Paper 3

EVALUATION OF THE NUTRITIONAL IMPACT OF THE SCHOOL SUPPLEMENTARY FEEDING PROGRAMME

by

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ABSTRACT

A study was conducted to evaluate the impact of the school feeding programme which is being implemented by the Ministry of Education. Primary school entrant children in 15 rural schools in Peninsular Malaysia were followed up longitudinally at 3-monthly intervals for two years, monitoring particularly the impact of the feeding programme on their nutritional status, dietary intake and food habits, school attendance and scholastic performance. A survey on knowledge, attitude and practices (KAP) was also conducted among parents and teachers to study their perception and acceptance of the programme. Results indicate that the feeding programme improved both nutritional status and dietary intake. Improvements in school attendance rates were also observed. Scholastic performance was suggestive of an improvement especially in arithmetic. The KAP study revealed the programme to be acceptable and to be continued. Other observations showed that little use was made of the programme to carry out nutrition and health educational activities.

The present study has shown that school feeding programmes can make up for the nutritional deprivation experienced by needy children. As such, the programmes play an important role in strategies which concerned alleviating protein–energy malnutrition among rural school children.

INTRODUCTION

The history of the school feeding programme in Malaysia can be traced as far back as 1945, when the British Military Army supplied free supplementary food to school children. The next 20 years or so saw the expansion of the programme through various local and international agencies. In 1974, the Malaysian government formally initiated the school supplementary feeding programme in conjunction with a pilot project of the national applied food and nutrition programmed (AFNP).

By 1979, this Programme had expanded to cover all districts in every state in Peninsular Malaysia, Sabah and Sarawak, under the administration of the Ministry of Education. The primary aim of the school feeding programme was to improve the health and nutritional status of children, especially those from rural areas, through a provision of a wholesome and balanced meal (Ministry of Education, 1972). Other more long term objectives were:

1. To enable children, and through them their parents, to understand that proper nutrition is essential for good health.

2. To teach children about the selection and consumption of a balanced diet.

3. To teach children to develop desirable hygienic practices in relation to

food handling, personal and environmental sanitation.

The present school supplementary feeding programme attempts to provide a balanced meal based on a menu developed by the Institute for Medical Research (IMR), using local foodstuffs. The government provides 35 cents (Malaysian) per child per day and every pupil between the age of 7 to 12 years, is provided with a free cooked meal, to supply the child with about 350-400 kcal and about 10 g protein daily for 150 school going days. This cooked supplement is currently provided only for those rural schools which have a total enrolment of less than 200 pupils per school.

This study attempts to evaluate the impact of such feeding programme in selected rural schools in Peninsular Malaysia. Primary school entrant children who were receiving these meals for the first time were studied longitudinally for two years, monitoring particularly the impact on their nutritional status, dietary intake and food habits. Knowledge and attitude of the parents and teachers towards the programme were also assessed.

OBJECTIVES

In keeping with the objectives of the Ministry of Education's school feeding programme, the overall objectives of this study were to examine its impact on the following:

1. Nutritional status of the recipients through anthropometry, biochemical and clinical parameters.
2. Dietary intake and food habits of the children.
3. School attendance and performance.
4. Knowledge and attitude of parents and teachers.

MATERIAL AND METHODS

Selection Of Schools

The selection of schools for the study was carried out in consultation with officers from the School Health Unit, Division of Schools, Ministry of Education.

Feeding Schools

Feeding schools were chosen on the basis of the following criteria:

1. Supplementary feeding programme was being carried out in the schools.
2. A keen interest shown by the school authorities to participate in this study.
3. Good rapport and cooperation from headmasters, teachers and pupils.
4. Schools which were rural, yet accessible by roads and which will facilitate periodic supervision.

Control Schools

Control schools include those which met the following criteria:

1. Schools that did not have a feeding programme.
2. Schools within the vicinity of the feeding schools, which would not only facilitate logistics of operations but would also ensure a similar ecological background as that of the feeding schools.
3. Schools which had an enrolment very close to that of the feeding schools. This would minimise the effects of other confounding variables, such as differences in socio-economic background.
4. Other criteria as mentioned for feeding schools (No. 2 – 4)

By the above criteria for selection of schools, 21 rural schools in 2 different districts were selected for this study, namely Sepang District in the state of Selangor and Temerloh in Pahang. Of these, 15 schools were chosen to be in the feeding group and 6 to be in the control group.

Selection Of Subjects

Feeding group

All primary school entrant children in the selected feeding schools were chosen to be in the feeding group.

Control group

All primary school entrance children in the control schools, selected according to the criteria mentioned above, were chosen to be in the control group.

Nutritional Status Indicators

Nutritional status was evaluated on the basis of clinical, anthropometric, biochemical and dietary measurements.

A longitudinal approach was chosen so that adequate data could be obtained to show the pattern of change in the various indicators. Anthropometry and other data were therefore collected at the beginning of the study and thereafter at 3-monthly intervals for two years.

All selected children were dewormed before the collection of baseline data. Thereafter, periodic deworming was carried out to ensure that parastic infestation will not be a confounding variable in the final analysis.

Anthropometric measurements

The measurements taken were height, weight, mid-arm circumference and triceps skin-fold. The methodology for height and weight measurements was based on those proposed by WHO (1983).

Height and weight measurements were converted to height-for-age, weight-for-age and weight-for-height standard deviation (S.D.) scores based on the National Centre of Health Statistics (NCHS) reference. All computations were performed using the Centre For Disease Control (CDC), Atlanta computer programme for anthropometric data analysis.

1. Standing height

Height was recorded to the nearest 0.1 cm. On examination the child stood erect on the centre of the platform of the Seca beam balance which had a height measuring attachment.

2. Body weight

Body weight was recorded to the nearest 0.1 kg on a Seca beam balance which was calibrated before each weighing session.

3. Mid-upper arm circumference

This measurement was performed at the left side of the body. The midpoint between the acromion and the olecranon processes was measured with a fibre glass tape and marked on the skin of the lateral surface of the arm. The circumference was measured at the marked point with the tape, while the child's arm hung loosely at this side.

4. Triceps skinfold thickness

This was measured over the posterior surface of the triceps muscle of the left arm with a Harpendan caliper. The caliper jaws were placed at the level marked during the arm circumference measurement.

Classification of anthropometric measurements

The anthropometric measurements of the children studied were classified according to the following growth criteria (WHO, 1983):

"underweight" – to denote children whose weight-for-age fell below −2 S.D. of the reference median.

'stunting" – to denote children whose height-for-age fell below −2 S.D. of the reference median.

"wasting" – to denote children whose weight-for-age fell below −2 S.D. of the reference median.

Clinical examination

Clinical examination for signs of nutritional deficiences was conducted by a medical doctor on every child at the beginning and at the end of the study. In addition, the presence of skin conditions, scabies, head lice and other skin infections were noted and a history of recent illnesses recorded.

Biochemical determinations

1. Blood specimens

Blood samples were obtained from all selected children by finger prick. Haemoglobin, hematocrit and albumin determinations were performed on these samples.

Haemoglobin was determined by the cyanmethaemoglobin method using 0.02 ml of blood. Readings were taken either on a spectrophotometer or direct digital readout haemoglobinometer.

Micro-haematocrit was determined after centrifuging on the micro-haematocrit centrifuge.

Albumin was determined on 0.025 ml plasma by the dye binding method using bromo-cresol (Pinnell and Northam, 1978).

2. Urine specimens

Random samples of urine were collected into 30 ml capacity screwcapped bottles containing a few drops of hydrochloric acid as preservative and stored at −15°C. The following tests were performed: hydroxyproline index (Whitehead, 1965), urinary urea determined by the diacetylmonoxime method and creatinine by the picrate method (Wootton and King, 1964).

Dietary intake

Dietary intake was recorded for a subsample (50%) of the selected students at the beginning and at the end of the study period. A dietary 24-hour recall for each child was performed by interviewing parents. Amounts of food consumed were recorded in terms of household measures and later converted into grams. Nutrient content of each dietary recall was calculated by computer using the Malaysian Food Composition Table (Tee, 1985). Adequacy of dietary intake was compared with the Malaysian Recommended Daily Allowance (RDA) (Teoh, 1975).

Household background information

General household information on families of the children in the study groups was obtained through a questionnaire. Data collected include: age and sex composition of the families, occupation, income, marital status, education of heads of households and their wives; housing conditions, such as sanitation, lighting, water supply and waste disposal; ownership of residence and other properties; family food consumption and food expenditure. These data were intended to serve as malnutrition and socio-economic factors.

Knowledge and attitude survey

A questionnaire was designed to assess knowledge and attitude among the

parents and teachers with regards to the feeding programme.

School performance and attendance

School performance was assessed through marks obtained by the study children in the regular end-of-term examinations on subject, such as reading, spelling and arithmetic. Information on attendance was obtained from attendance records maintained by the schools.

Statistical analysis of data

The statistical package for the social science (SPSS) computer programme was used for the determination of "Students test" and "chi square test". In all analysis, results were considered statistically significant if $p < 0.05$.

RESULTS AND DISCUSSION

Socio-Economic Background Of Study Children

Age and sex distribution

Table 1 gives a breakdown of the demographic characteristics of the children studied. The mean age of the children ranges from 79.6 months in Sepang to 80.9 months in Temerloh. The children were therefore rather homogeneous with regards to age. There were approximately equal numbers of boys and girls in both study groups, except for the control group in Temerloh where there was a slightly higher proportion of girls.

Household background information

A total of 410 households, representing 65% of all homes of the study children were visited and interviews conducted with parents. Over 80% of the respondents were heads of households, their wives or both. Interviews were conducted in the national language, *Bahasa Malaysia*. Response and cooperation from parents were at all times satisfactory. The mean household size was found to be 5.7 and 6.2 persons in the feeding and control groups respectively.

1. Educational status and occupation activities

Background information on educational status and occupational activities of heads of households are summarised in tables 2 and 3 respectively. Of the 410 heads of households interviewed in both districts, approximately 65% were found to have at least 3 years of primary school education. Approximately another 30% of the heads had no formal education. The main occupational activity of the heads of households studied in the two areas was rubber tapping. A substantial percentage

TABLE 1: DEMOGRAPHIC DATA OF STUDY CHILDREN

	Sepang District		Temerloh District	
	Feeding	Control	Feeding	Control
Sex distribution				
% Male	51	52	41	51
% Female	49	48	59	49
Mean age (months)				
Male	80.1	79.6	80.5	80.3
Female	80.4	80.3	79.6	80.9
Total number	202	103	186	134

of the heads were self-employed, which included ad hoc contract jobs, fruit and vegetable gardening, and minor economic activities, such as making of prawn and fish crackers *(keropok)*, dried fish, and processing of copra. The educational status and occupational activities of heads of households of both feeding and control groups were rather similar.

2. Household monthly income and expenditure on food

The mean monthly household income was found to be around $320 for both groups. The proportion of income spent on food was between 50 – 60% for all households studied.

3. Property ownership and housing conditions

House ownership was common in the majority (95%) of all those interviewed. About 50% of the population also owned some land which was mainly inherited property. Some of those land were put to good use as padi plots and fruit orchards. However, in many cases the land was left idle and overgrown with weeds.

TABLE 2: EDUCATIONAL LEVEL OF HEADS OF HOUSEHOLD

	Feeding Group		Control Group	
	n	%	n	%
No formal education	72	27.7	39	26.0
Adult educational classes	2	0.8	3	2.0
Primary school	173	66.5	94	62.7
Secondary school	4	1.5	3	2.0
Religious school	6	2.3	8	5.3
Vocational school	1	0.4	0	0
College/University	2	0.8	3	2.0
Number of households	260		150	

TABLE 3: OCCUPATION OF HEADS OF HOUSEHOLDS

	Feeding Group		Control Group	
	n	%	n	%
Goverment servant	10	3.8	3	2.0
Employees in private firms	12	4.6	5	3.3
Self-employed	55	21.2	36	24.0
Fishermen	11	4.2	6	4.0
Rubber tappers	128	49.2	78	52.0
Padi farmers	20	7.7	12	8.0
Other agricultural activities	24	9.3	10	6.7
Number of households	260		150	

Many of the homes visited were found to be lacking in basic amenities, like pipe-water supply, electricity, proper sanitation and rubbish disposal systems. Well and river water were the main sources of water for drinking, cooking, laundry and bathing in 65% of homes in Sepang and in 78% of homes in Temerloh. Where there was no electricity, oil and kerosene lamps were commonly used for lighting in both districts. Pour flush latrines were the most common means of sewage disposal in 52% of households in Sepang and in 60% of homes in Temerloh. Rubbish and other household wastes were disposed off either by burning or burying in the majority of the homes.

Baseline information on some socio-economic parameters, such as mean monthly income, percentage expenditure on food and occupational activities of heads of households were not found to be significantly different between the study groups in both districts.

Assessment Of Nutritional Status

Clinical findings

The main clinical findings in relation to malnutrition in the study children are as follows:

1. Protein-energy malnutrition (PEM) – features suggestive of muscle wasting and stunting were found in about 20% of the children studied.

2. Anemia – pallor or conjunctiva was seen in about 20% of the children in both groups.

3. Vitamin A deficiency – the most com mon eye sign observed was dryness and wrinkling of the conjunctiva among 11% of the children in both groups.

4. Dental health – 80% of the children had poor overall dental health, the majority of whom had tooth decay.

5. Head lice – about 45% of the children especially girls were found to be infested with head lice.

6. Scabies – was also commonly seen in both sexes in both study groups.

Overall, no cases of specific clinical signs of nutritional deficiencies were seen in both study groups in the two districts.

Anthropometry

1. Distribution of indicators

The distribution of nutritional anthropometry indicators over the two years of evaluation are given in tables 4 (Sepang) and 5 (Temerloh). As can be seen from the tables, the proportion of the children in the feeding group below median minus 2 S.D. was fairly high for both weight-for-age and height-for-age indicators, ranging from about 13 to 20% in both districts. Percent of children with weight-for-height below median minus 2 S.D.was much lower, being about 3% for both districts. A similar pattern was observed for the control groups in both districts. The proportion of malnourished children in Temerloh was generally slightly higher than that in Sepang.

2. Prevalence of protein-energy malnutrition

Tables 6 and 7 compare the prevalence of malnutrition between the study groups in both districts. Prevalence values in the tables were derived from calculations recommended by WHO (1983) which take into account the proportion of children in the reference population i.e. the NCHS reference, falling below the median minus 1 S.D. and below median minus 2 S.D. for each of the three indicators. These "expected" proportions were respectively 15.9% (below median minus 1 S.D.) and 2.3% (below median minus 2 S.D.) for all

TABLE 4: DISTRIBUTION OF ANTHROPOMETRIC INDICATORS AMONG STUDY CHILDREN IN SEPANG DISTRICT

	Weight-for-Age			Height-for-Age			Weight-for-Height		
	Start	End of 1st yr	End of 2nd yr	Start	End of 1st yr	End of 2nd yr	Start	End of 1st yr	End of 2nd yr
No. examined									
Feeding	202	198	199	202	198	199	202	198	199
Control	103	101	91	103	101	91	103	101	91
Below median — 1 S.D.									
Feeding	85	83	83	89	86	80	64	58	62
	(42.1)	(41.9)	(41.7)	(44.1)	(43.4)	(40.2)	(31.7)	(29.3)	(31.2)
Control	43	44	41	49	50	44	32	32	29
	(41.7)	(43.6)	(45.1)	(47.5)	(49.5)	(48.4)	(31.1)	(31.7)	(31.8)
Below Median — 2 S.D.									
Feeding	40	36	26	35	34	27	7	7	6
	(19.8)	(18.1)	(13.1)	(17.3)	(17.1)	(13.6)	(3.5)	(3.5)	(3.0)
Control	16	19	17	13	13	12	4	3	4
	(15.5)	(18.8)	(18.6)	(12.6)	(12.9)	(13.1)	(3.9)	(3.9)	(4.4)

Numbers in parentheses indicate percentages

TABLE 5: DISTRIBUTION OF ANTHROPOMETRIC INDICATORS AMONG STUDY CHILDREN IN TEMERLOH DISTRICT

	Weight-for-Age			Height-for-Age			Weight-for-Height		
	Start 1st yr	End of 2nd yr	End of	Start 1st yr	End of 2nd yr	End of	Start	End of 1st yr	End of 2nd yr
No. examined									
Feeding	184	173	176	184	173	176	184	173	176
Control	134	120	103	134	120	103	134	120	103
Below Median — 1 S.D.									
Feeding	85	80	79	83	74	76	56	52	51
	(46.2)	(46.2)	(44.9)	(45.1)	(42.8)	(43.2)	(30.4)	(30.1)	(29.0)
Control	66	60	51	65	59	50	42	39	33
	(49.2)	(50.0)	(49.5)	(48.5)	(49.2)	(48.5)	(31.3)	(32.5)	(32.0)
Below median — 2 S.D.									
Feeding	44	34	24	42	39	31	8	7	6
	(23.9)	(19.7)	(13.6)	(22.9)	(22.5)	(17.6)	(4.3)	(4.0)	(3.4)
Control	25	24	26	30	30	23	6	6	5
	(18.7)	(20.0)	(25.2)	(22.4)	(25.0)	(22.3)	(4.5)	(5.0)	(4.9)

Number in parentheses indicate percentages

TABLE 6: PREVALENCE OF MALNUTRITION AMONG STUDY CHILDREN IN SEPANG DISTRICT

	Weight-for-Age (%)			Height-for-Age (%)			Weight-for-Height (%)		
	Start	End of 1st yr	End of 2nd yr	Start	End of 1st yr	End of 2nd yr	Start	End of 1st yr	End of 2nd yr
Excess below median −1 S.D.									
Feeding	26.2	26.0	25.8	28.2	27.5	24.3	15.8	13.4	15.3
Control	25.8	27.7	29.2	31.6	33.6	32.5	15.2	15.8	15.9
Excess below median −2 S.D.									
Feeding	17.5	15.8	10.1	15.3	14.8	11.3	1.2	1.2	0.7
Control	13.2	16.5	16.3	10.3	10.6	10.8	1.6	1.6	2.1

TABLE 7: PREVALENCE OF MALNUTRITION AMONG STUDY CHILDREN IN TEMERLOH DISTRICT

	Weight-for-Age (%)			Height-for-Age (%)			Weight-for-Height (%)		
	Start	End of 1st yr	End of 2nd yr	Start	End of 1st yr	End of 2nd yr	Start	End of 1st yr	End of 2nd yr
Excess below median −1 S.D.									
Feeding	30.3	30.3	29.0	29.2	26.9	27.3	14.5	14.2	13.1
Control	33.3	34.1	33.6	32.6	33.3	32.6	15.4	16.6	16.1
Excess below median −2 S.D.									
Feeding	21.6	17.4	11.3	20.6	20.2	15.3	2.0	1.7	1.1
Control	16.4	17.7	22.9	20.1	22.7	20.0	2.2	2.7	2.6

the three indicators. These two figures were subtracted from the values presented in tables 4 and 5 to obtain the values in tables 6 and 7 so as to depict the "true" prevalence of PEM in the two districts.

The prevalence of PEM as determined by the percentage of children falling below median minus 2 S.D. of the reference was found to be moderately high for underweight (weight-for-age) and stunting (height-for-age). At the commencement of the study, about 10 – 20% of the children in both study groups in the two districts were found to be malnourished by these two indicators. Wasting (weight-for-height) occured only in about 1 – 2% of all the children studied. Prevalence of malnutrition in Temerloh was generally slightly higher than that in Sepang.

At the end of the first year of evaluation, the prevalence rates of PEM in the fed group of children in both the districts seemed to have lowered, as observed for all the three anthropometric indicators. In particular, there was a marked lowering in the weight-for-age indicator. This

continued into the end of the second year of evaluation. Prevalence rates for "stunting" and "wasting" were also further improved. No improvement was observed in the prevalence of PEM among the control groups in both districts. On the other hand, there appeared to be an increase in the prevalence of PEM in the control groups during the same period. These changes in prevalence of malnutrition are depicted in figures 1 – 3. A more detailed discussion on the reduction in malnutrition observed for the feeding group is given in the next section.

3. Reduction in prevalence of protein-energy malnutrition

Reduction in the prevalence of PEM was expressed as the difference between the final and initial prevalence values as a percentage of the initial value. These were separately calculated for the two time periods, namely from the commencement to the end of the first year of evaluation (Table 8), and to the end of the second year of the study (Table 9). Negative signs in the reduction figures indicate an increase in prevalence of PEM during the course of the study.

Results obtained at the end of the first year of evaluation indicated a definite reduction in the prevalence of malnutrition in the feeding groups in both districts (Table 8). The reduction was however not statistically significant. At the termination of the study (Table 9), the reduction in the prevalence of malnutrition from the start to the end of the second year of evaluation was found to be highly significant ($p < 0.05$) for all the nutritional indicators in both districts in the feeding groups. The highest percentage of reduction in PEM was seen in the weight-for-age indicator (42.3% in Sepang and 47.7% in Temerloh).

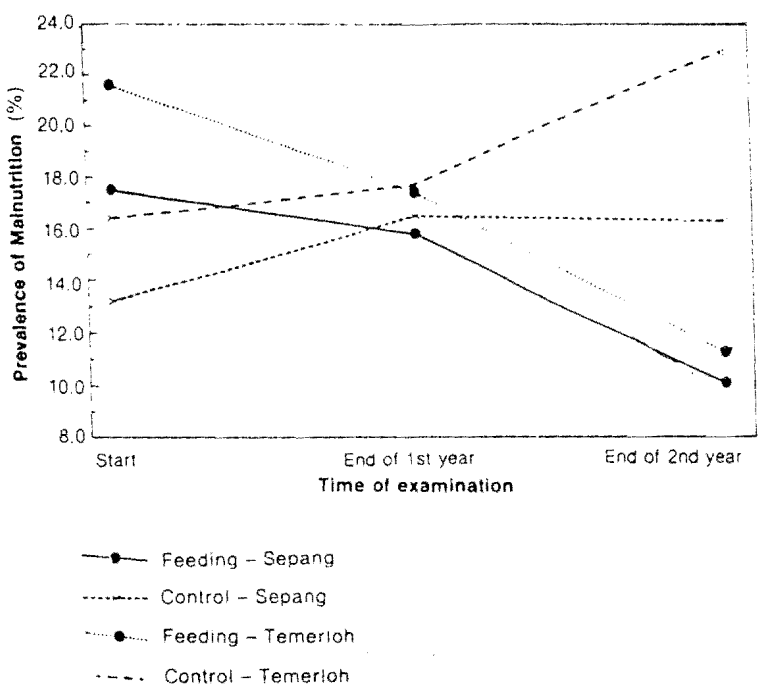


Figure 1: Prevalence of Malnutrition According to Weight-for-age of Children

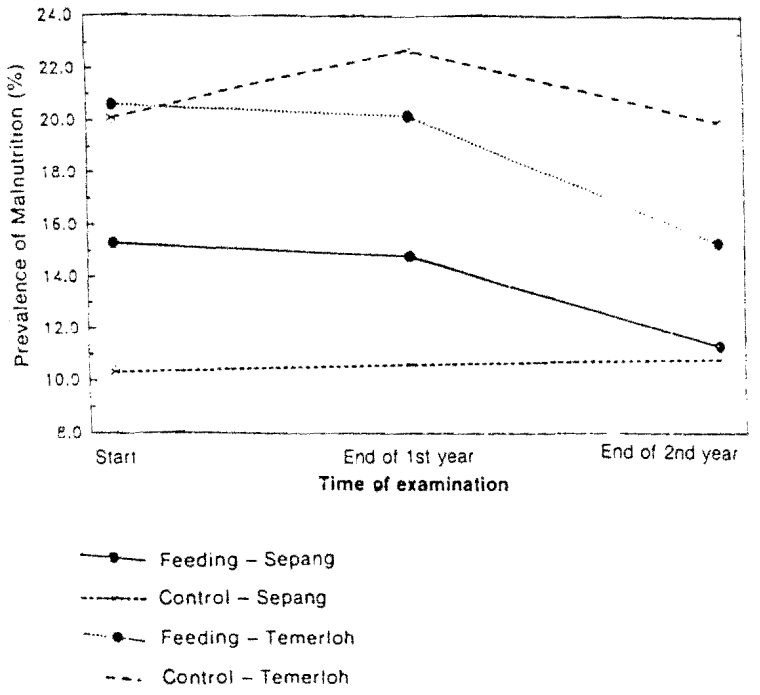


Figure 2: Prevalence of Malnutrition According to Height-for-age of Children

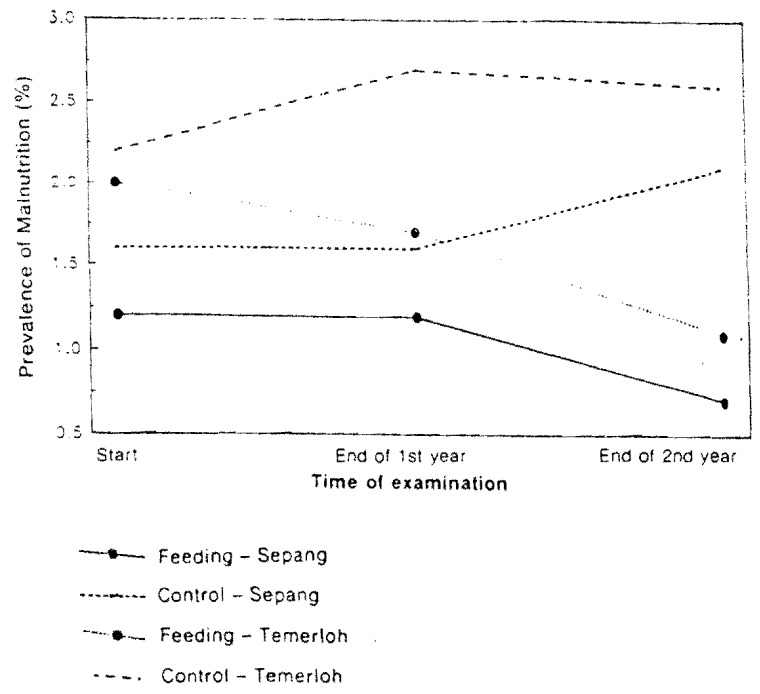


Figure 3: Prevalence of Malnutrition According to Weight-for-Height of Children

TABLE 8: REDUCTION* IN PREVALENCE OF MALNUTRITION FROM THE BEGINNING TO THE END OF FIRST YEAR OF EVALUATION

	Weight-for-Age (%)		Height-for-Age (%)		Weight-for-Height	
	Sepang	Temerloh	Sepang	Temerloh	Sepang	Temerloh
Below median −1 S.D.						
Feeding	0.8	0	2.5	7.9	15.2	2.1
Control	−7.4	−2.4	−6.3	−2.1	−3.9	−7.8
Below median −2 S.D.						
Feeding	9.7	19.4	3.3	1.9	−0	15.0
Control	−25.0	−7.9	−2.9	−12.9	0	−22.7

* Reduction is expressed as the difference between the final and initial prevalence values as a percentage of the initial value, i.e. initial value minus final value, divided by the initial value multiplied by 100. Negative sign indicates increase in prevalence rates.

TABLE 9: REDUCTION* IN PREVALENCE OF MALNUTRITION FROM THE BEGINNING TO THE END OF THE SECOND YEAR OF EVALUATION

	Weight-for-Age (%)		Height-for-Age (%)		Weight-for-Height	
	Sepang	Temerloh	Sepang	Temerloh	Sepang	Temerloh
Below median −1 S.D.						
Feeding	1.5	4.3	13.8	6.5	3.3	9.7
Control	−13.1	−0.9	−2.8	0	−4.6	−4.5
Below median −2 S.D.						
Feeding	42.3	47.7	26.1	25.7	42.7	45.0
Control	−23.5	−39.6	−4.9	0.5	−31.3	−18.2

* Reduction is expressed as the difference between the final and initial prevalence values as a percentage of the initial value, i.e. initial value minus final value, divided by the initial value multiplied by 100. Negative sign indicates increase in prevalence rates.

In contrast, in the control groups of both districts no reduction in the prevalence of malnutrition was observed for all except one indicator. In the district of Temerloh there appeared to be a slight reduction in the prevalence of stunting (0.5%), as indicated by the height-for-age indicator. However, this apparent increase was not statistically significant.

4. Mid-arm circumference (MAC) and triceps skinfold thickness (TSF)

MAC was used as a rough indicator of muscle mass and directly, the adequacy of protein intake. The left triceps skinfold thickness for age was used as an index of caloric reserve. The mean MAC and TSF for both sexes in the study groups in Sepang and Temerloh are given in tables 10 and 11.

In Sepang, the mean MAC of the feeding group was found to have increased from 16.5 ± 2.1 cm at the begining to 18.0 ± 2.3 cm at the end of the study period. An increase in MAC was also seen for the control group. However, no significant difference was obtained between the mean MAC values of the two groups at the end of the evaluation period. Mean values of TSF of the feeding and control groups in Sepang did not differ significantly at the end of the study which was two years later.

In Temerloh, the feeding group at the beginning of the study had a mean MAC of 16.9 ± 2.3 cm. A significant increase to 18.3 ± 2.2 cm was noted at the completion of the study. In the control group in this district, the change in the mean MAC from the beginning of the study to its completion which was two years later, was not found to be significantly different. Comparison of the mean values of MAC between the two groups at the end of the study was however found to be significantly different.

TABLE 10: MEAN (± SD) VALUES* OF MID-ARM CIRCUMFERENCE AND TRICEPS SKIN FOLD THICKNESS OF STUDY GROUPS IN SEPANG AT VARIOUS STAGES OF EVALUATION

	Start	Mid	End
Mid-arm circumference			
Feeding	16.5 ± 2.1	17.1 ± 1.8	18.3 ± 2.1
Control	16.4 ± 2.0	16.8 ± 2.0	17.7 ± 2.3
Triceps skinfold			
Feeding	8.5 ± 2.3	8.8 ± 2.1	9.4 ± 2.3
Control	8.6 ± 0.2	9.0 ± 3.0	9.1 ± 3.1

* Values in cm.

TABLE 11: MEAN (± SD) VALUES* OF MID-ARM CIRCUMFERENCE AND TRICEPS SKINFOLD THICKNESS OF STUDY GROUPS IN TEMERLOH AT VARIOUS STAGES OF EVALUATION

	Start	Mid	End
Mid-arm circumference			
Feeding	16.9 ± 2.3	17.1 ± 1.8	18.3 ± 2.2
Control	16.4 ± 1.8	16.9 ± 2.0	17.3 ± 2.3
Triceps skinfold			
Feeding	8.7 ± 1.0	9.7 ± 1.8	9.9 ± 2.2
Control	8.5 ± 1.8	9.1 ± 2.2	9.0 ± 2.4

* Values in cm.

The mean value of TSF of the feeding group in Temerloh was observed to be significantly higher than the control group at the end of the study period i.e, two years later, although no difference was noted at the initiation of the study.

Biochemical parameters

1. Haemoglobin status

In tables 12 and 13, the mean levels of haemoglobin (Hb) and the prevalence of anaemia between study groups in both districts are compared. At the commencement of the study, there was no statistically significant differences in mean Hb levels between feeding and control groups for both districts.

Using the WHO (1972) cut-off level of Hb ie. < 12 g/dl, the prevalence of anaemia in the feeding and control children in Sepang appeared to have remained the same at the end of the two years of evaluation. Using a slightly cut-off of < 11 g/dl, there was also no clear trend in decreasing prevalence of anaemia over the two years of study. In Temerloh, the prevalence of anaemia in both the study groups appeared to have increased using both cut-off levels.

2. Haematocrit status

Mean haematocrit (HTC) values for both study groups in Sepang and Temerloh were found to be well above the cut-off level for anaemia (<34%) at the start of the study. Changes seen in HTC values at the completion of the study did not differ significantly when comparison was made between the feeding and control groups in both districts.

TABLE 12: HAEMOGLOBIN LEVELS OF STUDY CHILDREN IN SEPANG AT VARIOUS STAGES OF EVALUATION

	Feeding Group			Control Group		
	Start	Mid	End	Start	Mid	End
N (sexes combined)	202	199	196	103	101	92
Mean Hb (g/dl)	12.8	12.7	12.7	13.2	13.0	12.4
S.D.	0.45	0.65	0.67	0.37	0.86	0.7
% below Hb < 12 g/dl	14.9	15.1	14.8	8.7	8.7	9.7
% below Hb < 11 g/dl	4.5	5.0	4.1	3.9	4.0	4.3

TABLE 13: HAEMOGLOBIN LEVELS OF STUDY CHILDREN IN TEMERLOH AT VARIOUS STAGES OF EVALUATION

	Feeding Group			Control Group		
	Start	Mid	End	Start	Mid	End
N (sexes combined)	184	173	176	134	120	103
Mean Hb (g/dl)	13.2	12.6	12.3	12.9	12.5	12.1
S.D	1.17	1.07	0.93	1.44	0.96	1.02
% below Hb < 12 g/dl	13.5	21.4	22.1	15.9	27.5	28.1
% below Hb < 11 g/dl	3.7	4.6	5.1	8.4	8.8	9.7

3. Protein status

Mean values for plasma albumin for the study groups in both districts are shown in tables 14 and 15. There was a significant increase in the mean albumin level of the feeding group in Sepang at the end of the first year of evaluation. In the second year of the study, there was a slight drop in the mean level which was not statistically significant. A highly significant reduction ($p<0.0001$) in the percentage of children having an albumin level of <3.5 g/dl was seen from the start to the end of the study, which was two years later. On the other hand, the changes in albumin levels for the feeding group in Temerloh was minimal. The mean albumin level remained the same throughout the study. A slight reduction in the percentage of children having an albumin level of <3.5 g/dl towards the end of the study was noted.

Albumin level of the control children in both districts remained more or less the same throughout the study.

4. Urinary urea nitrogen/creatinine ratio and hydroxyproline index

Mean values for the urinary urea nitrogen/creatinine ratio and hydroxyproline index were found to be satisfactory among the children in both districts at the beginning of the study. No significant changes in these parameters between the feeding and control groups were observed at the end of the study.

Impact On Dietary Intake And Food Habits

The objectives of this component of the overall study were:

1. To assess and characterize the daily meal pattern and food habits of the study groups.

TABLE 14: PLASMA ALBUMIN LEVELS OF STUDY CHILDREN IN SEPANG AT VARIOUS STAGES OF EVALUATION

	Feeding Group			Control Group		
	Start	Mid	End	Start	Mid	End
N (sexes combined)	183	166	169	103	99	92
Mean (g/dl)	3.7	4.5	4.2	3.7	3.8	3.7
S.D	1.42	1.37	1.19	1.30	1.37	1.29
% below 3.5 g/dl	18.6	4.2	3.2	5.3	4.6	5.0

TABLE 15: PLASMA ALBUMIN LEVELS OF STUDY CHILDREN IN TEMERLOH AT VARIOUS STAGES OF EVALUATION

	Feeding Group			Control Group		
	Start	Mid	End	Start	Mid	End
N (sexes combined)	181	183	180	134	120	103
Mean (g/dl)	4.1	4.1	4.1	4.0	4.0	4.1
S.D.	0.33	0.34	0.33	0.37	0.34	0.38
% below 3.5 g/dl	2.0	1.6	1.7	2.0	1.7	1.9

TABLE 16: PERCENTAGE DISTRIBUTION OF CHILDREN IN BOTH GROUPS STUDIED FOR DIETARY INTAKE

	Sepang District		Temerloh District	
	Feeding	Control	Feeding	Control
Total number of children in group	202	103	186	134
Number (%) studied for dietary intake	105 (52%)	36 (35%)	112 (60%)	40 (30%)

2. To measure any differences in energy and protein intake for 24 h., breakfast and lunch, between the two groups.

Any differences observed would indicate how well the feeding programme met its aims of providing a wholesome and nutritious meal.

Table 16 shows the distribution of the children in the feeding and control groups studied for their dietary intake and food habits. The percentage of children studied in the two districts ranged from 50 – 60% in the feeding group and from 30–35% in the control group.

Table 17 describes the types of foods typically eaten by the two groups of children at various meals during the day. Dietary pattern for the feeding and control groups of children in the two districts was

TABLE 17: MEAL PATTERN AND COMPOSITION

Composition of meals	% of children consuming	
	Feeding Group	Control Group
1. Breakfast		
Fried noodles	32	35
Fried bananas	55	42
Local cakes	65	68
Black coffee with sugar	75	81
Malted drinks, milk etc.	2	3
2. Lunch		
Plain boiled rice	98	97
Fried vegetable	84	90
Fish gravy	75	78
Fried dried fish	31	27
Ground chilly with prawn paste (*sambal belacan*)	42	51
3. Snacks		
Plain tea with sugar	52	63
Tea with milk and sugar	15	8
Biscuits, buns	10	12
Extruded snack foods	75	81
Local cakes	17	15
Other beverages e.g. malted drinks	2	2
4. Dinner		
Plain boiled rice	97	98
Fried vegetables	35	48
Chicken/meat egg/dish	4	5
Fried fish/dried fish	43	45
Groud chilly with anchovies (*sambal tumis*)	55	47

rather similar, and was found to be monotonous and rather uniform. A typical meal pattern of breakfast, lunch, tea and dinner was seen for nearly all children.

No significant differences were observed in the meal pattern and composition from the beginning to the end of the study.

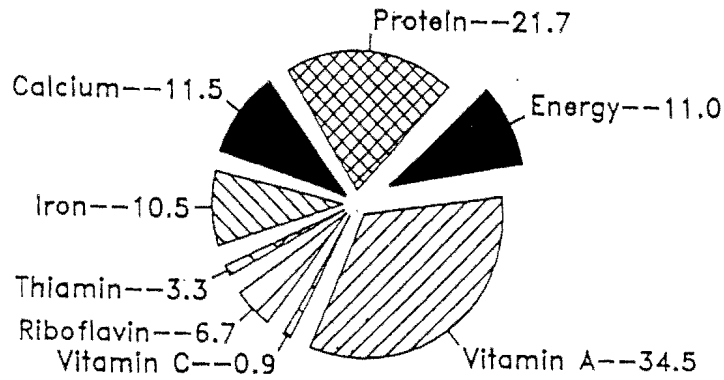
Intake of energy, protein and selected nutrients

The main results concerning the mean daily intake of energy, protein and six other selected nutrients, expressed as percent of the respective RDA, are given in tables 18 (Sepang) and 19 (Temerloh). Results are tabulated separately for breakfast, lunch and 24 h intake. The percentage contribution of the supplement to RDA is also given in the same tables.

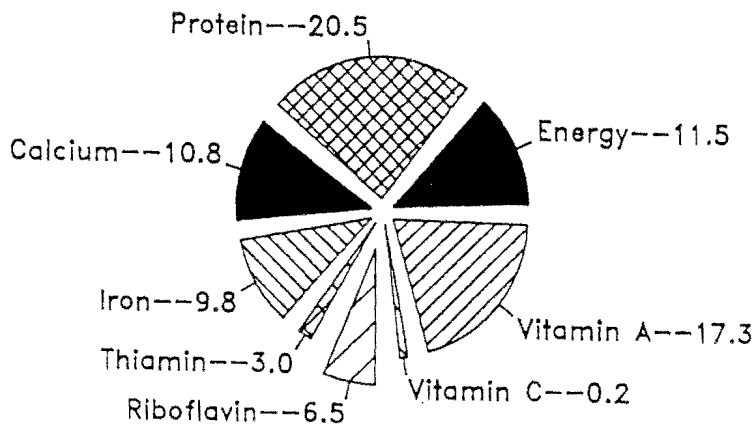
It can be elicited from the above tables that the percentage contribution of breakfast and lunch towards meeting the RDA was not significantly different between children of the feeding and control groups. This is true for children in both the districts. The contribution of the meal supplement towards meeting the RDA is given in figure 14. This is much lower for most nutrients when compared to those provided by breakfast or lunch. The feeding group exceeded the control group in their intake of almost all nutrients. This is clearly depicted in figures 5 and 6, which also show the adequacy of intake was similar for both districts for all the nutrients studied, except for vitamin C.

TABLE 18: MEAN DAILY PERCENTAGE SATISFACTION OF RDA FOR ENERGY, PROTEIN AND OTHER NUTRIENTS IN THE STUDY GROUPS IN SEPANG

	Energy	Protein	Calcium	Iron	Thiamine	Riboflavin	Vitamin C	Vitamin A
Mean % RDA from breakfast								
Feeding	14.6	22.6	19.7	16.9	22.1	21.1	11.6	27.3
Control	13.2	24.9	20.5	15.8	23.2	23.5	10.0	30.0
Mean % RDA from lunch								
Feeding	27.4	58.2	19.7	39.2	33.9	34.2	124.4	40.6
Control	28.6	60.5	18.1	38.1	33.2	31.8	122.4	48.6
Mean % RDA from supplement								
Feeding	11.0	21.7	11.5	10.5	3.3	6.7	0.9	34.5
Control	0	0	0	0	0	0	0	0
Mean % RDA in 24 hour intake								
Feeding	76.5	119.0	65.7	80.5	89.4	85.7	196.0	115.5
Control	82.7	121.8	69.0	83.4	88.9	89.0	200.9	129.6
Mean % RDA in 24 hour intake (with supplement)								
Feeding	87.5	140.7	77.2	91.0	90.4	92.4	196.0	150.0
Control	82.7	121.8	69.0	83.4	88.9	89.0	200.9	129.6



Sepang District



Temerloh District

Figure 4: Percent Contribution of Supplementary Feeding to Recommended Dietary Intake of Children.

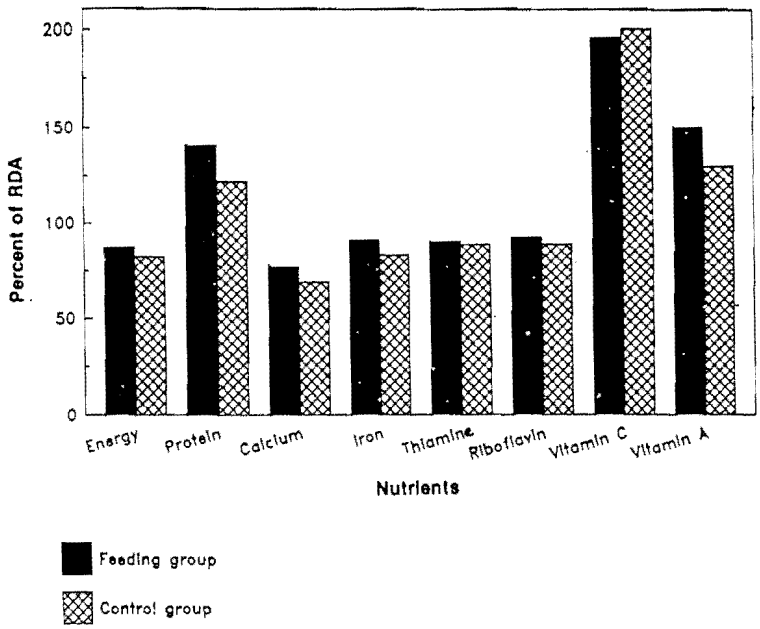


Figure 5: Mean 24-h Dietary Intake of Nutrients as % of RDA in Feeding and Control Groups in Sepang.

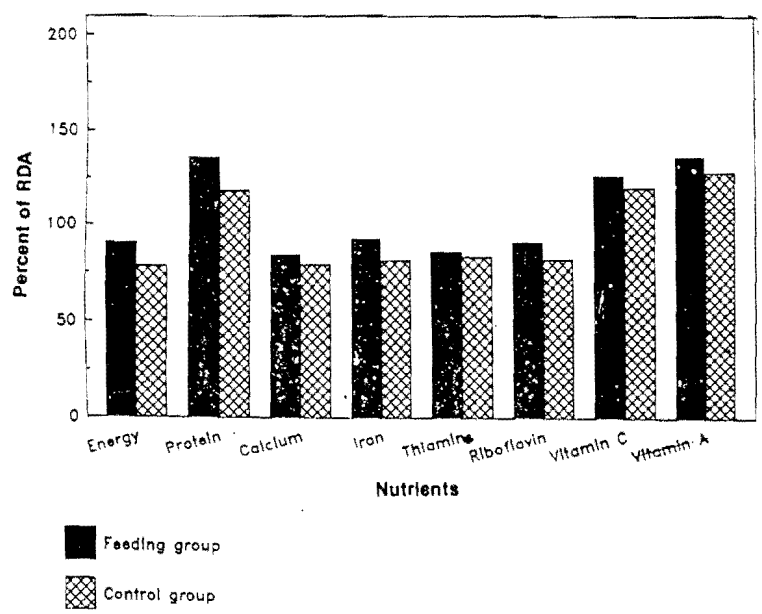


Figure 6: Mean 24-h Dietary Intake of Nutrients as % of RDA in Feeding and Control Groups in Temerloh.

Table 20 shows the percentage frequency of participation of the children in the various meals during the day. While the majority in both groups appeared to have all their meals regularly, the percentage was slightly higher in the control group. Eight percent of the children in the feeding group were found to skip breakfast. A combination of factors contributed to this habit of not eating breakfast. These include the lack of a positive attitude on the part of the parents towards eating breakfast, as they thought that the child could eat at school. Some parents said that the children did not feel hungry at breakfast. In addition, nearly 14% of the feeding group children did not have lunch on returning home. The majority of the students in both groups did not skip dinner.

TABLE 19: MEAN DAILY PERCENTAGE SATISFACTION OF RDA FOR ENERGY, PROTEIN AND OTHER NUTRIENTS IN STUDY GROUPS IN TEMERLOH

	Energy	Protein	Calcium	Iron	Thiamine	Riboflavin	Vitamin C	Vitamin A
Mean % RDA from breakfast								
Feeding	12.3	15.8	18.5	10.5	18.3	19.5	10.5	17.3
Control	12.9	13.9	17.9	10.9	19.4	21.7	12.3	19.4
Mean % RDA from lunch								
Feeding	25.4	48.2	17.9	30.7	22.9	23.7	50.8	44.5
Control	27.7	47.5	14.7	31.2	23.4	25.8	38.7	43.5
Mean % RDA from supplement								
Feeding	11.5	20.5	10.8	9.8	3.0	6.5	0.2	17.3
Control	0	0	0	0	0	0	0	0
Mean % RDA from 24 hour intake (without supplement)								
Feeding	79.0	125.0	73.6	82.5	82.9	84.0	125.3	118.2
Control	78.5	118.5	79.4	81.8	83.5	82.8	119.8	127.8
Mean % RDA from 24 hour intake (with supplement)								
Feeding	90.5	135.5	84.4	92.3	85.9	90.5	125.5	135.5
Control	78.5	118.5	79.4	81.8	83.5	82.3	119.8	127.8

TABLE 20: PERCENTAGE FREQUENCY OF PARTICIPATION IN MEALS

	Breakfast			Lunch			Dinner		
	E	S	N	E	S	N	E	S	N
Feeding	85.0	2.5	8.07	1.0	4.2	14.0	95.0	0.1	4.0
Control	81.0	6.0	13.0	90.0	3.1	6.9	98.0	2.0	0

E = Everyday S = Sometimes N = Never.

School Attendance And Performance

School attendance

The mean attendance rate in the feeding schools in the district of Temerloh at the start of the study was 93.5% whilst at the end of the first year of evaluation, the attendance rates rose up to 95.6%. At the end of the second year of evaluation, absenteeism further dropped and the average attendance rate went up to 97.2%. Changes in the attendance rates at these three points were found to differ significantly. Control schools at the beginning of the study were found to have a lower attendance rate in comparison to the feeding schools (92.4%). Absenteeism was noted to be fairly high at the end of the first year evaluation and by the end of the second year, school attendance had dropped markedly to 89.6%. This decline was found to be highly significant ($p < 0.001$).

In Sepang, the average attendance rate at the beginning of the study was 97.5% and at the end of the first year it dropped to 96.8%. The attendance rate picked up in the following year and at the end of the first year of evaluation and it rose up to 96.2% at the end of the study period. Changes in this group too did not differ significantly.

Performance in arithmetic

School performances were assessed on the basis of marks and grades obtained for arithmetics, reading and spelling during mid-term and final examination over the two years of study.

The average arithmetic scores in the feeding group in Sepang at the first mid-term examination in the first year of evaluation was found to be 70.1 ± 26.3. A slight but not significant improvement (70.9 ± 20) was noted at the final examination during this period in this group. The mean scores for this subject in the control group also showed a slight improvement but without any statistical significance. At the end of the second year evaluation, the children in the feeding group continued to perform even better and the average arithmetic scores in the final examination was found to be 72.5 ± 29.3; the improvement was statistically significant. No improvement nor deterioration of average scores for arithmetic was observed in the control group during this period.

The children in the feeding group in Temerloh obtained an average score of 75.1 ± 23.0 for arithmetic during the first mid-term examination in the first year of evaluation. No improvement in the final examination was noted during the period. However, in the second year of evaluation, this group significantly ($p < 0.05$) improved its mean scores from 70.6 ± 24.09 in the mid-term to 74.3 ± 19.28 in the final examination. The control group, as can be seen from the tables, do not appear to have improved in their performance in this subject over the two years.

Performance in reading and spelling

In nearly all the schools of both the control and feeding groups, grades i.e. A,B,C were given by teachers to assess the students performance in subjects like reading and spelling. In both Sepang and Temerloh, the percentage of children who showed an improvement in their reading skills in the first year was somewhat similar, ie. 42%. For the same duration, 27% in Temerloh and 20% in Sepang were found to have improved their grades in spelling. In the control group in Sepang, 13.2% fared better in reading at the end of the evaluation. Performance in the spelling tests among this group over the entire period of evaluation remained unchanged.

Similarly, in Temerloh, 27% of the children in the feeding schools seemed to have performed better in reading tests. The performance of the fed group in the

TABLE 21: PARENTS ATTITUDE TOWARDS FEEDING PROGRAMME

	Knowledge About Programme			Acceptability		Benefits	
	Existence	Content	Purpose	By Child	By Parents	To Child	To Respondent
Mothers (N = 125)	92	92	44	85	92	92	85
Fathers (N = 17)	95	94	65	83	95	90	85

Figures refer to percentages

spelling test, remained unchanged throughout the study.

Impact On Parents Attitude Towards The Feeding Programme

Findings with regards to the attitude of the parents towards the feeding programme are summarised in table 21.

The majority of the parents appeared to be aware of the existence and content in terms of menu of the feeding programme in their child's school. However, about half of the mothers who responded seemed to be ignorant of the purpose of providing a free meal for their child. Acceptance rate for the cooked meal was high among both parents and children. As for the benefits that the child would derive from the feeding programme, about half (41%) of the parents responded that the child will not go hungry while at school, while 21% stated that it was good for their child's health. Other reasons stated were: child had something to eat when no pocket money was given or, that it was good for the children who do not have breakfast. As to the manner by which parents benefitted from the programme, majority of them (42%) said that they could reduce the amount of pocket money given to the child. 26% also said that they need not send packed food from home, while 12% said that they need not prepare lunch in time as the child would have already eaten at school.

Knowledge And Attitude Of Teachers

All teachers in the participating schools were given the questionnaires. Everyone of them including the headmasters were requested to answer all the questions in detail. The response was good as nearly all the teachers with the exception of two headmasters, returned the completed forms. Table 22 shows the number of teachers who participated.

TABLE 22: SEX DISTRIBUTION OF TEACHERS WHO RESPONDED TO THE QUESTIONNAIRES

	Sepang (N = 74)		Temerloh (N = 54)	
	Males	Females	Males	Females
Number responded	31	43	22	32

On the objectives and menu of the programme

Majority of the teachers were able to correctly identify two and more objectives as stated in the programme manual (Ministry of Education, 1972), and were also able to state correctly two and more food items in the programme menu.

Benefits of the programme to the child

The unanimous reply to the question as to whether the programme had any beneficial effects on the child, was yes. Some of the commonly stated benefits are listed in table 23.

Teachers from both the districts had almost similar opinions. However, when compared to parents, the teachers as a group were able to identify a few more ways in which the child benefitted, for example, the teachers said that the children will not be tempted to buy undesirable snack foods. Motivation to attend school regularly was another. Teachers opinion that the programme also eased the financial burden on parents of having to provide their children with pocket money concurred with that of the parents.

Opinion about the menu and the programme as a whole

A number of teachers in the two districts who responded that the menu needed some improvement with minor changes made to it, are shown in table 24. It can be noted that majority of the teachers in both the districts were in favour of improving the menu. Some of the common suggestion made by the teachers are shown in table 25.

TABLE 23: TEACHERS VIEWS ON THE BENEFITS OF THE PROGRAMME TO CHILD AND PARENTS

1.	Programme prevents children from being hungry and helps them to concentrate on lessons.
2.	Programme is good for those who do not eat breakfast.
3.	Programme prevents children from buying non-nutritious snack foods at school canteen.
4.	Parents do not have to provide pocket money for their children to buy food at school.
5.	Food is given free therefore, parents do not have to worry about their children being hungry in school.
6.	Programme helps to supplement diet of those children who do not get enough food to eat at home.

TABLE 24: OPINION OF TEACHERS ON THE FEEDING PROGRAMME MENU

	Sepang District (N = 74)	Temerloh District (N = 54)
Satisfactory	32 (43.2%)	15 (27.8%)
Improvement/ change needed	42 (56.8%)	39 (72.2%)

TABLE 25: TEACHERS SUGGESTIONS OF MENU IMPROVEMENT

1. Include local fruits daily
2. Include more fish, meat and vegetables - to improve nutritional content.
3. Include hot beverages like milo especially when bread or bun is served.
4. Amount of food served needs to be increased, especially for children in higher classes.
5. Food needs to be prepared and laid out in a more attractive manner.
6. More variety in the menu is desirable.

TABLE 26: ACCEPTABILITY OF THE PROGRAMME AS A WHOLE BY THE TEACHERS

	Sepang District (N = 74)	Temerloh District (N = 54)
Programme		
Need improvement	49 (66.2%)	40 (74.1%)
Remain as it is	20 (27.0%)	14 (25.9%)
Should be stopped	2 (2.7%)	0
No answer	3 (4.2%)	0

Figure in parentheses refer to percentages

TABLE 27: RECOMMENDATIONS BY TEACHERS FOR THE PROGRAMME IMPROVEMENT

1. Allocation per head needs to be increased to 50 cents so that quality and quantity of food served will be enhanced.
2. Allocation of money from the Ministry to the schools should be timely so that the programme can start off right from the beginning of the first term.
3. Programme should be carried out for the entire duration of the school year.
4. Standardized guidelines on the methods of preparation of food should be prepared by the Ministry.
5. Teachers should be allocated specific days to supervise the cooking - this will ensure full participation of teachers.
6. Wherever possible, food must be prepared in the school premises only and not contracted out.

Teachers felt that local fruits, such as guava, banana and other seasonal fruits should be a regular feature in the programme's menu. They also felt that the nutritive value of the menu could be improved by increasing the content of protein foods and vegetables which were provided in the present menu. When questioned as to whether the programme by itself needed improvement, or to remain as it is now, or discontinued altogether, the majority of the teachers replied that the programme needed improvement. Table 26 shows the answers to this question.

Many areas which improvements could be made to the programme were identified by the teachers. The most common one was that the present cost

allocation per child needs to be increased from 35 cents to 50 cents. This increase would automatically take care of the need to provide fruits, more protein and vegetables in the menu. Other ways to the menu's improvement are listed in table 27.

Many specific recommendations were suggested by the teachers, especially in the areas of improvements which were to be made to the programme. The need to increase the present allocation per child may be ideal in theory but it may impose a considerable financial burden to the Government. They have also highlighted the need to improve the nutritional quality of the food served. Chemical analysis (done in IMR) on the nutrient content of duplicate samples of food served in the selected schools have shown that the nutritional content was lesser than the recommended amounts. Their recommendation to raise the allocation may be timely at this juncture as it could take care of the need to improve the nutritional quality of the present programme menu.

Observation On Some Constraints Of The Feeding Programme

The standardized menu of the supplement was designed to provide about 350-400 Kcal and 11 g of protein. Laboratory analysis of samples of meal portions showed a slightly lower level of these nutrients; an average of 250 Kcal and 7 g of protein was obtained.

Almost all of the schools studied had a defined space for cooking the meal. However, only two of the schools were found to cook the meal in the school kitchen and the food were served while hot. In other schools provision of meals was contracted out to some members of the local community. Food was cooked in their homes and brought in large containers to the schools for serving.

Other observations made were:

1. The portions of food served to all the children in the schools was the same irrespective of their age.

2. Teachers too were served the same meal during their mid-day break.

3. Ideally the meal is to be served before classes begun; in all the selected schools except one, the free meal was served between 10-10.30 in the morning.

4. In a few schools, the canteens were observed to be rather unhygienic. One of the reasons given for the difficulty in cleaning the premises was the frequent lack of water supply.

PROBLEMS IN IMPLEMENTATION OF PROJECT

There were no major problems that interfered with the logistics of the project. Project activities were carried out as scheduled. Cooperation from headmasters, teachers and parents was at all times satisfactory. By the end of 1986, six regular measurements on the nutritional indicators have been carried out at the scheduled dates. Additional visits to the study areas were made to collect data related to dietary habits, implementation and acceptance of the feeding programme.

Problems that were encountered are as follows:-

1. Drop-out rate due to absenteeism and transfer out into non- participating schools reduced the final number of students available for the examination in various nutritional indicators.

2. Lack of cooperation - A few school children out of fear sometimes

refused to be pricked for blood specimens; some even did not want to give urine specimens.

3. Insufficient volume of blood and urine samples for biochemical estimations.

4 Difficulty in locating homes of students to conduct interviews with parents.

CONCLUSION

It has been recognized that malnutrition among school children may result in poor growth, erratic school attendance and unsatisfactory scholastic performance. The provision of meals distributed free, at the school premises, and eaten in addition to home food, has often been used as a measure for improving nutritional status of these children. It has also been suggested that such programmes may also be useful for the correction of the nutritional inadequacies experienced in the pre-school years. The school supplementary feeding programme is one of the intervention strategies implemented by the government, and has been in operation for the past 20 years or more.

The effectiveness of school feeding programmes in improving the nutritional status of needy children has been controversial. This study attempted to evaluate its impact as currently implemented in selected schools in Peninsular Malaysia, and in so doing, provide input for the improvement of the programme, as well as, the implementation of similar programmes in the future.

The present study showed, at the outset, that protein-energy malnutrition (PEM) still existed at a moderate level among school children, especially in the rural areas. However, no overt clinical signs and symptoms of the specific nutritional deficiencies were observed throughout the study. Monitoring the weight and height of the school children over the two-year study period had indicated a reduction in the prevalence of PEM. Mid-arm circumference and triceps skinfold thickness measurements had also shown significant increases, particularly for the feeding group in the district of Temerloh. Such improvements in nutritional status in children receiving food supplement have also been observed by Rewal (1986) and Demeke and Wolde-Gabrial (1985).

Investigations into biochemical parameters, such as haemoglobin and plasma albumin revealed that anaemia and protein deficiency did not constitute major problems in these groups of children studied. There was no clearly improved haemoglobin levels at the end of the study period. Urinary biochemical parameters also did not demonstrate significant changes. On the other hand, the proportion of children with low albumin levels, particularly children in Temerloh, was significantly reduced.

Improvement in school attendance rates observed in this study lends support to the argument that school meal programmes augment enrolment also showed improvement, although this needs to be investigated in a more in-depth manner. Studies elsewhere (Hijazi and Abdul Latif, 1986) have reported similar findings for children benefitting from a school lunch programme.

In many intervention programmes, much of the desired impact has not been observed simply because the supplement became a substitute for regular meals. Dietary intake studies conducted showed that this was not the case in the present study. The supplemented meal was found to add substantially to the total daily dietary intake in the feeding group, especially to energy and protein consumption.

A knowledge and attitude survey conducted among parents of participating children and teachers in the

respective schools indicated that the programme was well received. Most parents were aware of the objectives of the programme and the benefits that accrued to their children and to themselves. While the need for its continued implementation was considered desirable, parents and teachers also recommended that some improvements be made to the programme. One of these recommendations was to increase the present budget to allow for more flexibility in the menu, which in turn would take care of the need for more nutritious foods to be included.

The feeding programme, despite being able to meet some of its aims, is not without any constraints. Some shortcomings were noted, and it was felt that the programme may not be achieving the other objectives, i.e. of teaching health and nutritions to the children. During visits to these schools, it had been observed that little or no health and nutrition education activities were carried out in conjunction with the feeding programme. Since school children are an important and captive target for the transfer of knowledge in nutrition and health, it is important that these aspects be given further emphasis to enable the programme to have some impact on the food and nutrition habits of children, thereby improving their nutritional status in the long run. It should be borne in mind that provision of a meal alone is certainly not enough to create a lasting impact on health and nutritional status. On a long term basis, it is vital that a systematic and committed approach to impart health and nutrition education to the school children be undertaken as part as parcel of this programme.

The study had systematically, through a number of parameters, determined the impact of the supplementary feeding programme on a selected group of rural primary school children. Improvements in nutritional status were observed and encouraging progress in scholastic performance and attendance of the children in school was noted. The observed short-comings in the implementation of the programme, and the feed-back obtained from parents and teachers should provide useful inputs for improving the programme, as well as the implementation of similar programmes in the future.

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DISCUSSION

Edwards : Why is the consumption of vitamins A and C high ?

Kandiah : This is true in the Malaysian context due to the availability of fruit trees within the surroundings of their houses.

Djoko : Is the haemoglobin level in the control group acceptable ?

Kandiah : Yes, it is acceptable. The acceptable level is 12 g per year in Malaysia.

Djoko : Do you provide any remedial treatment for the control group after this project has completed ?

Kandiah : No, we do not provide the remedial treatment. We put forward the recommendations to the Ministry of Education for the remedial treatment.

Valdecanas : Have you come up with recommendations that can be utilised at home ?

Kandiah : We have not gone to the stage of recommendations to mothers. The recommendations are at present being put forward to the Ministry of Education.

Edwards : Why do you associate vitamin C intake with high levels of infestation ?

Kandiah : The children tend to eat fruits that have fallen on to the ground and infested. Therefore, it is possible that the children might get the infestation.

Edwards : Is there any programme on hygiene and health ?

Kandiah : Yes, the children are taught hygiene and health in school. Besides this, there are also programmes on health and nutrition conducted for parents.

Tee : One of Ms. Kandiah's suggestion is in fact part of the duty of the maternal and health centres all over Malaysia i.e. to give health education to the mothers. These activities are ongoing. What is needed now is the re-enforcement of the programmes.

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