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Original Article

Studies on the Predisposing Factors of Protein Energy Malnutrition Among Pregnant Women in a Nigerian Community

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Abstract:
Protein Energy Malnutrition (PEM) continues to be a major public health problem in developing countries and affects mostly infants, young children, pregnant and lactating mothers. This study was carried on some of the factors that predispose pregnant women to PEM and hence identify groups at greater risk. A total of 1387 pregnant women (910 in the urban area and 477 in the rural areas) were recruited for the study. Anthropometric indices of weight, height and Body Mass Index (BMI) of the pregnant women were measured and semi structured questionnaires were used to elicit information on possible predisposing factors such as age, level of education, parity, child spacing etc. Results obtained showed that the mean weight and height of the rural pregnant women, were significantly ($p<0.0001$) lower than those of the urban pregnant women. The mean BMI of the rural subjects, was also significantly ($p< 0.0027$) lower than that of the urban subjects. Analysis of the effect of age showed that the younger age category (24 years and below) had significantly ($p<0.0001$) lower mean BMI and higher prevalence of PEM while the effect of level of education showed significantly ($p<0006$) lower mean BMI and higher PEM prevalence among the less educated (no formal and primary education). Those with parity of two, one and primipara showed significantly ($p<0.0175$) lower mean BMI while child spacing did not have any significant effect on both mean BMI and prevalence of PEM. The implications of these findings are discussed and recommendations made on how to tackle the problem.
Key Words: Protein Energy Malnutrition, Pregnant Women, Predisposing Factors, Owerri, Nigeria

Introduction:

Worldwide, an estimated 852 million people are undernourished with most (815 million), living in developing countries.(1,2) Poverty is the main underlying cause of malnutrition and its determinants.(3) The degree and distribution of Protein Energy Malnutrition (PEM) in a given population depends on many factors – the political and economic situation, level of education and sanitation, the season and climate conditions, food production, cultural and religious food customs, breastfeeding habits, prevalence of infectious diseases, the existence and effectiveness of nutrition programmes and the availability and quality of health services..(2,4)

Malnutrition continues to be a major health burden in developing countries. It is globally the most important risk factor for illness and death with hundreds of millions of pregnant women and young children particularly affected.(5) Poor nutrition in pregnancy in combination with infections is a common cause of maternal and infant mortality and morbidity, low birth weight and intrauterine Growth Retardation (IUGR).(6) In Nigeria, maternal death per 100,000 births is put at 800 while percentage low birth weight stands at twenty.(7)

Low birth weight babies have increased risk of mortality, morbidity and development of malnutrition. Children who suffer from malnutrition are more likely to have slowed growth, delayed development, difficulty in school and high rates of illness and they may remain malnourished to adulthood.(8,9) IUGR is associated with poor cognitive and neurological development for the infant and in adulthood, susceptibility to cardiovascular disease, diabetes and renal disease.(10)

Malnutrition remains one of the world's highest priority health issues not only because its effects are so widespread and long lasting but also because it can be eradicated. Eradication is best carried out at the preventive stage. Hence the need to identify groups of pregnant women at greater risk of developing PEM. Such high-risk groups can be targeted in any planned intervention programme.

Materials and Methods:

Subjects

A total of 1,387 pregnant women took part in the study, 910 in Owerri urban area and 477 in the rural area surrounding Owerri. The study was carried out at the antenatal clinics of government hospitals and private clinics in Owerri urban area and antenatal clinics of health centres in rural areas surrounding Owerri and covered a period of 11 months.

Approval to carry out the study was obtained from the appropriate health authorities and informed consent obtained from the subjects before the

commencement of the study. Pregnant women who had complications such as pregnancy induced hypertension, infections, malaria, metabolic disorders etc (as indicated in their medical records) were excluded from the study. All the pregnant women in the study received routine prescriptions of iron, multivitamins, folic acid and daraprim (as antimalaria prophylaxis). Data on age, educational level, parity, child spacing, etc were obtained from the pregnant women through a semi-structured questionnaire.

Sampling Technique And Sample Size

For the Owerri urban area, proportionate cluster sampling method was used. Five clusters were identified and one was randomly selected. All the hospitals and clinics in the selected cluster were included in the study. For the rural areas surrounding Owerri a total of 12 health centres were randomly selected from the 55 health centres belonging to 55 autonomous communities.

Sample size n, for random sampling was calculated using the relationship

$$n = (Z_{1-\alpha/\delta})^2 \; p(1-p)^{11}$$

Prevalence, P was taken to be 50, which gives the largest sample size.

Sampling error, was 5%

Confidence coefficient 1- α = 95% ($Z_{1-\alpha} = 1.96$)

Accordingly a minimum sample size of 384 was calculated for the rural areas. To take into account the cluster design effect, the calculated random sampling size, n is multiplied by two.(12) Hence a minimum sample size of 768 was obtained for the Owerri urban area.

Anthropometric Indices

Anthropometric measurements of the pregnant women were performed with the help of trained assistants. Body weights were measured without shoes and with light clothing to the nearest 0.1kg on a weight scale. Standing height was measured without headgear using a stadiometer to the nearest 0.1cm. Body mass index (BMI) was calculated as weight (kg) divided by height (m) squared (kg/m^2). According to UN classification, BMI < 18 is considered severely malnourished, 18-20 is moderately malnourished, 21-24 is normal, 25-27 is overweight and > 27 is obese.(13)

Statistical Analysis

Data was analysed using the software package SAS version 8. (SAS Institute Inc, Cary, North Carolina). Pearson chi Square, Anova and post Hoc Duncan's multiple range test were used to identify statistically significant differences. Data was considered significant for $p < 0.05$ at 95% confidence limit.

Results:

A total of 1,387 pregnant women were included in the study (910 in the urban area and 477 in the rural areas). The mean weight and height of the pregnant women in the rural areas, 63.65 ± 14.80kg and 1.58 ± 0.07m respectively were significantly lower than those of the urban subjects, 68.92 ± 10.23kg and 1.67 ± 0.08m respectively, $p<0.0001$ in each case. The mean BMI of the rural subjects, 25.28 ± 4.60kg/m^2 was also significantly lower than that of the urban subjects, 26.41 ± 3.36kg/m^2, $p<0.0027$. In the urban area, 35% of the pregnant women were public servants, 43% were involved in some business activity and 22% were housewives/students not holding any jobs. In the rural sub sample, 8% were public servants, 22% were involved in some business activity and 70% were engaged in subsistence farming as a means of livelihood.

Table 1: Mean BMI And Prevalence Of PEM According To Age Of The Pregnant Women.

Age (yrs)	Frequency	BMI (kg/m^2)			%* PEM
		Range	Mean	s.d	
Overall					
< 20	68	16.94-30.30	25.07[c]	2.58	25.00
20-24	443	18.82-42.36	25.16[c]	3.21	11.74
25-29	454	17.80-41.80	26.50[b]	3.86	6.17
30-34	261	18.65-38.08	26.35[b]	3.77	5.36
35-39	130	18.37-38.08	26.92[b]	4.86	4.62
> 40	31	22.48-36.57	29.04[a]	3.84	0.00
Total	**1387**				
Urban					
< 20	35	22.22-30.30	27.25[b]	2.63	0.00
20-24	245	18.82-33.15	25.72[b]	3.000	4.89
25-29	328	17.80-36.79	26.54[b]	3.42	4.57
30-34	186	20.00-35.50	26.49[b]	3.32	4.20
35-39	88	18.37-35.63	26.58[b]	3.59	3.41
>40	28	25.00-36.57	29.54[a]	4.32	0.00
Total	**910**				
Rural					
< 20	33	16.94-25.10	22.29[b]	2.52	51.52
20-24	198	18.99-42.36	24.33[b]	3.72	20.20
25-29	126	19.37-41.80	26.36[a]	4.19	10.31
30-34	75	18.65-38.09	25.94[a]	4.77	8.00
35-39	42	19.04-38.08	27.75[a]	6.53	7.14
> 40	3	22.48-26.49	23.51[b]	2.83	0.00
Total	**477**				

Values with different superscripts per column are statistically significant ($p<0.05$)

* % PEM: Overall – $p<0.0136$, Urban – $p<0.4194$, Rural – $p<0.0001$ (Pearson X^2 used)

Table 1 shows mean BMI and prevalence of PEM amongst the pregnant women according to age. Overall the pregnant women below 20yrs and 20-24yrs age groups showed significantly ($p<0.0010$) lower mean BMI and significantly ($p<0.0136$) higher percentage of PEM than the older age categories. In the urban sub-sample, both mean BMI of the 24 years and below age category was significantly ($p<0.0421$) lower than that of above the 40 years age group while prevalence of PEM

did not show statistical difference (p<0.4194) among the various age groups. In the rural sub-sample, mean BMI of the 24 years and below age group was significantly (p<0.0111) lower than the older age groups and their proportion of PEM was significantly (p<0.0001) higher.

Table 2: Mean BMI and Prevalence of PEM of the Pregnant Women According to Educational Level

Level of education	Frequency	BMI (kg/m^2)			%* PEM
		Range	Mean	s.d	
Overall					
No Formal Education	104	16.94-36-85	24.80[c]	2.57	12.50
Primary Education	362	17.80-40.03	24.76[c]	3.43	12.71
Secondary Education	621	20.48-42.36	25.86[b]	3.98	7.25
Post Secondary Education	300	18.73-41.80	27.03[a]	4.10	4.00
Total	**1387**				
Urban					
No Formal Education	62	22.86-34.18	25.63[a]	3.00	4.84
Primary Education	188	17.80-35.86	25.80[a]	2.94	4.79
Secondary Education	420	18.73-35.56	26.19[a]	3.08	4.05
Post Secondary Education	240	18.36-36.79	27.45[a]	3.70	3.75
Total	**910**				
Rural					
No Formal Education	42	16.94-36.85	24.72[b]	2.33	23.81
Primary Education	174	19.04-40.03	24.35[b]	3.93	21.26
Secondary Education	201	20.48-42.36	26.64[a]	4.58	13.93
Post Secondary Education	60	19.73-41.80	28.47[a]	4.48	5.00
Total	**477**				

Values with different superscripts per column are statistically significant (p<0.05)

* % PEM: Overall – p<0.0104, Urban – p<0.0351, Rural – p<0.0476 (Pearson X^2 used)

Table 2 shows mean BMI and prevalence of PEM amongst the pregnant women according to level of education. Overall, the pregnant women with primary education and no formal education had significantly (p<0.0006) lower mean BMI and significantly (p<0.0104) higher prevalence of PEM. In the urban area, although there was no statistical difference (p<0.6287) in mean BMI, there was significant difference (p<0.0351) in prevalence of PEM amongst the pregnant women according to level of education. In the rural sub-sample the primary and no formal education groups had significantly (p<0.0012) lower mean BMI and significantly (p<0.0476) higher prevalence of PEM.

Table 3: Mean BMI And Prevalence Of PEM According To Parity Of The Pregnant Women

Parity	Frequency	BMI (kg/m^2)			% PEM*
		Range	Mean	s.d	
Overall Primipara	106	19.26-33.12	25.68^b	3.24	5.66
1	251	17.44-36.79	25.31^b	2.95	12.35
2	304	16.94-42.36	25.45^b	3.85	7.89
3	354	18.64-41.80	26.45^a	4.32	6.50
4	205	19.53-35.56	27.13^a	4.08	7.32
>4	167	17.79-40.03	26.63^a	4.15	9.58
Total	**1387**				
Urban					
Primipara	100	19.26-33.12	25.82^c	3.43	6.00
1	185	18.82-36.79	25.12^c	3.06	5.41
2	220	18.36-33.96	25.66^c	3.35	5.45
3	240	19.84-35.62	26.79^b	3.02	2.08
4	112	20.89-35.49	27.58^a	3.58	2.68
> 4	53	17.80-36.57	27.84^a	4.45	3.77
Total	**910**				
Rural					
Primipara	6	22.66-23.31	22.99^a	0.45	0.00
1	66	17.44-27.88	23.59^a	2.89	31.82
2	84	16.94-42.36	24.80^a	4.68	14.29
3	114	18.64-41.80	25.61^a	5.63	15.79
4	93	19.53-35.56	26.49^a	4.13	13.68
>4	114	19.04-40.03	25.97^a	4.85	12.28
Total	**477**				

Values with different superscripts per column are statistically significant ($p<0.05$)

* % PEM: Overall – $p<0.0136$, Urban – $p<0.0166$, Rural – $p<0.1942$ (Pearson X^2 used)

Table 3 shows mean BMI and prevalence of PEM according to parity. Overall the lower mean BMI of parity of one, parity of two and primipara showed significant ($p<0.0175$) differences from the other groups although their prevalence of PEM was not significantly ($p<0.0638$) different. In the urban sub sample, the lower mean BMI of parity of one, two and primipara showed significant ($p<0.0244$) difference from those of the other groups. Their prevalence of PEM was also significantly ($p<0.0166$) different. In the rural sub-sample, although the mean BMI and prevalence of PEM did not show statistical differences, the pregnant women with parity of one presented the highest prevalence of PEM of 31.82%.

Table 4: Mean BMI And Prevalence Of PEM According To Child Spacing Of The Pregnant Women

Child spacing	Frequency	BMI (kg/m^2)			% PEM*
		Range	Mean	s.d	
Overall					
Primipara	106	16.94-32.36	25.53[a]	3.34	5.60
<1yr	80	19.98-29.90	25.21 [a]	3.56	10.00
1-1.5yrs	354	17.79-35.56	26.38 [a]	3.65	7.34
1.5-2yrs	415	18.73-40.03	26.59 [a]	4.26	6.70
2-2.5yrs	197	20.00-32.29	25.74 [a]	3.34	9.64
Above 2.5yrs	235	18.36-42.36	26.10 [a]	4.62	11.91
Total	**1387**				
Urban					
Primipara	100	18.82-32.29	26.17 [a]	3.24	6.00
< 1yr	50	21.83-28.26	26.01 [a]	2.09	6.00
1-1.5yrs	250	17.80-34.89	26.40 [a]	3.13	3.20
1.5-2yrs	295	18.73-34.89	26.70 [a]	3.48	3.05
2-2.5 yrs	102	20.00-32.29	25.87 [a]	2.86	5.88
Above 2.5yrs	113	18.36-36.79	26.58 [a]	4.33	5.31
Total	**910**				
Rural					
Primipara	6	16.94-32.36	23.15 [a]	4.00	0.00
< 1yr	30	19.98-29.90	23.88 [a]	4.14	16.67
1-1.5yrs	104	19.15-35.56	26.30 [a]	3.87	17.31
1.5-2yrs	120	20.00-40.03	26.36 [a]	4.60	16.67
2-2.5yrs	95	20.96-32.03	24.69 [a]	5.01	18.68
Above 2.5yrs	122	18.65-42.36	25.51 [a]	5.31	16.39
Total	**477**				

Values with different superscripts per column are statistically significant ($p<0.05$)

* % PEM: Overall – $p<0.2192$, Urban – $p<0.1991$, Rural – $p<0.1081$ (Pearson X^2 used)

Table 4 shows mean BMI and prevalence of PEM according to child spacing. Overall no statistical difference in mean BMI and prevalence of PEM was found among the pregnant women according to child spacing. The same was the case in both the urban and rural sub-samples.

Discussion

Majority of the subjects in the rural sub sample were subsistence farmers and as is the case in most sub-Saharan African countries although they spend long hours farming they still have limited access to food since the men control the family resources.[14] The rural women therefore consumes systematically below their minimum daily calorie requirement.[15] This would explain the lower mean weight, height and BMI of the rural subjects compared to the urban subjects. A previous study by the authors showed prevalence of PEM to be 3-4 times higher in the rural area compared with the urban area (unpublished finding).

The effect of age on the prevalence of PEM showed that the age groups, below 20years and 20-24 years, presented the higher prevalence of PEM of 25% and 11.74% respectively. Their mean BMIs were significantly lower than those of the other age group. The 24 years and below age group is apparently the group at greater risk for PEM especially in the rural areas. The age effect although not seen in the urban area was quite prominent in the rural areas.

The effect of level of education on the prevalence of PEM showed that those with no formal education and primary education had significantly lower BMI and higher percentages of PEM than those of other groups. Hence it can be concluded that the less educated are at greater risk of developing PEM. Level of education did not show any effect in the urban area but was a significant factor in the rural areas. The more educated pregnant women in the rural areas are the ones that are likely to be engaged in occupations other than farming which will fetch them more income and hence greater food purchasing power. In the urban area on the other hand, even the less educated pregnant woman is likely to be engaged in some economic activity which will earn her some income and thus guarantee her reasonable food purchasing power.

Parity of two, one and primipara recorded mean BMIs that were significantly lower than those of the other groups. This effect was more pronounced in the urban area than the rural areas. This can be explained by the fact that weight gain increases with increase in parity.[16] Hence those with lower parity are likely to have lower BMIs. However, in the rural areas, this might not necessarily be the case since as has been pointed out the rural women live physically arduous lives[17] and so the usual weight gain with increase in parity may not be observed.

Although the nutritional demands of frequent cycles of pregnancy and lactation (child spacing) have always been known to impact negatively on the nutritional status of women[17], results from the present study showed that child spacing did not have any significant effect on both the mean BMIs and the prevalence of PEM amongst pregnant women both in the urban and rural areas. The reason for this is not immediately obvious but it might be that the education intervention programmes (usually a common feature of antenatal clinics) on birth control measures and child spacing may be yielding dividends.

In conclusion, Protein Energy Malnutrition among pregnant women remains a major public health problem in Nigeria especially in the rural areas. Those who are at greater risk are the teenage and young mothers, the less educated, the primigravidae and those with parity of one or two especially in the rural areas. In view of the adverse effects of PEM on both mother and child it is recommended that appropriate intervention programmes be instituted to tackle the problem and the following recommendations are hereby made:

1. Introduction of feeding programmes in antenatal clinics and health centers or in the alternative, provision of food subsidies to targeted groups,
2. Counseling on dietary intake and reduced energy expenditure before and during pregnancy.
3. Nutrition education and efficient nutrition monitoring systems at all levels of care.
4. Subsidized agricultural inputs and labour saving devices for women.
5. Hygiene education, improved access to potable water and adequate sanitation and health care services
6. Providing opportunities for women's involvement in development through access to education, paid employment, assets such as land and credit facilities.

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