The Coexistence of Dual Form of Malnutrition in A Sample of Rural Malaysia

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ABSTRACT

Background: The coexistence of under and over nutrition might be influenced by a marked shift in dietary and lifestyle practices of people in developing countries. This study aims to identify factors associated with the occurrence of dual form of malnutrition in the same households in a rural district in Peninsular Malaysia.

Methods: A cross sectional study was conducted on a 223 mother-child pairs based on several inclusion criteria such as; non-pregnant, non lactating mothers and having youngest children aged from 2 to 12 years old. Anthropometric indices of Weight-for-age Z score (WAZ) ≤ 1SD was used to classify underweight status in children and body mass index (BMI) ≥25kg/m^2 was used to measure overweight status among mothers. A pre-tested questionnaire was used to collect socio-demographic data, whereas food frequency questionnaire was used to assess the diet diversity.

Results: The results showed that the prevalence of overweight mother/underweight child (OWM/UWC) pairs was 29.6%, whereas the prevalence of normal weight mother/normal weight child (NWM/NWC) pairs was 15.2%. Out of mother-child pairs measured, 61.0% of the children were underweight and 61.4% were stunted, whereas the prevalence of overweight and obesity in women were 35.0% and 17.0%, respectively. The study did not report any association between the dual burden of malnutrition and household size, number of children, educational level of the mother, total income, income per capita, and food expenditure, except with household type (OR:5.01;95% CI:1.63,15.34; $P = 0.005$). In general, the total diet diversity score of both types of mother-child pairs was low.

Conclusions: Dual forms of malnutrition in the same household exists in Malaysian households. This phenomenon will be a big challenge especially for food intervention programs to be implemented in the future.

Keywords: Dual form malnutrition, overweight, underweight

INTRODUCTION

Developing countries are undergoing rapid transitions of various types, giving rise to over- and undernutrition.[1] These conditions have been referred to as "under or over" nutrition,[2] but have lately been referred to as "dual burden households." A paradoxical burden of households is identified as a phenomenon of malnutrition wherein one individual is overweight while another individual is underweight within the same household.[3] Experts believe that changes in the diet and activity patterns have accelerated the obesity epidemic,[4] particularly on diet-related non-communicable diseases.[5] Countries undergoing rapid socioeconomic development face changes in food consumption patterns, and food habits are undergoing "nutrition transition".[6,7] The nutrition transition is a continuous process that occurs within all societies as patterns of diet and activity evolve over time. It is characterized by a shift from a high-carbohydrate and low-fat diet toward a "Westernized" diet, which involves higher consumption of refined grains, meat, dairy products, and edible oils. This pattern of nutritional shift is associated with low levels of physical activities performed because of modern facilities and convenient lifestyles.[5] Recent studies showed that underweight or stunting[8] coexist with overweight and obesity, such as in South Africa[9,10] and Brazil.[11] Within the same households, stunting among children was found to coexist with overweight and obese mothers.[12] Similar findings were reported in China, Russia, and Brazil.[2]

The double burden of malnutrition affects high-income households as well. However, with ample food available, some have argued that urbanization may promote better diet quality through increased access to dietary diversity.[13] Dual malnutrition is a serious problem in Asia. The most recent study found that the maternal-child double burden of malnutrition (MCDB) exists in 11.0% and 4.0% of households studied in rural Indonesia and Bangladesh, respectively.[14]

Malaysia is currently in a nutrition transition stage. A sedentary lifestyle coupled with higher consumption of energy-dense and refined carbohydrate-rich foods has led to the emergence of non-communicable diseases.[15] Unfortunately, underweight and stunting among children is more prevalent in poor households in rural areas.[16] Overweight in Malaysian adults, especially women from poor rural areas, has also been reported in previous studies. One of these findings reported that 52.1% of mothers were overweight, whereas 27.1% of the children were stunted and 5% were wasted.[5]

The dual burden phenomenon is a concern on at least two basic levels. For one, it profoundly complicates nutritional interventions.[17] Interventions aimed at reducing undernutrition (such as increasing household food supply) often contradict obesity prevention programs. Interventions to reduce overweight or obesity may recommend a reduced fat diet, which may have adverse effects on any underweight members in the same household.[3] Thus, alternative intervention programs that include the promotion of nutritious foods and a healthy lifestyle are necessary to address both types of malnutrition.[18] For another, childhood undernutrition is fast becoming known to cause a dramatic increase in the subsequent risk of obesity in adulthood.[19,20]

The aim of this study was to investigate the dual form of malnutrition and its associated factors in rural district of Peninsular, Malaysia.

METHODS

This study utilized a descriptive analytical design, employed a purposive sampling technique, and was conducted in a district called Bachok. Bachok is a coastal district located 25 kilometers east of Kota Bharu, the capital city of Kelantan state, Malaysia. In 2004, Kelantan state had the lowest mean monthly income ($US 571) of all states in Malaysia. Kelantan was selected because of the high incidence of poverty.[21] The state is also considered one of the regions with a higher proportion of undernourished children compared with other areas in Malaysia.[16] With strict inclusion criteria of households, mothers, and children, no probability sampling was run, and all the respondents were selected from the records of the welfare department until the calculated sample size was reached ($n = 223$).

The study was conducted in two phases: The first phase was a cross-sectional study. All of the 223 households in the study locations were screened for mother-child pairs that met the inclusion and exclusion criteria of at least one child

aged 2 to 12 years old with no health disabilities, non-pregnant and non-lactating mother in the age group of 18 to 55 years [Figure 1]. The specified age range included children from post-weaning to pre-puberty age. During this stage, children are dependent on mothers for food, and their food pattern resembles that of their respective households. The vulnerability of the youngest child led to their selection in households with more than one child within our age range.

Two trained research assistants measured the heights and weights of mothers and children following standard recommended procedures of the World Health Organization. A SECA digital weighing scale (to the nearest 0.1 kg) and a SECA body meter (with precision of 0.1 cm) were used. The ages of the children were calculated in months from their birth certificates. The weights and heights of the children were translated into three anthropometric indices, namely, height-for-age (HAZ), weight-for-age (WAZ), and weight-for height (WHZ). The three anthropometric indices were then analyzed in terms of the Z score using the Epi Info 3.5.1 software. Weight-for-age Z scores of children were classified as follows.[22]

Significantly underweight (Moderate–Severe): <-2 SD of the National Center for Health Statistics (NCHS) median for WAZ.

Mildly underweight: ≤ -2 SD ≤ × <-1 SD of the NCHS median for WAZ.

Normal: -1 SD ≤ x ≤ 2 SD.

This classification was agreed upon by the participating researchers in Malaysia to establish a more homogenous group. WAZ <-1 SD was used to define underweight.[5,23]

Body mass index (BMI computed as weight in kg/height in meter^2) cut-offs used to define overweight

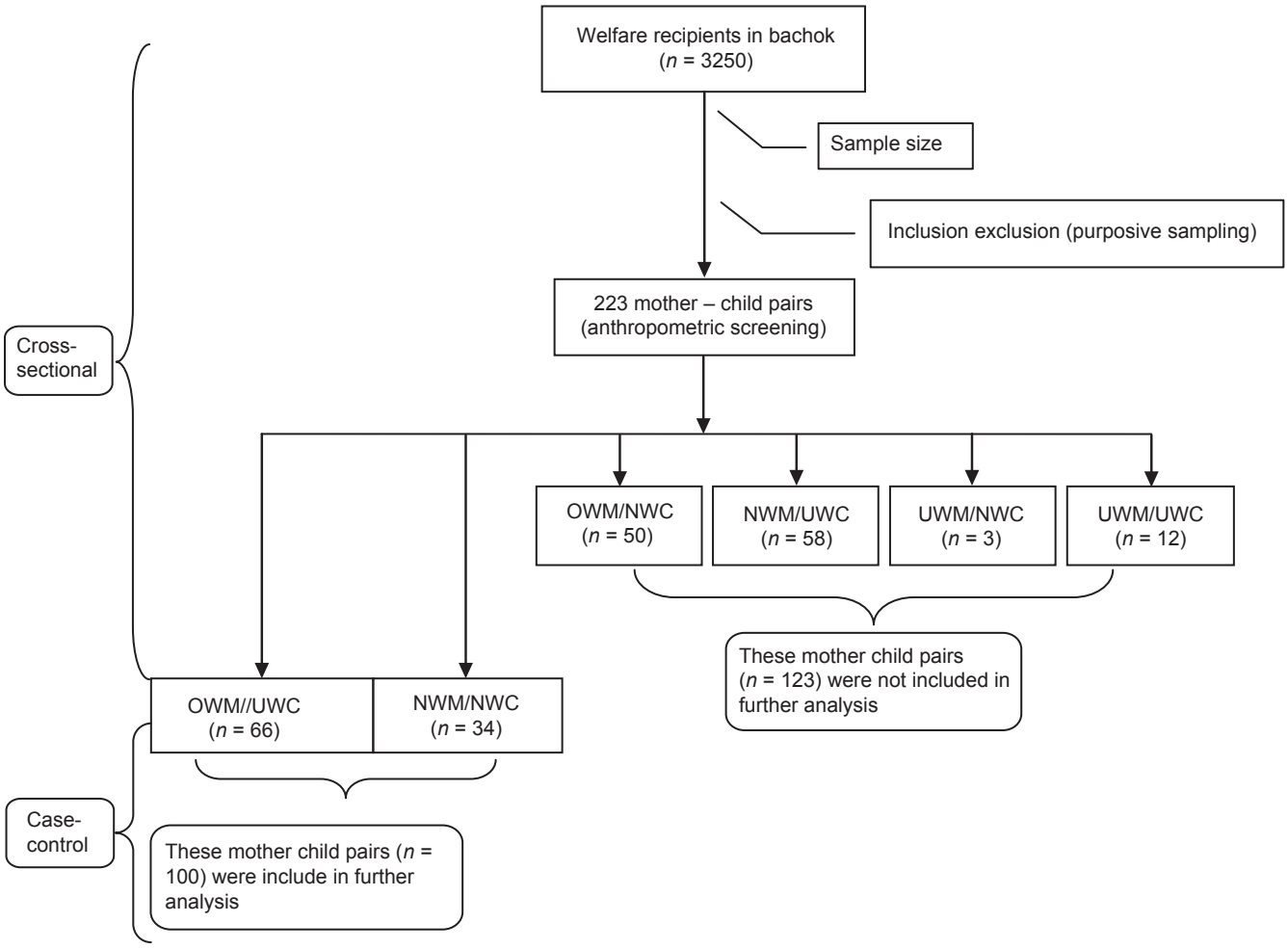

Figure 1: Sampling and study design

was BMI > 25 kg/m^2 and BMI < 18.5 kg/m^2 for underweight.[24]

A household is considered to have a dual form of malnutrition when mother-child pairs consisted of an underweight child and an overweight mother. This child-mother pair is denoted as overweight mother/underweight child (OWM/UWC).[5] Using this definition, only 66 (29.6%) mother-child pairs out of the 223 mother-child pairs measured fulfilled the definition of the dual burden of malnutrition [Table 1].

The second phase of the study was a case-control study, and for the purpose of comparative analysis, 34 normal weight mother/normal weight child (NWM/NWC) pairs and 66 OWM/UWC pairs were included in the study. The remaining mother-child pairs (n = 123) did not comply with the operational definition of the dual form of malnutrition and were thus excluded in further analysis [Figure 1].

Prior to data collection, permission was obtained from the Department of Social Welfare, Malaysia. Research protocol was approved by the Research Ethics Committee Universiti Sains Malaysia. Household socio-demographic information and the dietary diversity of the child-mother pairs were obtained from all 100 households. The food frequency questionnaire (FFQ) was used to record all the usual dietary intake of the households. The FFQ consisted of 30 food items that were common among the Malays. The 30 food items represent eight major groups of cereals and cereal products, meat and meat products, fish, fruits, vegetables, legumes, milk and dairy products, and beverages. A score of 1 is assigned if the food group is consumed daily or at least twice a week; 0 is assigned for other responses. The possible score range is 0-30, with a higher score indicating a more diverse diet.

Table 1: Proportion of mother-child pairs (N=223)

Mother-child pairs	*n*	Percentage
OWM/UWC[1]	66	29.6
NWM/NWC[2]	34	15.2
OWM/NWC[3]	50	22.4
NWM/UWC[4]	58	26.0
UWM/NWC[5]	3	1.3
UWM/UWC[6]	12	5.4
Total	223	100.0

[1]Overweight mother/Underweight child, [2]Normal weight mother/Normal weight child, [3]Over weight mother/Normal weight child, [4]Normal weight mother/Underweight child, [5]Underweight mother/Normal weight child, [6]Underweight mother/Underweight child, OWM/UWC: Overweight mother/underweight child, NWM/NWC: Normal weight mother/normal weight child

Data were analyzed using a statistical software package version 17.0 (SPSS, Inc, Chicago, IL). Descriptive statistics such as mean standard deviation, median and inter quartile range, as well as frequency and proportion were used to describe the sample. Independent t-test and Mann Whitney test were used to compare normally distributed and not normally distributed continuous variables, respectively. Chi-square test was carried out to compare categorical factors between OWM/UWC and NWM/NWC pairs. Univariate and multivariate logistic regressions were then performed to identify factors associated with the dual burden of malnutrition. All independent variables with $P < 0.25$ were considered important and were thus included in the multivariable analysis. However, important factors were also included in the multivariate regression model despite their insignificant associations with dual malnutrition. Significance level was set at $P < 0.05$.

RESULTS

Table 2 shows the selected characteristics of the households. On average, the mean age of the mothers was 42.44 (6.13) years, with the majority (60%) aged 31-45 years. No significant difference in age was observed between the two groups. Majority of the mothers (66.0%) obtained lower and higher secondary levels of education, whereas 13.0% never received formal schooling. Similarly, no difference in the level of education was found between OWM/UWC and NWM/NWC pairs. Similarities were observed between OWM/UWC and NWM/NWC pairs in terms of household composition such as household size (P = 0.492), number of children per household (P = 0.406), number of school-going children (P = 0.661), sex of children (P = 0.338), and employment status. Majority of the mothers were employed (69.0%), with a higher proportion (71.2%) of overweight

Table 2: Socio-demographic characteristics of OWM/UWC and NWM/NWC pairs

Variables	OWM/UWC (*N*=66)		NWM/NWC (*N*=34)		*t-stat* (df) χ^2 (df)	Mean difference (95% C.I.)	*P* value
	n (%)	Mean (SD)	*n* (%)	Mean (SD)			
Age of mother (years)		42.33 (6.33)		42.65 (5.79)	–0.24 (98)	–0.31 (–2.89, 2.26)	0.810††
Educational level of mother					1.95 (4)		0.745F
No schooling (%)	7 (10.6)		6 (17.6)				
Primary (%)	9 (13.6)		3 (8.8)				
Lower secondary (%)	35 (53)		17 (50)				
Higher secondary	10 (15.2)		4 (11.8%)				
Others (%)	5 (7.6)		4 (11.8)				
Household size		7.09 (2.653)		6.74 (1.959)	0.69 (98)	0.35 (–0.66, 1.37)	0.492††
No. of children per household		5.62 (2.83)		5.15 (2.42)	0.83 (98)	0.47 (–0.65, 1.60)	0.406††
No. of children go to school		3.17 (1.48)		3.03 (1.46)	0.44 (98)	0.14 (–0.481, 0.75)	0.661††
Type of household*					5.74 (1)		0.020¶
Double headed HH[a] (%)	34 (51.5)		9 (26.5)				
Single headed HH[b] (%)	32 (48.5)		15 (73.5)				
Employment status					0.44 (1)		0.504¶
Working women (%)	47 (71.2)		22 (64.7)				
Housewife (%)	19 (28.8)		12 (35.3)				
Sex of the child					0.09 (1)		0.832¶
Male (%)	27 (40.9)		15 (44.1)				
Female (%)	39 (59.1)		19 (55.9)				
Age of the children (months)		88.73 (31.65)		94.30 (31.72)	-0.83 (98)	–5.57 (–18.84, 7.69)	0.407††
Household income RM		822.25 (375.37)		785.0 (330.83)	0.48 (98)	37.24 (–113.97, 188.47)	0.626††
<RM691[c] (US $ 219.36) (%)	33 (50.0)		14 (41.2)		0.71 (2)		0.701¶
691-1000 (US $ 219.36-317.46) (%)	21 (31.8)		13 (38.2)				
>RM 1000 (>US $ 317.46) (%)	12 (18.2)		7 (20.6)				
House hold income per capita RM		121.78 (42.44)		130.50 (68.99)	-0.78 (98)	–8.72 (–30.87, 13.43)	0.437††
<RM 59d (US $ 18.73) (%)	3 (4.5)	3 (8.8)		0.73 (2)			0.693¶
RM 59-118.04e (US $ 18.73-37.4) (%)	29 (43.9)	14 (41.2)					
>RM 118.04 (>US $ 37.4) (%)	34 (51.5)		17 (50.0)				
No. of individuals contributed in HH income		1.33 (0.77)		1.05 (0.62)	1.81 (98)	0.27 (–0.02, 0.57)	0.073††
None contributing to HH income	4 (6.1%)		4 (11.8%)		2.99 (2)		0.223
Only one contributing to HH income	43 (65.2%)		25 (73.5%)				
More than one contributing to HH income	19 (28.8%)		5 (14.7%)				
Total food expenditure RM		474.1 (218.79)		441.88 (189.22)	0.73 (98)	32.26 (–55.41, 119.94)	0.467††

OWM/UWC: Overweight mother/underweight children indicated paradoxical burden malnutrition group, NWM/NWC: Normal weight mother/normal weight children indicated normal group, ††Independent *t* test. ¶Pearson Chi-Square Test, F Fisher exact test and Significant level at 0.05, [a]Double headed HH: Is the household where the father and mother are living together in the same household, [b]Single headed HH: Is the household which is headed by female (mother) due to the absent of the spouse and the mother either widowed or divorced, [c]Household poverty line income, [d]Hard core poor, [e]Poor, USD 1=RM 3.15

mothers being employed than normal weight mothers (64.7%). However, an association between household types and groups of OWM/UWC and NWM/NWC ($\chi^2 = 5.72$; $P = 0.020$) was found. More than half of the households (57.0%) were single female-headed, with the female heads either divorced or widowed; the double-headed households made up 43.0% of the total.

Almost half of the households (47.0%) lived below the poverty line (US$ 219.36) based on Malaysian reference.[25] No significant difference was observed between the monthly income of the OWM/UWC group, which was US$ 261.01 (119.16), and that of the NMW/NWC group, which was averaging US$ 249.20 (104.85). Our results showed that neither the expenditure on food nor the number of family members contributing to the total income in these households were associated with the different types of mother-child pairs.

The children involved in this study comprised 42.0% males and 58.0% females; the mean age was 82.14 (27.66) months. Based on the univariate analysis, only the type of household was associated with the dual form of malnutrition (OR: 2.95; 95% CI, 1.19, 7.27; $P = 0.019$). From the results of the simple linear regression, an independent variable with a $P < 0.25$ was considered an important and associated factor and was included in the multiple linear regression analysis. The preliminary final effect model included only one variable, which was the type of household (OR: 5.0; 95% CI, 1.63, 15.34; $P = 0.005$). Women who were either divorced or widowed were five times more likely to be associated with OWM/UWC conditions than married women [Table 3].

Household dietary diversity scores ranged from 2 to 18, and the mean score was 7.87 (3.40). The dietary scores for the eight food items and the total diet diversity score are presented in [Table 4]. The diet diversity score of the NWC/NWC group was higher than the score of the OWM/UWC group for the six food groups.

Table 3: Odd ratio for risk factor of overweight mother/underweight child

Variables	Simple logistic regression		Multiple logistic regression		
	b	Odd ratio (95.0% C.I.)	*P* value	Adjusted OR (95.0% C.I.)	*P* value
Age of mother (years)	–0.008 (0.03)	1.01 (0.94 - 1.08)	0.808		
Education of mother			0.752		
Never been to school	0.069 (0.87)	1.071 (0.194-5.913)	0.937		
Primary	–0.875 (0.94)	0.417 (0.065-2.66)	0.355		
Lower secondary	–0.499 (0.73)	0.417 (0.144-2.5)	0.496		
Higher secondary	–0.693 (0.89)	0.417 (0.087-2.88)	0.438		
Others	0.062 (.089)	0.940 (0.78-1.12)	0.488		
Household size					
No. of children per household	0.068 (.081)	0.934 (0.797-1.09)	0.402		
No. of children going to school	0.064 (.145)	0.938 (0.706-1.2)	0.657		
Household type					
Double headed HHa					
Single headed HHb	1.082	2.951 (1.19-7.27)	0.019	5.0 (1.63-15.34)	0.005
Employment status					
Working women (reference)					
Housewife	0.30 (0.45)	1.34 (0.558-3.26)	0.506		
Sex of child					
Male (reference)					
Female	–1.386 (1.25)	0.25 (0.021-2.94)	0.271		
Household income RM		1.0 (0.99-1.001)	0.623		
House hold income per capita RM	0.003 (0.004)	1.0 (0.95-1.00)	0.435		
No. of participants in household income	–0.602	0.547 (0.279-1.07)	0.080		
Total food expenditure	–0.001	0.99 (0.997-1.000)	0.464		

aDouble headed household, bSingle headed household

As for the other two food groups, namely fish and sea foods and beverages, the score was in favor of the OWM/UWC group. Despite the differences in the means of the eight food groups and the total diet diversity score, none of the differences were found to be statistically significant.

About 50.0% and 16.0% of the women were overweight and obese, respectively [Table 5]. Only

Table 4: Diet diversity score of mother-child pairs (*n*=100)

Food groups	OWM/UWC (*n*=66) mean (SD)	NWM/NWC (*n*=34) mean (SD)	*t*-stat (df)	Mean difference (95% C.I.)	*P* value
Grain and cereals	2.09 (0.92)	2.26 (1.08)	–0.84 (98)	–0.17 (–0.58, 0.24)	0.403
Meat and meat product	0.40(0.72)	0.68 (0.75)	–1.817 (98)	–0.28 (–0.59, 0.03)	0.072
Fish and sea foods	1.37 (0.60)	1.35 (0.54)	0.210 (98)	0.03 (–0.21, 0.27)	0.834
Fruits	0.00 (01.00)[A]	0.00 (1.00)[A]	–0.45[B]		0.650[C]
Vegetables	1.62 (1.75)	1.64 (1.47)	–0.07 (98)	–0.02 (–0.72, 0.67)	0.941
Legumes and nuts	0.00 (0.00)[A]	0.00 (0.00)[A]	–1.42[B]		0.154[C]
Milk and dairy products	1.05 (0.67)	0.55 (0.57)	–0.47 (98)	–0.06 (–0.29, 0.18)	0.636
Beverages	1.22 (0.45)	1.15 (0.55)	0.77 (98)	0.08 (–0.13. 0.28)	0.443
Diet diversity final score	7.65 (3.38)	8.29 (3.46)	–0.89 (98)	–0.63 (–2.07, 0.78)	0.374

[A]Median (IQR), [B]Z statistics, [C]Mann Whitney test

Table 5: Anthropometric characteristics of mother-child pairs

Variables	Total (*n*=100)		OWM/UWC (*n*=66)		NWM/NWC (*n*=34)		*P* value
	n (%)	Mean (SD)	*n* (%)	Mean (SD)	*n* (%)	Mean (SD)	
Mother							
Weight (kg)		61.85 (8.92)		65.94 (6.65)		52.78 (5.77)	0.000††
Height (cm)		152.58 (5.29)		151.89 (4.88)		153.63 (5.72)	NS
BMI (kg/m^2)		26.45 (3.73)		28.44 (2.42)		22.28 (1.80)	0.000††
BMI <18.5 (%)	0.00		0 (0.00)		0 (0.00)		
18.5-24.99 (%)	34 (34.00)		0 (0.00)		34 (100)		
25-29.99 (%)	50 (50.00)		50 (75.8)		0 (0.00)		
≥30.00 (%)	16 (16.00)		16 (24.2)		0 (0.00)		
Child							
Weight (kg)		19.42 (5.76)		18.90 (5.18)		27.37 (11.70)	0.000††
Height (cm)		114.051 (6.72)		113.06 (14.39)		126.36 (19.98)	NS
Weight-age *Z* score		–1.21 (0.971)		–1.73 (0.47)		0.033 (0.96)	0.000††
Sig. underweight (%)	18 (18.0)		18 (27.3)		0 (0.0)		
Mild underweight (%)	48 (48.0)		48 (72.7)		0 (0.0)		
Normal (%)	32 (32.0)		0 (0.0)		32 (94.1)		
Overweight (%)	2 (2.0)		0 (0.0)		2 (5.9)		
Height-age *Z* score		–1.22 (1.23)		–1.75 (0.78)		–0.288 (1.41)	0.000††
Sig. stunting (%)	27 (27.3)		26 (39.4)		1 (2.9)		
Mild stunting (%)	35 (35.4)		27 (42.4)		8 (23.5)		
Normal (%)	36 (36.4)		12 (18.2)		24 (70.5)		
>2 SD (%)	1 (1.0)		0 (0.0)		1 (2.9)		
Weight-height *Z* score		–0.54 (0.83)		–0.85 (0.62)		0.12 (0.82)	0.000††
Sig. wasting (%)	1 (1.2)		1 (1.7)		0 (0.0)		
Mild wasting (%)	26 (30.6)		23 (39.7)		3 (11.1)		
Normal (%)	58 (68.2)		34 (58.6)		24 (88.9)		
>2 SD (%)	0 (0)		0 (.0)		0 (.0)		

††Independent *t* test and significant level at *P*<0.05, BMI: Body mass index, OWM/UWC: Overweight mother/underweight child, NWM/NWC: Normal weight mother/normal weight child, SD: Standard deviation

34.0% of the mothers had normal body weight; none were underweight. The mean body weight of the OWM/UWC group was significantly higher than that of the NWM/NWC group; $P < 0.001$. BMI also differed significantly between the two groups ($P < 0.001$).

In 100 children, more than half were underweight (66.0%) and stunted (62.7%), whereas 31.8% were wasted [Table 5]. However, these percentages include both mild and significantly malnourished. The mean body weight of the underweight children in the OWM/UWC group was significantly lower at 18.90 (5.18) kg than the normal body weight of the children in the NWM/NWC group at 27.37 (11.70) kg; ($P < 0.001$). The means of HAZ, WAZ, and WHZ were all negative for children in the OWM/UWC group, suggesting the generally poor nutritional status of these children.

DISCUSSION

The coexistence of the paradoxical form of malnutrition in mother-child pairs has been found in several developing countries, especially those with a per capita gross national income (GNP) in the middle range. In Vietnam, China, Kyrgyzstan, Indonesia, Russia, Brazil, and the United States, 3% to 16% of the households comprised both underweight and overweight members.[3]

A household with an underweight child and an overweight or obese adult is the typical dual burden household for developing countries undergoing rapid transitions. Based on large national surveys, the co-existence of an underweight child and an overweight non-elderly adult was found to be the most prevalent combination of underweight and overweight household types in China (39.0%), Brazil (59.0%), and Russia (62.0%).[2] In earlier studies, researchers treated overweight and underweight as two separate public health problems, each of which has specific underlying factors. However, the existence of underweight and overweight among the members of the same household simply implies that these members have a similar degree of exposure to certain factors that can influence both types of malnutrition. The emergence of the dual burden of malnutrition in these households is a result of the nutrition transition progress in developing countries that are becoming more affluent and urbanized. These countries are seeing a decrease in physical activity levels and a shift in diets, which have come to include denser energy foods.[12]

In Malaysia, Khor and Zalilah reported the coexistence of the dual form of malnutrition. In their study of 140 rural households, the prevalence of OWM/UWC pairs was 26.0%; households with NWM/NWC pairs comprised 19.7% of the study population.[5] The findings of another Malaysian study[26] confirmed the results of the earlier study, as the percentage of dual burden households with OWM/UWC pairs was found to be 25.8%; households with NWM/NWC pairs comprised 14.8% of the total study population.

In the present study, the proportion of households with OWM/UWC pairs (29.6%) was higher than the percentages reported in previous studies.[5,26] The substantial increase in the prevalence of the dual form of malnutrition makes the dual malnutrition phenomenon an important health problem that needs to be addressed. The higher rates of the dual form of malnutrition can be attributed to the high proportion of underweight children (61.0%) and overweight mothers (62%) from the first phase of the study. The diet diversity score was low for expensive food items in both types of mother-child pairs. The hike in food prices and socio-economical constraints in low-income households facilitate consumption of excess energy from cheap foods. This behavior may affect adults and children within the same household differently. For example, young children may easily use up the excess energy and still be underweight, whereas adults may end up gaining weight.[27] Physical activity levels and food distribution within the household may also vary from one family member to another, further contributing to the under/over weight phenomenon.[2] As the children may not eat as much as adults, the diet may be inadequate in terms of both micronutrients and energy to meet the children's nutritional requirements. Consequently, chronic energy and nutrient inadequacy due to the limited amount and variety of food intake can compromise the growth of children.[26]

The larger household size in our study (6.97) might be another explanation for the higher proportion of OWM/UWC pairs in comparison with the previous Malaysian studies by Khor and Saibul, wherein household sizes were 5.8 and 5.75,

respectively. In families with limited resources, the bigger the household is, the lower the amount of food each household member consumes.[28]

Compared with overweight mothers, normal weight mothers had lower household sizes, lesser number of children, and higher income per capita, although these differences were not significant, and these findings were consistent with other Malaysian studies.[5,26] The present study did not report any association between dual malnutrition and maternal education, which is compatible with the study of Saibul and her colleagues.[26]

The high prevalence of maternal overweight in the rural Bachok District is implausible because maternal overweight is usually associated with urban areas and wealthier households.[29,30] Compared with rural of poor households, wealthier, urban households often have closer access to processed, energy-dense Westernized diets, and are less physically active because of sedentary occupations. Our findings were consistent with those of Baiotis and Lino (2002), which suggested that overweight women in poor communities tend to engage in binge-eating when food is available.[31] In recent study, Patel and colleagues suggested that awareness for need of family planning and educate mothers to improve the nutritional status of children. Nutritional rehabilitation centers are needed to treat malnutrition problem in children and also mothers.[32]

Living in poor households, with homogeny in the economic status as all respondents were recipents of monthly welfare allowance, might be an explanation for the absent relationship between economic factors and the type of mother-child pairing. We expected that married women were more likely to be overweight than widowed or divorced mothers. The physical activity of the mother in a double-headed family was lesser because of the participation of the spouse, and the spouse's presence removes the burden of stress resulting from the management of family economic and social issues. However, our findings went in the opposite direction. Although some studies did argue for this expectation, stating that majority of single-headed households are headed by females, and in households headed by two parents, the male spouse is usually the one who is looking for money to solve family problems, as is the case in single-parent headed households.

Although, the results of the present study are insufficient to make an inference for the whole population, the results shed light on a serious public health issue that should be considered. Small sample size due to specific inclusion and exclusion criteria of respondents is another limitation of the study.

CONCLUSION

Despite the number of studies that have dealt with the dual burden of malnutrition, determining the factors that influence this phenomenon remains difficult. Moreover, previous studies put forward differing factors that affect the occurrence of the dual burden of malnutrition, although majority of such studies agreed that the phenomenon is common in poor and food-insecure communities.[32]

In this study, we found that although undernutrition remains a major health problem among low-income communities, a high proportion of the women were found to be overweight and obese.In these communities, underweight or stunted children may be at risk of becoming overweight or obese in adulthood. Addressing this type of paradox is a significant challenge. However, any intervention program or activity should be modified and developed to address both forms of malnutrition simultaneously.

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