Comparison of Nutritional Results of Clinic Based and Village Based Weighing Programs*

by

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Abstract

1. Weighing programs for young children, whether based in clinic or the village, run by health professionals or trained laymen, give comparable results to improve child nutrition.

2. When carried out in the village, participation of village mothers, particularly the poor and underserved is far more likely to give greater coverage to this nutritional activity.

3. In view of the drop in percent standard weight during the first year of life greater attention should be placed on this period in all nutrition programs.

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4. In addition to weighing each month, the village Taman Gizi where mothers prepare and feed a nutritious meal to their children is a useful educational device and should be encouraged in all villages. Government assistance in establishment of Taman Gizi is desirable but should, from the outset, require a level of participation by the community that will eventually result in total self-reliance in this activity.

5. Distribution of dried milk powder which can be used in child feeding bottles should be discontinued both in the health center and the village. Dried milk mixed with a cereal would be an acceptable food supplement to offer to children not gaining weight in clinic or village programs.

6. The basic elements of a national nutrition program should include:
   a. monthly weighing and the use of KMS as a communication and motivation tool for mothers,
   b. communal preparation of food and other educational activities in a Taman Gizi aimed at behavioral change to bring about greater attention to feed more and better food to children, especially under two years age, and,
   c. participation and independence of the community should be stimulated from the outset, not only to make the program more affordable but also to assure its continuation in the village.

causes or from complications of spinal cord compression, resulting from atlanto — axial dislocation or thoracic kyphosis (Spranger et al., 1974).

Progression of the deformities is usually arrested as growth is completed; however, with age, degenerative changes and arthritis in the joints might develop.

There is no specific treatment. Surgical correction of deformity should be undertaken only after careful evaluation and analysis. Pain and difficulty in walking should be the only indications for operative intervention (Tachdjian, 1972).

However Spranger et al. (1974) and Lipson (1977) suggest fusion of the posterior upper cervical spine as a routine procedure in patients with Morquio’s disease to correct the atlanto-occipital instability resulting from hypoplasia of the odontoid process and ligamentous laxity. In this way the compression of the spinal cord may be prevented.

Lipson (1977) reviewed 11 cases of Morquio’s disease and found that they were at risk for acute traumatic quadripareisia, chronic myelopathy of a variable and often rapid rate of progression, and sudden death by respiratory arrest.

To our opinion fatigue and trembling of the extremities are the early signs of compression of the spinal cord and are already indications for operation. Two of our cases were already paralysed; the one with tetraparesis had been operated upon and a posterior cervical fusion was made resulting in improvement of the paresis.

Acknowledgement

The authors are grateful to Padmo Santijojo M.D. from the Department of Neurosurgery, Oen Liang Hie, M.D. from the Department of Biochemistry and Chehab Rukmi Hilmi M.D., from the Department of Orthopedic Surgery for their close cooperation and generous assistance in managing these cases.

REFERENCES


4. PENNOCK, C.A.: A review and selection of simple laboratory methods used for the study of glycosaminoglycan ex-
Limitation of motion, especially of extension of the knees due to the bony deformity of the epiphyses, as recorded in all of our cases. There was no hypermobility of the joints as stated by Tachdjian (1972). The hands and feet were short, with broad digits. The gait was waddling (case I, II and IV).

The distinctive rontgenographic features of Morquio's disease are due to defective conversion of cartilage to mature bone and are manifested as deformities of the spine and the epiphyses of long bones.

The vertebral bodies in the thoracic and lumbar regions are flattened (platyspondyly) with irregular and defective upper and lower surfaces, which tend to approximate each other anteriorly, forming a central projection or tongue (Kozlowski, 1974). The intervertebral discs are narrower than normal, although, in early cases, they may appear widened. There is odontoid hypoplasia and signs of atlanto-occipital instability (Spranger et al., 1974 and Lipson 1977).

All of our cases have platyspondyly and odontoid hypoplasia. Diagnostic measures include radiograms of the cervical spine in flexion, neutral position and extension. Lateral rontgenogram of the cervical spine in neutral position, an antero-posterior projection of the skull and the upper cervical spine-Water's projection with open mouth-failed to show the odontoid process in all cases.

It was said that the epiphyses of the long tubular bones are irregularly ossified, with the centre of ossification appearing as triple foci that gradually fuse. As a result, they are broad and flattened (Tachdjian, 1972). There are conically shaped bases of the second through fifth metacarpals (Spranger, 1974).

As was said before, changes in the skull, if any, are minimal, and the facial bones develop normally.

The possibility of antenatal diagnosis by amnio-centesis, fetoscopy or ultrasound should be remembered (Kozlowski, 1976).

Elevated urinary excretion of keratan sulphate and chondroitin-6-sulphate in children has a diagnostic value (Spranger et al., 1974; Spranger and German, 1967). There is also abnormally coarse inclusion in peripheral granulocytes (Spranger et al., 1974).

We did the Mucopolysaccharide suchtet as Spranger and German (1976) did, to show the quantitative mucopolysaccharide in the urine. It is a modification of the Barry and Spinager method. Some tests which demonstrate the increased keratan sulphate excretion in Morquio’s disease was done by Pedrini, Pennoch, Di Ferrante, Robertson and Harry with different methods (Spranger and German, 1967).

Patients may reach their sixties. They frequently die from cardiopulmonary feeding for their child and daily attention is encouraged to result in a more rapid gain in body weight.

The aim of this study was to compare the nutritional impact of weighing programs carried out in the Health Center and in the village either by trained health worker or the mothers themselves as Kader Gizi. In the MCH center, weighing and advice are given by a professional worker usually mid-wives, providing face-to-face education and usually the additional provision of dried skim milk, a World Food Program contribution which is used predominantly to encourage attendance at the clinic. In the village, the PLKB who has received only passing training in nutrition and child care, plays a facilitating role in the weighing activities. She provides specific advice as directed from the Health Center, and in addition in some cases may provide to selected undernourished children, small amounts of WFP dried skim milk. In addition, she encourages the regular gathering of mothers to prepare a nutritious meal in the setting of one village home, called the Taman Gizi. At least in the initial stages, the cost of the food for Taman Gizi is paid for by the government with the hope that this will continue as an independent village effort.

Kader run weighing programs are by far the most economical, being run by volunteer women of the village who have been trained by the Health Center staff in weighing, filling the weight-chart, specific nutritional instruction, and or-
ganizing and running their own Taman Gizi based on money or food materials raised from amongst the community itself. No free food or milk is provided. The extremely low cost of this approach makes it affordable virtually universally.

The purpose of this study is to compare the results of these three approaches to nutritional improvement and to investigate which appears to be the most cost-effective way of providing nutritional and well baby services to large, village populations.

Materials and Methods

The study was based in villages in Kawedanan, Karangkobar, Kabupaten Banjarrengar, Central Java during late 1978. The area is mountainous, dry land and classed as a poor area in a poor kabupaten. In 1976, the daily per capita income was estimated at Rp. 32, 25% are illiterate and only 13% have attended schools beyond primary school. The vast majority are farmers, eating cassava and corn as their main diet. Many must eat kana (garut) as a substitute for the basic food when harvests are low. A 1976 IPB survey showed that average calorie intake was 1900 calories per day and protein 25 grams of which only one was animal protein. (Suwanda, 1977). Recommended allowances by the Nutrition Directorate of Indonesia are 2100 calories and 45 gm protein (Nutrition Research and Development Center, 1978).

Children selected for inclusion in this study were those under five years of age, newly entered into one of three weighing programs: MCH, PLKB, or Kader. Only those who came to 3 or 4 weighing sessions in four consecutive months were used in this analysis. Any reporting illness during this time period were excluded. Weights were recorded directly on KMS which became the basic tool for recording study data as well as educating mothers. Children attending the MCH clinics received personal advice and 250 grams of dried skin milk, each time they came. The FLKB-run village program received government assistance for a monthly Tuman Gizi plus 250 grams of milk for selected children whose body weight was below 80% of Harvard standard. The program was combined with motivational activities related to Family Planning in the village. The Kader group was organized by village mothers who have been trained for 2 weeks by the Puskemas doctor. All nutrition education was given by mothers themselves and a Taman Gizi was established monthly using village raised funding.

Body weights were noted to the nearest 1/10 kilograms, and expressed in percent of Harvard standard to allow comparison between age groups. Change in body weight over the course of 4 consecutive months and provision of milk was recorded for each child. Data was analyzed on the UGM UNIVAC computer using Portstat programs.

Morquio Syndrome, type V: Sheie Syndrome, type VI: Maroteaux — Lamy Syndrome.

Morquio Syndrome, also known as Morquio's disease, spondylo-epiphysial dysplasia, Brailford's disease and chondro-osteodystrophy, is a rare hereditary condition (Tachdjian, 1972). Until now we do not know any reported case in the Indonesian literature. The cause of this disease is unknown. Some authors suggest that consanguinity, a recessive mode of transmission, may play a role (Tachdjian, 1972 and Spranger et al., 1974). Sporadic cases do occur (Tachdjian, 1972).

The basic defect appears to be in the formation of articular cartilage and is due to disordered maturation of the epiphyseal chondroblasts. The chondrocytes in the epiphysis are arranged irregularly, showing zones of vacuolisation and loss of normal staining properties of ground substance. The epiphyseal plate is irregular, with islands of cartilage cells within the bony trabeculae of the metaphysis. The line of the provisional zone of calcification is interrupted and distorted (Tachdjian, 1972).

It is said that the developmental error is usually not apparent at birth and the affected infants are thought to be normal (Tachdjian, 1972).

All of our cases were born spontaneously with no congenital malformation. Features of the disease became apparent when they began to walk (case II and III) and later on the characteristic findings became increasingly evident. Similar to the findings of other authors (Tachdjian, 1972 and Spranger, 1974), in all of our cases the 'typical clinical features were established at the age of four years. It is said that the dorsolumbar kyphosis is usually the first deformity to attract the parents' attention. However in our cases all were brought to the hospital in a late stage, with general bone malformation and even paralysis (case I-III).

The dwarflike appearance is due to shortness of the trunk and knock knees, although the limbs are relatively long. A number of generalized and symmetrical deformities of the skeleton (Tachdjian, 1972) are clearly seen in all of our cases.

The neck is short and the patient stands with the knees and hips flexed in a crouched position, with the head thrust forward and sunk between the high shoulders. The size and shape of the head is normal, though it appears large because of the diminished growth of the trunk and limbs. The facies is relatively normal.

The level of intelligence is within normal limits. The anteroposterior diameter of the chest is increased, with the sternum projecting forward (pectus carinatum—pigeon chest).

The joints especially of the knees, elbows, wrists and ankles, are enlarged, owing to hypertrophy of the bone ends and not of the soft tissues. (Tachdjian, 1972).
Results

The number of children analyzed from each weighing program, their age range, mean age and results of weighing, expressed in percent of Harvard standard, are shown in Table 1. A total of 151 children were analyzed with mean age of 19 months. To allow comparison of body weight between ages, all weights were expressed as percent of the Harvard standard as suggested by the Indonesian National Meeting on Anthropometric Standards in Nutrition (Lokakarya Anthropometri Gizi, 1975). Change in body weight in each group is expressed in kilograms over the three month-course of the study. Change in percent of Harvard standard is also shown. The small differences in body weight and weight gain are not significant between the groups. Although, the average weight-gain over three months was 150 grams this represented a net fall in standard weight of roughly 2%.

In Table 2, weight change is expressed by age group. It can be seen that the major fall in percent of standard weight occurs in the youngest age groups, while children above 1 year demonstrated a slight improvement in body weight standard. Thus the greater fall in percent body weight seen in MCH clinic cases most likely reflects the younger age of these children.

Weight percentile by age is shown in Figure 1, where it can be seen, as previously shown in numerous other studies, that Indonesian children are born with weights close to the Harvard standard but drop rapidly during the first year of life towards the value of roughly 80% of the standard (Rohde, 1974; Sri Kardjati et al., 1977, 1978). While this fall in body weight percentage continues in most studies till age 2 - 3 years, it is notable that in this study this decline appears to have been arrested by the age 1 year after which growth continued at a rate equal to or slightly better than the Harvard standard. Thus, children participating in the weighing programs tended to loose relative weight only in the first year but showed normal growth thereafter. Although, the graph in Fig. 1 is clearly cruvinerly it can be analyzed by a simple linear regression which gives an equation $Y = 94.1 - 0.55X$, where $Y$ equals body weight and $X$ = age in months. Thus, the new born is roughly 94% of the standard and his weight for age declines at 0.55% of the standard for each month of growth. Even with a fall of this magnitude in the 1st year, the child would be roughly 87% of standard at 12 months of age. The children in this study had a far greater fall during the 1st year but it should be noted that the study occurred as a cross-sectional one, and no children were involved from birth.

Table 3 shows the growth in body weight and percent body weight in groups receiving milk and no milk. Overall, there is no difference in growth between the 42 children who received milk and 109 who did not. A comparison of mali-
TABLE 1: Nutritional Status and Weight Gain over Three Months in Children Attending Clinic or Village Weighing Programs

<table>
<thead>
<tr>
<th>Total Children</th>
<th>Age in Months</th>
<th>First weight % Harvard</th>
<th>Last weight % Harvard</th>
<th>Weight Change % of Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kader</td>
<td>25</td>
<td>1 — 51</td>
<td>84.6</td>
<td>82.0</td>
</tr>
<tr>
<td>PLK3</td>
<td>110</td>
<td>1 — 54</td>
<td>81.8</td>
<td>80.7</td>
</tr>
<tr>
<td>MCH</td>
<td>16</td>
<td>1 — 40</td>
<td>83.3</td>
<td>80.8</td>
</tr>
<tr>
<td>Total</td>
<td>151</td>
<td>1 — 54</td>
<td>82.8</td>
<td>80.9</td>
</tr>
</tbody>
</table>

TABLE 2: Three — Month Weight Gain by Age of Child at Entry to Program

<table>
<thead>
<tr>
<th>Age in months</th>
<th>Number of children</th>
<th>Change in Weight Kg/3 months</th>
<th>Mean Change in Weight % Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 — 3</td>
<td>18</td>
<td>1.46</td>
<td>-9.5%</td>
</tr>
<tr>
<td>4 — 6</td>
<td>14</td>
<td>0.82</td>
<td>-8.1%</td>
</tr>
<tr>
<td>7 — 12</td>
<td>28</td>
<td>0.6</td>
<td>-2.3%</td>
</tr>
<tr>
<td>13 up</td>
<td>91</td>
<td>0.6</td>
<td>+1.0%</td>
</tr>
<tr>
<td>1 — 54</td>
<td>151</td>
<td>0.74 Kg</td>
<td>-1.9%</td>
</tr>
</tbody>
</table>

TABLE 3: Three — Month Weight Gain in Children Given Free Milk or No Milk

<table>
<thead>
<tr>
<th>Milk Supplement</th>
<th>All Children</th>
<th>Malnourished</th>
<th>Well nourished</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Change in Weight Kg</td>
<td>% Std.</td>
</tr>
<tr>
<td>Milk</td>
<td>42</td>
<td>+0.6</td>
<td>-2.2</td>
</tr>
<tr>
<td>No milk</td>
<td>109</td>
<td>+0.8</td>
<td>-2.2</td>
</tr>
</tbody>
</table>

FIG. 1a, b, c, d: Dwarflike appearance, shortness of the trunk, knock — knees, short neck with relative large head, pigeon chest and deformities of the extremities are clearly seen in all cases.
Data concerning her developmental history was not clear. She was the 3rd child of the family with the same disease. (The others are cases III and IV).

On admittance she looked alert, active, and had a body weight of 11½ kg and a body length of 86 cm. The head was large with a short neck and the thoracic cage deformed: a pigeon chest. Both corneas were rather cloudy (with astigmatism), the fundus oculi appeared to be normal. Heart and lungs were within normal limits. The abdomen was supple and the liver was palpable 2 cm below the right costal margin.

Extremities were broad with stubby fingers and swollen joints. A bone survey revealed the same radiological changes as in case I. The diagnosis of Morquio's disease was made but no operation could be done yet.

Case III: LAN, a 16-year-old girl, the elder sister of case II. She was paralysed since the age of 12 years. Born spontaneously with no congenital abnormalities. On admittance she looked alert, the head was enlarged with a short neck, the chest deformed. The eyes were myopic but the corneas were clear.

Heart and lungs were normal. The abdomen was supple, the liver not palpable. The extremities were broad with stubby fingers and swollen joints. The legs were hypotrophic and paralysed. The skeletal abnormalities were similar to those of the other cases.

Case IV: LPH, a 17-year-old girl. She was the eldest sister of case II and III. Born in 1960, spontaneously and at term, without congenital anomalies. The motoric development seemed rather slow.

Deformity of the legs was noted since the age of one year, a dwarflike appearance since 2 years of age. When she was brought into the hospital she looked alert and active.

The head was large with a short neck and a pigeon chest was also found. Her eyes were normal. There were no abnormalities of the heart and lungs. The abdomen was supple, the liver was palpable 3 cm below the right costal margin, but the spleen was not palpable. The extremities were short with stubby fingers, swollen joints and knock knees. The bone X-ray findings were similar to the other cases.

Discussion

Mucopolysaccharidosis is an inborn error of metabolism, one of a lysosomal disorder of carbohydrate metabolism (Tachdjian, 1972).

Disturbances in mucopolysaccharide metabolism are divided into six different types by Mc. Kusick and are delineated by their mode of inheritance, by the specific mucopolysaccharide involved and by their clinical and roentgenographic features (Tachdjian, 1972; Horton and Schimke, 1970). The classification is as follows: type I: Hurler Syndrome, type II: Hunter Syndrome, type III: Sanfillipo Syndrome, type IV: Mor-
nourished children (those with body weights below 70% of Harvard standard) reveals that both milk recipients and non-recipients had positive growth in both body weight and percent standard body weight over the course of the study. Interestingly, those receiving milk had substantially less growth than those with no milk. The well nourished group (those greater than 90% of body weight) had only 3 who received milk but this is interesting to note that their growth both in terms of absolute weight and percent of standard weight was less than those well nourished children who did not receive milk.

**Discussion**

As shown in Table 1 the number of children coming to MCH clinic for regular weighing is extremely small. Three reasons appear to underlie this underutilization:

1. At the MCH clinic a mother must pay similarly to receiving treatment at the polyclinic,
2. The MCH clinic is considered by mothers a place to take the child only when he is sick,
3. The clinic is open only limited times and located far from the village making attendance difficult and even expensive for mothers,
4. Mothers consider the alternative of weighing the child in the village far more easy and practical.

While the results of weighing in MCH appear to have been accompanied by the greatest fall in percent standard weight. This clearly reflects the younger age of children attending these clinics and it can be safely stated that results of child growth are equal between all three weighing programs.

Growth data from a number of studies in Indonesia have shown that children grow close to the Harvard standard for the first three to four months of life after which they deviate progressively downward from that standard until two and a half to three years of age after which they grow parallel with the standard once again. In this study a similar pattern is seen throughout the first year but it is important to note that children participating in the weighing program appeared to parallel the growth of the Harvard standard once they had passed the age of twelve months. The slope of the linear regression curve of body weight percentage with age shows that these children loose 0.55% of standard per month. If this fall could be arrested at one year of age and growth continue parallel to the Harvard standard after that, the average child would weigh more than 85% of this standard, a substantial improvement; over the present mean of less than 80%. To accomplish this, far greater attention to growth in the first year should be given. In order to intensify nutrition activities for this age group, the weaning age, it would be best to limit nutrition activities to

Deformities of the vertebra, chest and extremities, which looked like severe rickets but were resistant to vitamin D were described by Morquio in 1929 (Tachdjian, 1972). After that Tachdjian (1972) collected ± 100 cases from the literature all over the world. Nowadays this disease is known as an inborn error of mucopolysaccharide metabolism which can be hereditary of origin. Tetra pareisis, paraplegia and sudden death as a result of spinal cord compression are the complications of this disease. The authors report 4 cases of Morquio's disease, of which 3 are siblings, with the purpose to discuss the clinical symptoms, the radiological findings of the disease and the complications.

**Case Reports**

Case I : J, a 5 year-old girl of Chinese origin was hospitalized because she could not walk anymore. Since 3 years old there were deformities of her extremities, her elbows and ankles were swollen. One month before admittance she began to tremble on both legs and was fearful of falling when she walked. She was the 4th of 5 siblings, born spontaneously with a body weight of 3.8 kg, and a body length of 50 cm. There were no congenital anomalies. Motoric and mental development were normal. There was no consanguinity between her parents. One of her brothers with the same symptoms died suddenly at the age of 4½ years. No other member of the family suffered from the same disease.

Physical examination on admission: a small girl with a body weight of 12 kg and a body length of 85 cm, a relatively large head and a 'short neck. There were no abnormalities of the cranial nerves. The chest was grossly deformed — a pigeon chest — but there were no abnormalities of the heart and lungs. The liver was palpable 2 cm below the right costal margin. The extremities were short with stubby fingers and swollen joints. There were tetra paresis, increased physiological reflexes, clonus and a positive Babinsky reflex.

Radiological examination: Platypondyia of the whole vertebral column, dysplasia of the odontoid, coxa valga and ossification disturbances of the lower extremity epiphyses. The metaphyses of the upper extremities had a V — form, the skull was within normal limits. Based on these X-ray findings the diagnosis of Morquio’s disease was made. A biochemical examination of the urine ("Mucopolysaccharide such test") was done, with a positive result.

An operation was performed to immobilize the three upper cervical bodies and to relieve the compression of the spinal cord. After operation movement of the extremities improved. Nowadays the patient can move her arms and legs normally.

Case II : LCN, a 7 year — old Chinese girl was brought into the hospital with severe bone deformities. She was a dwarf and had difficulties in walking since early childhood. She was born full term, spontaneously.
CASE REPORT

Morquio's Disease

by

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Abstract

Morquio's disease belongs to the group of mucopolysaccharidosis which causes deformities of the bones. The diagnosis is made by radiological examinations and others such as biochemical examination.

Four cases of Morquio's disease are presented, which are the first reported in the Indonesian literature. All cases are of Chinese origin.

Cervical fusion had been done in one of the cases to prevent the complication of neurologic sequelae and sudden death. The symptoms, diagnosis and therapeutic measures to prevent sequelae have been discussed.

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In spite of instructions to the contrary, almost all dried skim milk supplied from World Food Program is given to the child in a feeding bottle. Interviews with these mothers showed that they tend to breastfeed less frequently and indeed many indicated that breastfeeding stopped entirely after the provision of milk. Their attention to milk feeds resides in a belief among mothers that other foods were not important for their child as long as the child was receiving bottle milk. Previous studies have shown
close association between bottle milk and frequency of diarrhea (Kanaan, 1972) and heavy contamination of bottles have documented in this society (Suryono et al., 1980). Although we made no attempt in this study to record the incidence of diarrhea it seems likely that this may have contributed to the results in the milk recipient group.

We should emphasize that although this study would indicate that milk has no particular benefit and may be detrimental, that it is probably related to both the way in which it is used and the attitudes of village mothers towards the milk in relationship to the total diet of the child. If milk were provided in a form in which it could not be placed in the bottle, such as mixed with flour to form an easily made baby weaning cereal, it could well enhance rather than detract from the nutrition program. Monthly weighing could detect when children begin to deviate from a normal growth pattern and the Taman Gizi could provide samples of this cereal based on milk fortified weaning food as well as a demonstration to the mothers on how to make their own in their home on a daily basis. The provision of weaning food could be based entirely on weight gain and not weight for age of the child with the aim of continuous growth throughout the first year. By carrying out the weighing themselves mothers better understand the meaning of growth and can motivate and evaluate each other as the village program continues.

REFERENCES


C. parapsilosis. Little is known of the pathogenicity of these other species, largely because most studies have not attempted to determine their occurrence in various disease states and have designated that C. parapsilosis, at least, has an important pathogenic potential.

The present study indicates that species of Candida occur commonly in the gastrointestinal tract of children with malnutrition, possibly because of impaired immunological surveillance.

In our study of candida-killing-ability in well-nourished and malnourished group (Table 13) using the method of Lehrer and Cline (1969) with the modifications of Xanthou et al. (1975) to minimize the volume of blood taken from the children, it was shown that in malnourished children the candidacidal activity of their leucocytes was significantly reduced. This finding runs parallel to the higher isolation rate of Candida spp. from throat swabs. Organisms isolated from the upper small bowel are similar to the flora of the oral cavity and our previous study suggest that Candida spp. are likely to be found in the upper intestine of these children (Gracey et al., 1973). Our finding showed that polymorphs from malnourished children have an impaired ability to kill candida and extend the observations that the ability to kill Staphylococcus pyogenes is reduced (Seth and Chandra, 1972). These mechanisms may contribute to the significantly increased incidence of candidal infections in malnourished children. And as has been studied by Burke et al. (1977) and Thelen et al. (1978) this overgrowth of Candida spp. in the small intestine may contribute to the production of diarrhoea by their effects on intestinal absorption of sugar and water.

REFERENCES

8. SURYONO, D.; ISMAIL, S.D.; SUWARDJIA and ROHDE, J.E.: Bacterial...