterior cervical groups, as well as the submaxillary and submental sets.

THE EARS.

The examination of the ears was very cursory, the only item noted being an obvious discharge from one or both ears. Table 3 indicates the incidence of abnormalities noted.

The multiplicity of conditions which might give rise to these conditions cannot be assessed. Their very common occurrence is, however, of assistance in assessing the standard of health of the school-children examined.

THE EYES.

The main lesions diagnosed were blepharitis (including "angular" blepharitis), acute and chronic conjunctivitis,

keratitis, blindness, and strabismus. The mean incidence of children with one or more of these defects was 5.91 per cent., ranging from 1.97 per cent. in Pretoria to 27.51 per cent. in Bochem. There were more children affected in this last area alone than there were in the remaining eight districts combined. The incidence of the various lesions in Bochem were as follows: Purulent blepharitis, 14.83 per cent.; acute conjunctivitis, 00.25 per cent.; chronic conjunctivitis, 7.48 per cent.; complete blindness of one eye, 1.77 per cent.; strabismus, 1.90 per cent.; keratitis and corneal opacity, 12.04 per cent.

The causes of these abnormalities are probably trachoma, syphilis, and deficiency disease, probably of vitamin A and even more likely of the vitamin B2 group. The findings do not indicate that syphilis, even though of common occurrence in Bochem, was the only or even the most important cause.

GOITRE.

Endemic goitre was common in only one area (Witziesshoek), where 13.75 per cent. of boys and 40.23 per cent. of girls were affected.

THE HEART AND LUNGS.

The heart was judged to be diseased in the presence of a diastolic murmur and/or enlargement. The systolic murmur in itself was not assumed to indicate disease. Nineteen children (0.27 per cent.) had a diastolic murmur at either the apex or base, and of these five had clinically detectable enlargement. Heart disease was, therefore, a minor cause of ill-health in the children examined.

Abnormal lung signs (including fine and coarse crepitations, rhonchi and bronchial breathing) were found in a mean percentage of 1.75, ranging from 0.00 in Pretoria to 6.90 in Kentani. They were found to be common in only three districts, namely, Pietermaritzburg, Qumbu and Kentani (2.44 per cent., 3.88 per cent. and 6.90 per cent., respectively). Watkins-Pitchford and Allan concluded in 1924 that the crepitations were caused by an alveolitis resulting from exposure to smoke from open fires in huts.

POSTURAL DEFORMITIES.

1. The mean incidence of the common type of very poor posture and musculature from malnutrition was found to be 31.95 per cent. in boys and 28.93 per cent. in girls, ranging in boys from 10.76 in Pietermaritzburg to 58.66 per cent. in Bochem, and in girls from 11.31 per cent. in Pietermaritzburg to 52.60 per cent. in Bochem.

2. Bony deformities are analysed to indicate the severity of the abnormality. Thus we have the "minor deformities" which did not result in crippling, and those lesions which produced cripple gait or deformity. The former included many cases of knock-knee and bow-leg and, to a less extent, irregular chest shape, sabre tibia, genu recurvatum, skull bossing and enlarged radial epiphyses. There were 83 cases of severe deformity and crippling, an incidence of 1.16 per cent. of all children examined, ranging from 0.54 per cent. in Witziesshoek to 2.05 per cent. in Pietermaritzburg.

The main causes of these abnormalities appear to have been injury (following accidents, burns, etc.), tuberculosis, congenital deformity, rickets, birth trauma, infantile paralysis and syphilis.

ENLARGEMENT OF LIVER AND SPLEEN.

Enlargement of the liver was found in eight districts, the mean percentage incidence for all areas being 12.34 per cent. of boys and 8.79 per cent. of girls, ranging from nil in Witziesshoek to 51.37 per cent. of boys and 34.60 per cent. of girls in Letaba.

Palpable spleens were recorded in only four areas—Pietermaritzburg (1 case), Nqutu (1.41 per cent. boys and 1.07 per cent. girls), Bochem (15.81 per cent. boys and 15.91 per cent. girls), and Letaba (67.38 per cent. boys and 56.83 per cent. girls).

Malaria was no doubt the cause of the enlarged spleens, as these were found to occur in well-known malarious areas. However, it cannot be considered to be the only cause of this condition, for enlargement of the liver was found in non-malarious areas. The possible influence of syphilis and Bilharzia may be discussed, but it is felt that even these three diseases are not the whole explanation of this condition, and that further research into the influence of various specific food-deficiency states would be of interest.

HÆMOGLOBIN ESTIMATIONS.

These were carried out with a "Sicca" hæmometer with lighting suitably adjusted for a 6-volt battery. Readings were made in all areas with the exception of Pretoria, the mean percentage hæmoglobin being 88.40 per cent. in boys and 87.75 per cent. in girls, ranging from 83.62 per cent. (Kentani) to 99.31 per cent. (Pietermaritzburg) in boys, and 82.57 per cent. (Kentani) to 97.16 per cent. (Pietermaritzburg) in girls. In no area was a significant difference noted in the readings for boys and girls.

INTESTINAL PARASITIC INFECTION.

Specimens of fæces were examined from a random sample of children in all areas. While there is a very interesting group of differences in the types of parasitic infestation in the children of the various areas, the high incidence of one or other infestation is an indication of serious defects in the disposal of excreta and refuse, more particularly human excreta. The mean percentage incidence of specimens in which one or more abnormalities were reported was 26.68, ranging from 9 per cent. in Bochem to 36.71 per cent. in Pretoria.

Table 5 summarises the main incidence of the various parasites in the areas in which they were common.

EXAMINATION OF URINE.

Urine specimens were examined in six of the nine districts, Qumbu, Kentani, Pietermaritzburg, Nqutu, Letaba and Bochem. The incidence of urinary Bilharzia as judged by our findings was as follows: Qumbu, nil; Bochem, 3.35 per cent.; Nqutu, 8.46 per cent.; Pietermaritzburg, 13.25 per cent.; Kentani, 28.57 per cent.; Letaba, 70.72 per cent.

Chemical tests for the presence of albumen, sugar and acetone were also carried out. The incidence of albuminuria generally paralleled that of Bilharzia. Sugar was found in five of the six areas, ranging from 1.28 per cent. in Pietermaritzburg to 13.82 per cent. in Letaba. Acetonuria was confined to the Letaba area, in which 6.54 per cent. of specimens were positive. These findings may be related to liver damage.

SYPHILIS.

The Wassermann reaction was determined by the South African Institute for Medical Research on specimens taken from random samples of children in each area. Table 6 indicates the incidence of children with a positive Wassermann of all those tested.

TABLE 5.—SUMMARY OF INCIDENCE OF VARIOUS INTESTINAL PARASITES FOUND IN SPECIMENS OF FÆCES EXAMINED.

	Nil.	Present but less than 10 per cent.	10–19.9 per cent.	20.29 per cent.
<i>Schistosoma mansoni</i>	8 areas	—	—	Letaba.
<i>Schistosoma hæmatobium</i>	8 areas	Letaba	—	—
<i>Ascaris lumbricoides</i>	5 areas	Nqutu, Pretoria, P.M.burg.	—	Kentani.
<i>Tænia</i>	2 areas Witziesshoek, Letaba.	7 areas	—	—
<i>Hymenolepis nana</i>	4 areas	Bochem, P.M.burg, Nqutu	Bloemfontein	Pretoria.
<i>Oxyuris vermicularis</i>	6 areas	Nqutu, Witziesshoek, Pretoria	—	—
<i>Trichuris trichiura</i>	7 areas	P.M.burg, Pretoria	—	—

TABLE 6.—THE INCIDENCE OF SYPHILIS AS DETERMINED BY THE WASSERMANN REACTION.

Districts arranged in order of Increasing Frequency.	Percentage of Children with Positive Wassermann Reactions.
Letaba	4.76
Witzieshoek	10.67
Qumbu	11.34
Pretoria	13.85
Pietermaritzburg	15.24
Nqutu	30.44
Kentani	35.90
Bloemfontein	42.50
Bochem	46.38

The following figures indicate that there is no difference in incidence between total urban and rural groups examined:

Urban (Pretoria, Pietermaritzburg and Bloemfontein): 59 out of 250 blood specimens tested gave ++ or + positive Wassermann reactions. Incidence, 23.60 per cent.

Rural (Witzieshoek, Qumbu, Kentani, Nqutu, Bochem and Letaba): 132 tests of 567 gave ++ or + positive Wassermann reactions. Incidence, 23.28 per cent.

It may be reasonably concluded that the rural communities are as much a reservoir of the disease as are the towns.

Clinical Index.—A modification of the Dunfermline scale was used, and the following figures indicate the incidence of children who were considered to be in excellent condition:—

Boys 1.26 per cent. (ranging from 0.2 per cent. Kentani to 2.4 per cent. Pietermaritzburg).

Girls 1.87 per cent. (ranging from 0.3 per cent. Kentani and Letaba to 4.8 per cent. Qumbu).

Somatometric Findings—Comparison of Bantu and White Children.

1. Bantu boys are significantly lighter than white boys. In the 9-year-old group the Bantu are 19.4 per cent. lighter, and in the 14-year-old group 21.2 per cent. lighter than the white boys.

2. Bantu girls are also significantly lighter by 18.67 per cent. in the 9-year-old and 13.30 per cent. in the 14-year-old group.

3. Bantu boys are significantly shorter than white boys by 6.53 per cent. in the 9-year-old group and by 7.42 per cent. in the 14-year-old group.

4. Bantu girls are significantly shorter than white girls by 6.87 per cent. in the 9-year-old group and by 5.58 per cent. in the 14-year-old group.

5. Environmental factors such as nutrition and preventable diseases are at least as important as hereditary factors in determining the size of children.

Comparisons between Bantu Children of Six Different Areas (Pietermaritzburg, Nqutu, Qumbu, Pretoria, Bochem and Kentani).

1. Two relatively "good" areas, Pietermaritzburg and Nqutu: *Boys*: The difference between heights are not significant. Nqutu boys are slightly but not significantly lighter than the Pietermaritzburg boys. *Girls*: The difference for both height and weight are not significant, but the Nqutu girls are lighter than the Pietermaritzburg girls by more than the Nqutu boys are lighter than the Pietermaritzburg boys.

2. A relatively "good" area compared with a bad area—Pietermaritzburg compared with Bochem: *Boys*: The Pietermaritzburg boys are taller, but this is not significant statistically. Bochem boys are lighter, significantly so in five out of eight age-groups, than the Pietermaritzburg boys. *Girls*: The Bochem girls are shorter, significantly so in five out of eight age-groups. They are lighter than the Pietermaritzburg girls in all the age-groups studied.

An adverse environment therefore appears to affect girls in both height and weight, while in the case of boys its effect appears to be more evident in regard to weight.

Comparison of Height and Weight of Bantu Boys and Girls in Six Areas.

Boys: Up to the age of 9 the boys from the five other areas (Pretoria, Qumbu, Bochem, Kentani and Nqutu) are taller than those in Pietermaritzburg. After this age those in Bochem, Pretoria and Kentani are much shorter. Qumbu fluctuates and Nqutu is about the same in height. Up to 10

years Qumbu boys, and up to 9 years Nqutu boys, are heavier than those in Pietermaritzburg; Bochem, Kentani and Pretoria are lighter at all ages. Qumbu figures fluctuate, again probably from errors of sampling.

Girls: Girls are shorter in four districts (Nqutu, Kentani, Pretoria, Bochem) than the Pietermaritzburg standard.

In the case of girls, those in three districts (Pretoria, Bochem, Kentani) are shorter in all the age-groups. Those in Qumbu are a little taller up to 8½ years, while Nqutu is, in general, very close to the Pietermaritzburg level.

In regard to weight, the Qumbu girls are heavier up to 9½ years. The girls in all the other districts are lighter, especially in Pretoria, Kentani and Bochem, as is also the case with the boys.

For purposes of comparison with these somatometric findings Table 7 is included. It indicates the number of children in each area who had at least one clinical abnormality (tonsil enlargement, palpable cervical glands and all laboratory findings are excluded from this analysis).

TABLE 7.—THE PERCENTAGE OF CHILDREN WITH OBVIOUS SIGNS OF ILL-HEALTH AND/OR MALNUTRITION.

Area.	Obvious Ill-health and/or Malnutrition.	
	Boys (per cent.).	Girls (per cent.).
Pietermaritzburg	44.51	42.97
Qumbu	55.75	50.10
Nqutu	57.39	50.63
Pretoria	72.13	60.69
Kentani	78.99	70.50
Bloemfontein	76.81	75.60
Witzieshoek	77.87	80.75
Bochem	88.80	84.19
Letaba	90.43	83.60

It will be noted that the contrast between a relatively good area such as Pietermaritzburg and a relatively poor area such as Bochem, regarding the height and weight, is also noticeable in the incidence of abnormalities detected clinically. It may, therefore, be reasonably assumed that the state of health and nutrition of the children examined bore a close relationship to their physical development.

CONCLUSIONS.

The main specific nutritional deficiency signs noted were those related to the vitamin A and B groups. Rickets and endemic goitre were less frequently seen. There is considerable evidence that ariboflavinosis is a prevalent deficiency disease among the Bantu of this country. Pellagra and pellagra-like disease among the Bantu are on the increase, and are already a major nutritional and public health problem in this country.

The thin, round-shouldered, flat-chested, pot-bellied child with spindly legs was such a common sight that it can only be concluded that many were on the borders of starvation. The problem is thus not only one of providing this or that particular food factor, but rather a need for a general increase of all foodstuffs which will tend to build up a healthy Bantu population, averting starvation as well as the many more specific deficiency diseases.

Diet deficiency diseases, syphilis, malaria, bilharzia, tuberculosis, scabies and impetigo, preventable crippling, and many other less severe or less common diseases, form no small array of factors which are contrary to the maintenance of good health and nutrition. No amount of juggling can succeed in separating the influence of one as opposed to the others where they so commonly occur together. The outstanding fact is that they are all preventable.

We wish to thank the Secretary for Public Health, under whose direction the survey was carried out; also Dr. H. S. Gear, Deputy Chief Health Officer, Union Health Department, Pretoria, for guidance and help.

Dr. Carel Johannes du Toit, M.B., Ch.B. (Cape), D.T.M. and H., has been appointed full-time additional Assistant Medical Officer at the Native Hospital of the West Rand Consolidated Mines, Limited, and the Luipaards Vlei Estate and Gold Mining Company, Limited, with effect from the 1st March, 1944, *vice* Dr. P. M. Goedvolk, who has resigned.