A NUTRITIONAL ASSESSMENT OF PEDI SCHOOLCHILDREN*

P. M. LEARY, M.D. (CAPE TOWN), D.C.H. (R.C.P. & S., ENG.), D.A. (R.C.P. & S., ENG.), D. OBST. R.C.O.G.,
Department of Child Health, University of Cape Town and Red Cross War Memorial Children's Hospital, Rondebosch, CP

In a previous communication[1] it was noted that few surveys of the nutritional status of *rural* Bantu schoolchildren had been reported. In the course of their comprehensive survey (1938 - 1939) Kark and Le Riche[2] visited 6 rural areas, and a detailed study was made of the nutritional status of a large number of children. A high incidence was reported of the clinical signs usually associated with malnutrition, and a vivid picture painted of the 'thin, round-shouldered, flat-chested, pot-bellied child with spindly legs . . . on the borders of starvation'. Results of more recent surveys have been reported by Emily Kark[3] and by Walker.[4]

The recent extensive and comprehensive nutrition status surveys conducted on urban schoolchildren in Pretoria have stressed the need for similar data to be obtained from rural Bantu schoolchildren. This paper reports the clinical nutritional assessment of 301 Pedi schoolchildren examined in the course of an anthropometric and clinical survey conducted during August and September 1965. The geographical and cultural background, mean anthropometric findings, serum protein figures and menarchal age of these children have already been described, as has the statistical method in which a representative sample was selected from the more than 6,000 children attending schools in this area.[3]

METHOD OF CLINICAL EXAMINATION

Immediately after taking anthropometrical measurements, a brief full clinical examination was conducted, the aim being to detect any obvious signs of acute or chronic disease which might act as a conditioning factor. Special emphasis was then laid on the detection of physical signs usually regarded as suggestive of general or specific dietary deficiency. The proforma used to record results was based on that suggested by Joliffe,[5] modified in the light of local experience.

Deformities

Special attention was paid to possible signs of old rickets, such as Harrison's sulcus or bow-legs. Winged scapulae, deformities of the chest and spinal column, malunited fractures and obvious congenital abnormalities were noted.

Lips

A common finding among pellagrins attending the hospital and clinics in Sekhukhuniland is a bright red patch of desquamation and depigmentation on the lower lip. Gillman and Gillman[6] draw attention to this sign and also note that angular stomatitis is very common in chronically malnourished infants. The presence of angular stomatitis, cheilosis and scaling of the lips was noted.

Teeth

There was insufficient time to make a detailed search for caries, using a probe. Hence, caries was only recorded as present when it was obvious and therefore fairly gross. The presence of chalky patches and brown discoloration, suggesting fluorosis, was also noted.

Gums

A careful inspection was made of the gums of each child, with special attention to sponginess, hypertrophy of interdental papillae, bleeding on pressure with a spatula, retraction of alveolar margins and pyorrhoea.

Mouth

The presence of ulcers and inflammation was sought. The state of the ostia of the parotid ducts was noted.

Tongue

The appearance of the tongue was noted with special reference to colour, the presence of coating, abnormal smoothness and tooth indentations along the edges.

Throat and Tonsils

An inspection was made of the tonsils for evidence of enlargement or infection. The presence of postnasal drip and pharyngeal inflammation was noted.

Parotid Glands

The size of the parotid glands was assessed looking at the patient full face. Enlargement of the glands was noted. Palpation was found to be an unreliable way of assessing the extent of the soft enlargement of the glands in some children.

Lymph Glands and Thyroid

After inspection of the throat and tonsils, the triangles of the neck were palpated for glands. Only when there was clinically significant enlargement was this recorded. At the same time the size of the thyroid was assessed. Multinodular goitre is common among middle-aged women in certain parts of Sekhukhuniland, and a number of adolescent girls have been seen at the hospital clinics who had significantly enlarged thyroid glands. These observations suggest a low soil iodine content.[7]

Eyes

Extensive eye surveys have been conducted in Sekhukhuniland and the incidence of trachoma has been reported as 94%.[8] Trials of trachoma vaccine are still in progress. For this reason, a detailed examination of each child's eyes was not undertaken. Obvious lesions were noted and a careful examination was made for xerophthalmia and 'Bitot's spots'.

Skin

The state of the skin was assessed by inspection and palpation. Skin abnormalities were classified under the following headings:

(*i*) *Oedema.* 'Pitting' of the subcutaneous tissue on pressure over bony prominences such as the ankle malleoli.

(*ii*) *Xerosis.* Dryness of the skin with crinkling and 'crazy paving' effect but without desquamation.

(*iii*) *Follicular hyperkeratosis.* The lesion resembles 'goose-flesh' but persists when the skin is warmed by rubbing. The 'goose pimples' consist of keratotic plugs projecting from hair follicles and are easily palpable.

(*iv*) *Perifolliculitis.* Areas of capillary congestion around hair follicles with swelling and enlargement of the follicles.

(*v*) *Acne.* Pustules and enlarged comedones on the face, chest and back.

(*vi*) *Impetigo.* Infected lesions usually associated with crusted scabs.

(*vii*) *Pellagra lesions.* These are symmetrical and found on exposed parts of the body such as the face, neck, arms and legs. Most commonly seen in Sekhukhuniland are hyperpigmented areas on the forearms and the backs of hands. These desquamate, leaving hypopigmented areas. Occasionally, more sophisticated patients attend the hospital clinics complaining of 'sunburn'. On examination, the early erythematous lesions of pellagra are found. Hyperpigmented areas and areas of desquamation are also commonly found in the malar area of the face and on the anterior surface of the neck (Casal's necklace). The cutaneous bullae described by Gillman and Gillman[6] were not seen in Pedi children, and in-

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fection and ulceration of the desquamating areas are not common.

Abdomen

At this stage of the examination the child was asked to lie down on a small mat placed on the floor. The abdomen was palpated with special reference to enlargement of the liver and the spleen.

Reflexes

The examination was completed by eliciting the knee and ankle reflexes.

RESULTS

The incidence of each clinical sign found is recorded in Tables I and II.

Deformities

An easily recognizable deformity was found in 4·3% of the children. These were far more common among the boys, perhaps reflecting their more adventurous approach to life.

Lips: Cheilosis, Angular Stomatitis and Scaly Lips

The first two signs were extremely rare, and no girl was seen with angular stomatitis. Roughly one-third of both boys and girls showed scaling of the lips.

Teeth

Six per cent of the children had obvious caries, and more girls than boys had bad teeth. Prevalence was not influenced by age. Twenty-six per cent of the children had chalky patches or brown staining of their teeth, suggestive of fluorosis. These signs were found more commonly in the younger age-groups.

Gums

Pyorrhoea was rare, and gums which bled on pressure with a spatula were uncommon. Hypertrophic interdental

TABLE I. CLINICAL SIGNS—BOYS*

Sign	Age in years									% of total number of boys
	7	8	9	10	11	12	13	14	15	
Deformity	11·8	10·5	10·5	5·3	7·7	5·6	5·6	5·9		7·1
Cheilosis	5·9	5·3	5·3			11·1	5·6		6·2	4·5
Angular stomatitis			5·3	5·3						1·3
Scaly lips	23·5	47·4	15·8	31·6	46·2	33·3	50·0	70·6	43·8	39·7
Caries	17·6		5·3			5·6		5·9	6·2	4·5
Fluorosis	35·3	31·6	57·9	21·1	23·1	22·2	11·1	23·5	12·5	26·9
Hypertrophic papillae	35·3	47·4	47·4	78·9	46·2	61·1	44·4	41·2	37·5	49·4
Bleeding gums		10·5	5·3	5·3	7·7					3·2
Pyorrhoea				10·5						1·3
Glossitis		10·5		10·5	7·7		11·1	5·9	6·2	5·8
Throat infections										
Parotid gland enlargement	5·9	21·1	15·8	31·6	23·1	27·8	27·8	23·5	6·2	20·5
Lymph gland enlargement	5·9		10·5				11·1	11·8		4·5
Thyromegaly			5·3							0·6
Eye lesions		5·3		10·5			5·6		6·2	3·2
Xerosis	58·8	78·9	63·2	73·7	46·2	38·9	55·6	47·1	26·3	55·8
Follicular hyperkeratosis	23·5	5·3	15·8	21·1	38·5	33·3	27·8	52·9	26·3	26·9
Hyperpigmentation				10·5	15·4	22·2		17·6		7·1
Impetigo	11·8		10·5	10·5		5·6	5·6	11·8		6·4

* Findings expressed as percentages of the total numbers in each age-group.

TABLE II. CLINICAL SIGNS—GIRLS*

Sign	Age in years									% of total number of girls
	7	8	9	10	11	12	13	14	15	
Deformity	—	11·8	—	—	—	—	—	—	—	1·4
Cheilosis	—	—	5·6	—	—	—	—	—	—	0·7
Angular stomatitis	—	—	—	—	—	—	—	—	—	—
Scaly lips	15·4	29·4	46·2	33·3	40·0	33·3	29·4	52·9	50·0	35·2
Caries	23·1	5·9	11·1	13·3	6·7	—	—	5·9	8·3	7·6
Fluorosis	23·1	41·2	27·8	40·0	33·3	23·8	17·6	5·9	8·3	24·8
Hypertrophic papillae	7·7	52·9	38·9	46·7	40·0	28·6	47·1	58·8	41·7	40·7
Bleeding gums	—	5·9	—	—	—	—	5·9	5·9	—	2·1
Pyorrhoea	—	—	5·6	—	—	—	—	—	—	0·7
Glossitis	—	5·9	11·1	—	6·7	—	5·9	5·9	25·0	6·2
Throat infections	—	—	—	—	6·7	—	—	—	—	0·7
Parotid gland enlargement	—	17·6	16·7	13·3	—	14·3	—	11·8	—	9·0
Lymph gland enlargement	—	—	—	6·7	—	—	—	—	—	0·7
Thyromegaly	—	—	—	—	—	—	—	—	—	—
Eye lesions	—	—	—	—	—	4·8	—	—	8·3	1·4
Xerosis	30·8	35·3	44·4	53·3	40·0	38·1	41·2	23·5	8·3	35·9
Follicular hyperkeratosis	15·4	29·4	22·2	—	20·0	—	29·4	17·6	8·3	15·9
Hyperpigmentation	7·7	5·9	5·6	—	6·7	4·8	—	—	—	3·4
Impetigo	—	5·9	11·1	13·3	6·7	—	—	5·9	8·3	5·5

* Findings expressed as percentages of the total numbers in each age-group.

papillae, on the other hand, were very common and found in all degrees, from slight heaping of the apices of the mucous membrane between the teeth to a general spongy overgrowth of the gingivae around the teeth.

Tongue

Glossitis was present in 6% of the children and in all cases took the form of smoothness of the tip and sides of the tongue and sometimes of the anterior portion. The 'raw beef' tongue of pellagra and the 'magenta tongue' said to suggest riboflavin deficiency[5] were not seen, and none of the children classified as having glossitis showed any evidence that the tongue was painful or tender.

Throat Infections

In only one child were the tonsils regarded as the site of active infection.

Parotid Gland Enlargement

This was always bilateral and found in far more of the boys (20·5%) than of the girls (9%). It is possible that the incidence of enlargement in girls is actually greater than recorded, as the over-all thicker layer of subcutaneous fat may have masked parotid enlargement.

Lymph Glands

Significant enlargement of cervical lymph glands was uncommon. The incidence in boys (4·5%) is again greater than in girls (0·69%).

Thyroid

Only one child, a 9-year-old boy, had a palpably enlarged thyroid gland.

Eyes

The signs of trachoma, 'sago grain' follicles on the palpebral conjunctiva, and corneal pannus, were disregarded. Two children had squint. One child had deformed eyelids, partly as a result of bilateral tarsectomies. Four children had corneal leucomata. Purulent conjunctivitis, Bitot's spots and xerophthalmia were not seen.

Skin

(*i*) *Oedema.* There were no children with pitting oedema.

(*ii*) *Xerosis.* This was an extremely common finding. In almost all cases the skin over the anterior surface of the legs was affected. Xerosis was occasionally seen on the forearms and face, but not on the thighs or parts of the body normally covered by clothing. The lesion was more prevalent among boys (55·8%) than among girls (35·9%). It was especially common in the younger boys.

(*iii*) *Follicular hyperkeratosis.* This lesion was again far commoner in boys. It was found on the posterior and lateral aspects of the upper arms, over the shoulders and scapulae and, less frequently, on the fronts of the thighs. In most cases it was of moderate degree, with hypertrophy of hair follicles but little keratosis. In contrast to xerosis, follicular hyperkeratosis was relatively more frequent among the older boys.

(*iv*) *Perifolliculitis.* None of the children was found to have this lesion.

(*v*) *Acne.* A few of the older children had pustules and follicular plugging on their faces, but the incidence was low, consistent with the finding that the majority had not reached puberty.

(*vi*) *Impetigo.* The incidence of septic impetigo was 6·4% of boys and 5·5% of girls. Among these children lesions were common on the head and legs. Pediculosis was not seen.

(*vii*) *Pellagra.* Lesions of overt pellagra were not seen. Of the children examined, 5·3% showed blotchy areas of skin hyperpigmentation. These were commonly found on the neck and shoulders and may have been evidence of early pellagra. However, these areas were not associated with tenderness or irritation and were found in areas normally covered by clothing in some of the children.

Heart and Lungs

Soft systolic murmurs, thought to be 'functional' in aetiology, were heard in a number of children but not recorded. No pathological murmurs were heard. None of the children had clinical evidence of lung pathology.

Abdominal Viscera

Clinical enlargement of the liver or the spleen was not found in any of the children. No other abdominal masses were detected.

Reflexes

All the children had normal knee and ankle reflexes.

DISCUSSION

In 1951 the joint FAO/WHO Expert Committee on Nutrition discussed the problems of clinical assessment in nutrition surveys and recommended that specific schedules be drawn up for a given area, based on previous clinical experience of malnutrition in that area. Signs looked for included most of those mentioned in WHO Technical Report No. 258[9] as being of known value in nutrition surveys. Table I shows that among Pedi boys, scaly lips, xerosis, follicular hyperkeratosis and parotid gland enlargement occurred with some frequency. The incidence of all these signs among girls was lower (Table II). Changes in tooth enamel, suggestive of fluorosis, occurred with the same frequency in both sexes. The incidence of caries was low.

Doubtful Validity of Signs

Thomson and Duncan[10] noted that the Carnegie United Kingdom dietary and clinical survey failed to demonstrate what clinical signs were indicative of poor nutrition in children not suffering from starvation or outright deficiency. WHO Technical Report No. 258, mentioned above, states that clinical examination is the essential part of all nutritional surveys, but goes on to list the difficulties and shortcomings of a clinical assessment of nutritional status. The most significant of these causes for error is the fact that so many of the clinical signs generally accepted as being indicative of a nutritional deficiency are, in fact, non-specific, and may be found in well-nourished subjects. For example, glossitis, angular stomatitis and cheilosis may result respectively from syphilitic infection, dental malocclusion and exposure to wind and cold in subjects whose diet is accepted as optimal. Conversely, subjects in whom results of somatometry, biochemical investigations and dietary questioning suggest a very poor level of nutrition may yet have none of the clinical signs attributed to malnutrition. Standard *et al.*[11] provide support for this argument in their study of Jamaican children.

Reference has already been made to this.

When clinical findings from various nutrition surveys are compared, allowance must be made for bias on the part of the observer. The recording of general impressions, with subsequent classification into wide groups, as in the 'Dumfermline scale', is particularly open to inaccuracy due to lack of objectivity on the part of even experienced examiners. Brock and Latsky[12] found the Tuxford index unreliable in the Cape nutrition survey. Subjective variation in the interpretation of more specific signs of malnutrition is also found. Kark's[3] report of a 100% incidence of skin lesions in Durban Bantu may be cited as an example of criteria which are probably too strict. Further difficulty arises in clinical assessment because deficiences of two different essential nutrients may produce the same physical finding. Glossitis may result from both nicotinic acid deficiency and ariboflavinosis.

Significance of Pedi Clinical Signs

Clinical findings among the Pedi children should be considered against this background. The weight of 39·5% and the height of 33·2% of these children are below the corresponding Boston third percentile. It has been accepted that this indicates that the children as a group are undernourished.[1] The incidence of clinical signs should provide further confirmation of this, but critical analysis of the signs found raises doubts about their validity; the two signs with the greatest frequency—xerosis and scaling of the skin of the lips—may not be directly related to dietary defects.

The survey was conducted during the winter, when the atmosphere of the Transvaal is dry. *Winterhande* (dryness and cracking of the skin of the hands) and chapped lips are not uncommon among well-nourished Whites living in the area. The anterior surface of the legs was by far the commonest site in which xerosis was found. As shoes and socks are seldom worn, exposure to the dry, cold atmosphere, and probably to open fires in the evenings, provides a ready explanation for this lesion. Xerosis has been linked with follicular hyperkeratosis, xerosis conjunctivae, keratomalacia and Bitot's spots as signs of vitamin-A deficiency.[5] In this survey, follicular hyperkeratosis was again a physical sign found with some frequency. However, the incidence was less than half the incidence of xerosis, while the eye signs of vitamin-A deficiency were conspicuously absent. Abbott *et al.*[13] have suggested an association between vitamin-A deficiency and a relative lymphocytosis. If this is true, the increased proportion of lymphocytes found in the majority of blood smears examined in this survey may have some relevance when considered together with xerosis and follicular hyperkeratosis as pointers towards vitamin-A deficiency. While the dietary evidence for a deficiency of vitamin A is strong, the clinical findings are equivocal. Biochemical studies of vitamin-A levels in Pretoria Bantu children have shown no evidence of significant vitamin-A deficiency.[14]

While few children had gums which bled on pressure with a spatula, hypertrophy of interdental papillae was a common finding. The significance of this physical sign is again debatable. The presence of spongy, bleeding gums is an accepted clinical sign of ascorbic acid deficiency and is often associated in this condition with perifollicular haemorrhages, petechiae, intramuscular and subperiosteal haematomata and haematuria.[5] None of the lastmentioned signs was present. Walker[4] has commented on the virtual absence of scurvy among young Bantu. In his series he found satisfactory levels of ascorbic acid. At Jane Furse Hospital the occasional case of scurvy is diagnosed, but the condition is uncommon, probably due to the popularity of *merôgo* in the diet. This spinach may contain as much as 32·9 mg./100 G of ascorbic acid. Ascorbic acid deficiency seems an unlikely cause for the gum changes found. There is little evidence for an infective cause, and the incidence of pyorrhoea is low. The sign must be regarded as non-specific if, indeed, it is of any significance at all in the assessment of nutritional status.

Parotid gland enlargement in association with malnutrition was first noted by Kenawy.[15] Gillman and Gillman[6] have recorded that it was frequently seen in malnourished Bantu on the Witwatersrand, often in association with pellagra. They felt that it was presumptuous to ascribe the lesion to a specific dietary deficiency, but that it was one facet of the more general alterations in metabolism which occur in the malnourished subject. Du Plessis[16] has described parotid gland enlargement in a number of subjects with malnutrition secondary to a lesion of the gastro-intestinal tract. In one of his cases, correction of the malnutrition led to a rapid return of the glands to normal size. Among severely malnourished patients admitted to Jane Furse Hospital, parotid enlargement is often noted for the first time only a number of days after the patient has been placed on a balanced hospital diet. This has been noted by others and is said to be especially related to a high bread intake.[16]

In the present survey, 20·5% of the boys and 9% of the girls had parotid enlargements. A male preponderance of this sign has been noted previously.[6,15,16] The prevalence of this sign in association with low mean height and weight, but absence of unequivocal signs of avitaminosis, lends support to the theory of Gillman and Gillman that parotid enlargement is part of the general metabolic disturbance following malnutrition. On the other hand, the staple diet of the children included in the survey is maize-meal porridge eaten at bread-like consistency. Parotid enlargement may be associated with this.

The incidence of other clinical signs indicative of deficiency was so low as to be of little significance in the general assessment of the nutritional status of the children.

Cervical lymph gland enlargement was very rare. At Bochem, Kark[2] reported a very high incidence of this sign, as did Brock and Latsky[12] in the course of the Cape nutrition survey. These authors were reluctant to ascribe this finding to malnutrition, but felt that an association must be present. The absence of this finding among undernourished Pedi children suggests that this association is not inevitable. In the dry winter atmosphere of Sekhukhuniland, upper respiratory tract infections are less common than in the urban areas and at the coast. This may well account for the infrequency of enlarged cervical glands.

CONCLUSION

In summary, clinical examination in the present survey was of value in that it showed no evidence of gross cardiac, pulmonary, abdominal or neurological pathology among the children examined. The high incidence of mottled tooth-enamel suggests that fluoride is present in the local

water supplies, with the resulting low incidence of dental caries. Doubt is entertained about the significance in nutritional assessment of the other clinical signs recorded, as they lack specificity. Where a specific deficiency disease is present, the recognized clinical signs may be diagnostic. When a survey is being made of healthy children, it is debatable whether the incidence of unrelated signs contributes more information about their nutritional status than can be deduced from height and weight recordings.

SUMMARY

In the course of an anthropometric and clinical survey of Bantu schoolchildren living in a rural Reserve, the incidence was noted of physical signs suggestive of general or specific dietary deficiency. Findings are reported, and the validity of the so-called clinical signs of nutritional deficiency discussed. It is felt that these signs are of little value in surveys such as the one reported.

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