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Determinants of the Nutritional Status of Pre-School Children in an Urban and Peri-Urban Setting: A Case of Kurunegala Municipal Area, Sri Lanka

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ABSTRACT. *A total of 305 children age 3 to <6 years in Kurunegala were surveyed to determine the factors that are associated with nutritional status of pre school children living in urban and peri-urban areas. Mid-upper arm circumference (MUAC) and triceps skin fold thickness (TSF) of pre-school children were measured and the nutrient intake was assessed using a 3 day diet diary. A pre-tested, self-administered questionnaire was used to collect child, maternal, paternal, and household factors affecting child nutrition. A two-day activity recall was used to assess mother time on childcare activities. Blood haemoglobin level was measured from a sub sample of the cohort.*

The results showed that boys have a significantly higher birth weight, current weight, height, and body mass index (BMI) while girls have significantly higher TSF. The prevalence of underweight, wasting and stunting in the study cohort is 18.7%, 27.7%, and 2.6% respectively. The prevalence of anaemia was 30.5%. Mean intake of energy, fat, carbohydrate, vitamin C, and percentage of energy derived from carbohydrate and protein were significantly below the recommended dietary allowances (RDA) and calcium, iron, and percentage of energy derived from fat were significantly above the RDA for the total group. The multiple stepwise regression analysis indicated that birth weight, male gender, average care received from mother, educational level of father are positive determinants whereas child morbidity and number of children in the family are negative determinants of the nutritional status of the pre-school children in urban and peri-urban areas in Kurunegala.

INTRODUCTION

Protein energy malnutrition (PEM) is a nutritional deficiency problem of public health significance, especially among pre-school children in Sri Lanka (MRI, 2001). Although the nutritional status of pre-school children has been improved continuously in the past few decades in the country, undernutrition has been a problem of considerable magnitude in this age group. Sri Lanka Demographic and Health Survey reported that the

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national prevalence of stunting, wasting, and underweight which are widely used indicators to determine the PEM of the children of 3 - 59 months is 13.5%, 14%, and 29.4% respectively (Department of Census and Statistics, 2000).

Kurunegala in the North-Western province is the third highest populated district in Sri Lanka (Department of Census and Statistics, 2002). The rapid development activities undergone in the recent past in the area have changed the socioeconomic status. A progressive improvement in the nutritional status of the people who live in this area is anticipated. However, the prevalence of stunting, wasting, and underweight of pre-school children aged 6 - 59 months are 11%, 18.6%, and 29.1% in the North-Western province (MRI, 2001) which reflect poor performance with respect to nutrition indicators although the other socioeconomic development indicators showed some improvement.

It has been shown that the communities at transitional stages of development are confronted with both extremes of malnutrition wherein undernutrition coexists with overnutrition problem (Popkin *et al.*, 1997). Pre-school children are at the most vulnerable stage for health and nutritional problems in the life cycle and there are more complex biological, socio-economical, and behavioral determinants that will affect the nutrition of a young child through feeding and child rearing practices (Chaudhury, 1984; Yasoda and Geervani, 1994; Steyn *et al.*, 1998). It has been reported that the dietary intake and health status are the primary determinants of child malnutrition (Smith *et al.*, 2000). They are influenced by various other underlying determinants such as food security, care for mothers and children (associated with women's education), and health environment quality. Although the figures for child malnutrition in North-Western province seem to be unsatisfactory, its prevalence may not be the same in urban and peri-urban areas, where the overall socio-economic condition is better than that of rural areas. The factors that underline malnutrition of children living in rapidly urbanizing areas may be specific but they have not yet been properly elucidated. The present study was an attempt to determine specific factors that are significantly associated with malnutrition in pre-school children living in urban and peri-urban areas in Kurunegala Municipal area.

MATERIALS AND METHODS

Study design and selection of subjects

This paper presents a part of the results of a cross sectional comparative study investigating the effect of mothers employment on the nutritional status of pre-school children. Two stage sampling technique was used to select the subjects. Pre-schools in Kurunegala municipal area were stratified into three categories based on the preschool fees per term; (1) less than Rs. 1000 per term (2) Rs. 1000 - Rs. 3000 (3) more than Rs. 3000 per term to represent three income groups. From these three categories, 12 pre-schools were randomly selected. A total number of 305 pre-schoolers (age range of 3 to < 6 years) completed the study. The informed written consent was received from the parents. Pre-school children of mothers, who work abroad, stay at distant places away from home for their work, those were separated, divorced, or dead were excluded from the study. In addition, the pre-schoolers who had genetic disorders such as hemophilia were excluded since their growth and development can deviate from the normal due to the chronic disease conditions.

Data collection

Particulars of mother, father, child, and household

Pre-tested, pre-structured, self-administered, questionnaire was used to collect particulars of child, mother, father, and household. Child related factors investigated were gender, age, birth weight, child morbidity, average care time of mother, calorie adequacy of diet, and protein adequacy of diet. Maternal factors investigated were education and availability of extra help at home. Paternal factors were occupation, and education level. The household factors considered were household income, and number of children in the family. Time allocation for childcare by the mother was determined using an hour-to-hour pre-tested activity recall for two days (one week day and one weekend day). Date of birth and birth weight of the children were confirmed by examining their child development records.

Anthropometrical Assessment

Weight of the children was measured with minimum clothing and without shoes to the nearest 100g using an electronic balance (Seca 835, UK). Height was measured with a portable wall-mounting stadiometer to the nearest 0.1cm. Mid-upper arm circumference (MUAC) was measured on the left arm using non-stretchable tape to the nearest 0.1 cm. Triceps skin fold thickness (TSF) was measured on the left arm (Jamar fat caliper, Korea) to the nearest 1 mm.

Dietary Assessment

Intake of energy and selected nutrients of the children were assessed with a 3-day diet diary. All food and beverage consumed, except water, were recorded on two non-consecutive weekdays and one weekend day by the mother or in her absence the caregiver. Household measures such as cups, tablespoons, and teaspoons were used to quantify the food consumed by the respondents. Participants were given verbal and written instructions on how to complete the diet diary.

Blood haemoglobin

Blood haemoglobin concentration in capillary blood of a sub sample of the children (n = 82) was determined using HemoCue® B – Hemoglobin Photometer (Angelholm, Sweden).

Data analysis

The weight and height of children were converted to sex-specific Z scores based on the international reference population of the US National Center for Health Statistics (NCHS)/Center for Disease Control. Three anthropometric indicators were derived by computing Z scores for weight-for-age (WAZ), weight-for-height (WHZ), and height-for-age (HAZ) using the Epi-Info 2000 software package (Dean *et al.*, 2000). Underweight, wasting, and stunting of the children were determined if their WAZ, WHZ or HAZ was < -2 SD of the median value of the National Center for Health Statistics/World Health Organization (NCHS/WHO) international growth reference (WHO, 1995). Body mass index

(BMI) was calculated dividing the weight in kilograms by the square of height in meters. Average care time provided by the mothers was calculated proportionately from two-day activity recall data.

Energy and nutrient intake was computed using computerized nutritional database Food Base 2000 (Institute of Brain Chemistry and Human Nutrition, University of North London) which was updated by the Department of Applied Nutrition, Wayamba University of Sri Lanka by including Sri Lankan food composition data. Nutrient intake of each group was compared with the recommended dietary allowances (RDA) recommended by Medical Research Institute, Sri Lanka for preschool children (MRI, 1998).

Statistical analysis

Descriptive statistics, means and standard deviations for continuous variables and frequency distributions for categorical variables were calculated. Comparisons were done between males and female groups and nutrient intake of study population RDAS using independent student's *t*-test. Stepwise multiple regression analysis was done to establish independent variables, which had a significant influence on dependent variables WAZ, HAZ, WHZ, and BMI. The Statistical Package for the Social Sciences (SPSS/PC +) version 10 was used for the statistical analysis.

RESULTS

Characteristics of the sample

Table 1 shows the major child, maternal, paternal, and household characteristics of the sample. Of the 305 children who participated in the study, there were 153 boys and 152 girls. Mean birth weight of the sample was nearly 2.9 kg and the prevalence of low birth weight (< 2.5kg) was 14.8 %. Sixty three percent of the subjects were the first-born children in the family. In the study 70.8 % of children had suffered from any one of the disease conditions considered for the study. Those included cold and cough, severe diarrohoea, measles or worm infestations.

Maternal and paternal characteristics showed that high proportion of fathers and mothers of the children in this cohort had achieved Advanced Level or better educational qualifications. Only about 8% of fathers were unemployed or worked as unskilled labourers while majority of fathers had professional or business employment status. Mean monthly income was Rs.14315.00 ± 12039.37 and about 21% of the households in the cohort received only Rs. 6000 monthly.

Anthropometry and nutritional status

The anthropometric characteristics of the group are presented in Table 2. The mean age of the children was 57.3 months Boys had significantly higher birth weight, current weight, height, and BMI while girls had significantly ($p<0.01$) higher TSF. Almost all the children were breastfed in this group (data not shown) and the mean age at which breastfeeding stopped was 29.8 months. Only about 5% of children had started

complementary feeding before the age of four months and the mean age at which complementary feeding started was 4.5 months.

Table 1. Percentage distribution of key demographic and socio-economic characteristics of the group

Characteristics	Categories	No (n=305)	Percentage
Gender	Male	153	50.2
	Female	152	49.8
Birth weight	Low (<2500 g)	45	14.8
	Normal (> 2500 g)	260	85.2
Birth order of index child	First child	192	63.0
	Second or below	113	37.0
Presence of disease	Yes	216	70.8
	Not any	89	29.2
Calorie adequacy	< RDA	255	83.6
	> RDA	50	16.4
Protein adequacy	<RDA	168	55.1
	> RDA	137	44.9
Extra help at home	Not available	115	37.8
	Available	189	62.2
Mothers' education	O/ L & below	120	39.3
	A/L & above	185	60.7
Mothers' employment	Unemployed	156	51.1
	Employed	149	48.9
Fathers' education	O/ L & below	143	46.9
	A/L & above	162	53.1
Fathers' employment	Unemployed/unskilled laborers	24	7.9
	Professionals/Business	281	92.1
Number of children	1	113	37.0
	2 or >2	192	63.0

Table 2. Anthropometric characteristics, feeding period and haemoglobin concentration of the pre-school children

Characteristics	Total (n = 305)		Boys (n = 153)		Girls (n = 152)		P
	Mean	SD	Mean	SD	Mean	SD	value*
Age (months)	57.3	6.8	57.3	6.9	56.7	6.0	0.633
Birth weight (kg)	2.93	0.60	3.05	0.60	2.89	0.49	0.010
Weight (kg)	15.7	2.5	16.0	2.8	15.1	2.2	0.001
Height (cm)	106.4	5.7	107.4	6.0	106.1	5.1	0.030
MUAC (cm)	15. 7	1.6	15.9	1.7	15.6	1.5	0.114
TSF (mm)	7.5	2.4	7.1	2.6	7.9	2.2	0.004
BMI (kg/m^2)	13.5	1.3	13.8	1.5	13.3	1.1	0.002
WHZ	-1.42	0.95	-1.28	1.04	-1.40	0.84	0.333
WAZ	-1.23	1.08	-1.08	1.14	-1.18	0.99	0.358
HAZ	-0.22	1.03	-0.17	1.04	-0.108	0.97	0.330
Age breastfeeding Stopped (months)	29.8	14.1	30.3	13.8	29.2	14.5	0.533
Age complementary Feeding started (months)	4.5	1.0	4.5	1.0	4.5	1.0	0.980
Haemoglobin #	11.5	1.4	11.3	1.5	11.7	1.2	0.090

Boys n = 44; Girls n = 38 *Between boys and girls by *Students'* t-test

The overall prevalence of underweight, wasting, and stunting was 18.7%, 22.3% and 2.6%, respectively (Table 3). The overall prevalence of underweight and stunting in the study cohort was lower than that of prevalence at national level and NWP (reported earlier). However, wasting in the study cohort was higher than the prevalence at national level and NWP. The prevalence of anaemia among the children in the present study was higher than overall national prevalence rate and prevalence in North Western Province.

The intake of selected nutrients of the pre-school children is presented in Table 4. Mean intake of energy, fat, carbohydrate, vitamin C, and percentage of energy derived from carbohydrate and protein were significantly ($p<0.01$) below the RDA and calcium, iron, and percentage of energy derived from fat were significantly ($p<0.01$) above the RDA for the total group. Intake of energy per kg of body weight in this cohort was significantly ($p<0.0001$) lower and intake of protein per kg body weight was significantly ($p<0.001$) higher than the RDA. In this study cohort, about 83% of the children did not meet the RDA of energy and about 55% did not meet the recommendations for proteins (data not shown).

Table 3. Prevalence of nutritional status of the pre-school children ($n = 305$)

Nutritional indices	Prevalence % (No.)	National prevalence %*	Prevalence % in NWP **
Underweight	18.7 (57)	29.4	29.1
Wasting	22.3 (68)	13.5	18.6
Stunting	2.6 (08)	14.0	11.0
Anaemia	30.5 (25)	29.9**	28.0

* Department of census and statistics, 2000
** MRI, 2001

Table 5 presents the child related, maternal, paternal, and household factors found to be significantly influencing WAZ, HAZ, WHZ, and BMI of this cohort of children according to stepwise multivariate regression. Child related factors, birth weight and morbidity are significant independent determinants of WAZ and WHZ. Birth weight is an independent predictor of HAZ. Birth weight had a positive effect on nutritional indices while child morbidity had a negative effect. The educational level of the father is a positive independent predictor of HAZ and WAZ. Having two or more children in the family showed a significant negative effect on WAZ and HAZ. Average care time received from mother and gender of the child are independent positive predictors for BMI of children.

DISCUSSION

The main objective of this cross sectional study was to find out the determinants of the nutritional status of preschool age children living in urban and peri-urban areas. The study was setup in Kurunegala municipal area, which is a rapidly developing area in the NWP in Sri Lanka. The results of the study confirm earlier reports that the prevalence of stunting, wasting, underweight and anaemia (forms of malnutrition) is high among pre-school children age 3 to <6 years (Department of Census and Statistics, 2000; MRI, 2001). The prevalence of stunting in the study area was relatively lower than that of other national

surveys in Sri Lanka (Department of Census and Statistics, 2000). The multivariate analysis showed that birth weight, gender, average care time of mother, child morbidity, number of children in the family and educational level of father are important determinants of nutritional status of pre-school children living in urban and peri-urban areas.

In the present study, although the prevalence of underweight and stunting is lower than the respective national values, the wasting is higher among children than the national prevalence. Underweight (weight-for-age) is an indicator of either current or past nutrition, whereas stunting (height-for-age) is an indicator of past nutrition. Wasting (weight-for-height) is a sensitive indicator of current nutrition status. Wasting indicates a recent and severe process that has produced a weight loss usually as a consequence of reduced food intake and disease or chronic inadequate food intake (ACC/SCN, 2000).

High incidences of wasting in the present study could be due to the high reported episodes of disease conditions of the children. The regression analysis further indicates that child morbidity is negatively related to the current as well as past nutritional status of children. Recurrent acute infections waste nutrients and poor appetite leading towards reduced food intake that results in poor nutrition of children. Nutrient intake data of the present study further supports that majority of the children (84%) does not meet the RDA of energy. Inadequate energy and other nutrients intake together with high incidence of infections may explain the high incidence of wasting in this cohort.

Table 4. Energy and macro and micro nutrient intake of the pre-school children (n = 305)

Nutrient intake per day	Mean	SD	RDA*	P value [a]
Energy (kcal)	1233.1	384.2	1570	<0.0001
Protein (g)	36.6	12.0	36	
Fat (g)	38.3	14.3	44	<0.0001
Carbohydrates (g)	173.0	49.2	236	<0.0001
% Energy from fat [b]	28.2	7.1	25	0.010
% Energy from protein	12.0	8.4	15	0.010
% Energy from carbohydrates	53.7	1.9	60	0.010
Calcium (mg)	504.4	218.5	400	<0.0001
Iron (mg)	13.5	5.5	10	<0.0001
Vitamin C (mg)	28.4	21.5	40	<0.0001
Intake per kg of body weight	**Mean**	**SD**	**RDA****	
Energy (kcal)	80.96	27.31	90	<0.0001
Protein (g)	2.40	0.83	1.2	<0.0001

* MRI, Sri Lanka 1998
** National Research Council, RDA, Washington DC, 1989
[a] Difference between mean intake and RDA
[b] Calculated based on the recommended energy proportions

Table 5. Relationship between nutrition indices with other variables according to the stepwise multivariate regression analysis

Dependent Variable	Predicted variable	R^2	Adjusted R^2	Coefficient (β)	P value
Weight-for-age (WAZ)	Birth weight	0.088	0.075	0.191	0.001
	Child morbidity			-0.128	0.020
	Education level of father			0.133	0.019
	Number of children			-0.144	0.010
Height-for-age (HAZ)	Birth weight	0.096	0.086	0.179	0.001
	Education level of father			0.175	0.002
	Number of children			-0.189	0.001
Weight-for-height (WHZ)	Birth weight	0.032	0.025	0.132	0.023
	Child morbidity			- 0.126	0.025
Body Mass Index (BMI)	Gender	0.045	0.039	0.172	0.003
	Average care time of mother			0.121	0.034

The present analysis showed that the set of factors that influence different nutritional indices is different from each other. Regression analysis indicated that birth weight of children is a common significant factor that determines the acute as well as chronic nutritional status of children. This is consistent with the findings from other studies (Rabiee and Geissler, 1990; Brugha and Kevany, 1994; Chopra, 2003). A low birth weight (LBW) infant is more likely to be underweight or stunted in their early life (ACC/SCN, 2000). Chopra (2003) in a study conducted in South Africa showed that children with LBW are over eight times more likely to be underweight and five times more likely to be stunted. Mean birth weight of the cohort of the present study (2.93 kg) coincides with the value (2.90 kg) of the NWP (Department of Census and Statistics, 2000). However, the incidence rate of LBW in the present study is higher than that of NWP (12.6%) and lower than the national value (16.7%).

Some studies suggest maternal and paternal characteristics are important determinants in child nutrition (Yasoda and Geervani, 1994; Steyn *et al.*, 1998; Armar-Klemesu *et al.*, 2000; Chopra, 2003). A positive effect of paternal education on both acute and chronic nutritional status was observed in the present study. The principal way in which

paternal educational level has positive effect on the nutrition of children is that high education ensures better employment opportunities increasing income of the household. The results of the present study showed that more than fifty percent of fathers in the sample were employed in government and private sector that secure fixed monthly income.

Average time a mother spent for childcare is an independent determinant of BMI of pre-school children and has a positively effect on BMI of children in the present study. Childcare ensures full physiological and emotional well-being that in turn has benefit on nutrition and health of the children (ICN, 1992). Many researchers agree that the mother is the best caregiver for young children but the time she spends with her child exert positive effect on the nutrition depend on the way she react with the child (Esterik, 1995).

The present analysis showed that increasing number of children in the family negatively affected WAZ and HAZ but not WHZ of the index child. Similar results were found in other studies (Chopra, 2003). One explanation is that the increased number of children in the family leads to distributing available physical and care resources among all the children. Therefore, the proportion received for person reduces, adversely affecting individual nutritional status. In the present analysis, male gender had greater BMI than female children. Boys also had higher WHZ and WAZ than that of girls. This is in agreement with other studies (Norhayati *et al.*, 1997). It is likely that observed sex difference in BMI could be due to higher birth weight of boys compared to girls (3.05 kg *vs* 2.89 kg).

Other selected variables, age, maternal and paternal factors (maternal education, extra help at home and occupation), household income, energy adequacy, protein adequacy were not independent predictors for the nutritional status in this cohort. It should be noted that the multivariate analysis explained only a small proportion of the variation in nutritional indices considered in the study, suggesting there are other explanatory variables which were not included in the models. Although the models are significant they explain only 8.8%, 9.6%, 3.2%, and 4.5% of the total variation in the WAZ, HAZ, WHZ, and BMI respectively in this cohort. Therefore, future studies probably with a follow up period are needed to shed light on these unexplained factors that determine the nutrition status of pre-school children.

CONCLUSIONS

The prevalence of wasting and underweight among pre-school children aged 3 to <6 years living in urban and peri-urban areas in Kurunegala is 22.3% and 18.7%, respectively. The prognostic independent factors which determine the nutritional status of pre-school children found in the present study are birth weight, gender, average care time received from mother, child morbidity, number of children in the family, and educational level of father.

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