PJN
ISSN 1680-5194

PAKISTAN JOURNAL OF NUTRITION

ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorpjn@gmail.com

Pakistan Journal of Nutrition 10 (5): 485-491, 2011
ISSN 1680-5194

Child Spacing and Parity Progression: Implication for Maternal Nutritional Status among Women in Ekiti Communities, Southwestern Nigeria

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Abstract: The evolving dynamics that face maternal health in developing countries are worrisome. The achievement of the desirable Millennium Development Goals on maternal and child health in Ekiti will remain a mirage if women nutrition is compromised. Short birth spacing and high frequency of childbearing adversely affect maternal health through maternal depletion syndrome. This study was a cross-sectional house-hold survey where a stratified multi-stage sampling technique was used to select 1450 women of childbearing age as respondents. Body Mass Index (BMI) measurement was used as indicator of nutritional status. Results showed that the median birth interval was 33.0 months. Parity progression rate was higher among under-nourished mothers and births after an interval of less than 24 months (short birth interval) was accounted for by 38.3% of undernourished mothers. Taking into account of several potentially confounding variables, the Cox-regression model showed that mothers who left birth interval of less than 24 months are 2.0 ($p<0.01$), 4.4 ($p<0.001$), 5.71 ($p<0.001$) at risks of undernourishment than their counterparts who left 24-35, 36-59 and 60+ months interval between births respectively. The strength of the association remains unchanged when the potential confounding variables were controlled. Births interval of at least 36 months will produce best health outcomes for mothers in terms of nutrition as evidence in this study. Strategies should be adopted to improve women knowledge on the effect of short birth spacing on maternal nutrition.

Key words: Birth interval, parity progression, cox-regression model, maternal nutrition

INTRODUCTION

Contemporary trends in child and maternal survival point to a calm global health misfortune: 10 million under five children and over 500,000 women breathe their last breath annually, due mainly to avertable causes. One hundred and fifty million children around the world are malnourished. Each year, an estimated 20 million infants are born with low birth weight, a condition directly connected to infant transience. Despondently, the international community is yet to mobilize adequate resources, infrastructure and political will needed to address this often unnoticed international catastrophe (United Nations, 2008).

Researches are consistent with the view that short birth spacing and high frequency of childbearing adversely affect maternal health. The evolving dynamics that face maternal health in developing countries are worrisome, particularly in sub-Saharan Africa. In this region, maternal and child mortality is high and among the regions contributing to poor maternal and child health outcomes globally (Rutstein, 2003).

Previous studies on the effects of birth spacing and Parity Progression (PP) on maternal nutritional status revealed that short birth interval and higher PP have adverse effect on maternal nutritional outcome. This is because a short birth interval may give mothers insufficient time to recuperate from the nutritional burden of pregnancy (King, 2003). The onset of pregnancy increases energy needs by 13%, protein needs by 54% and vitamin and mineral needs by 0-50% (Institute of Medicine (2000); (2001)). For instance, if the mother's reserves have been depleted during pregnancy, a longer inter-pregnancy interval will allow for repletion prior to the conception of the next child.

In any research on maternal nutrition and birth interval analysis, maternal Body Mass Index (BMI) is a key variable to consider, as it may be assumed to be inversely related to the birth interval and PP. However, different analytic issues need to be considered on this assumption. For instance, a woman with higher BMI is likely to return to fertility sooner than her counterpart with lower BMI (Kurz *et al.*, 1993; Heinig *et al.*, 1994; Popkin *et al.*, 1993) and if such woman is not using contraception, this will eventually transcend to a shorter birth interval.

The mother's dietary adequacy and physical activity level are important effect modification factors of the consequence of birth interval on the mother's nutritional status (Kathryn and Roberta, 2004). For a woman with generous nutrient intake, a longer period for "repletion"

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is unlikely to make a difference, whereas for malnourished women or those with high levels of physical activity, this recuperative interval could be essential. Other factors such as socioeconomic status, educational level, prenatal care, parity, cultural belief and maternal morbidity, may act as confounder of the relationship between birth interval and maternal nutritional status (Winkvist *et al.*, 1994).

Investigating the relationship between birth interval, PP and maternal nutritional status may at times be cumbersome because of numerous variables that needed to be involved in the analysis. In addition to the complex set of factors that may be drawn in, it is likely that the type of relationship may be more evident in populations with higher poverty level. Use of contraception is another complicating factor, particularly if choosing to become pregnant again is influenced by the mother's or the child's health status. Some potentially confounding variables may be important in certain populations but not in others (culture).

The effect of short birth intervals has been demonstrated many times to be one of the key variables affecting maternal nutrition. Little research has been done, however, on determining the effect of parity progression and birth interval on maternal nutrition, particularly in Ekiti communities. Evaluation of maternal nutritional status allows identification of subgroups of women population that are at increased risk of faltered growth, disease and health. Also, parity progression was examined by classifying the births with respect to year of occurrence by birth order according to maternal nutritional status. This was with a view to revealing the patterns of childbearing in the study area.

This study examined the question of whether a short birth interval and high rate of progression are associated with adverse nutritional outcomes for mothers of reproductive age in Ekiti communities, southwestern Nigeria.

MATERIALS AND METHODS

Study design: The study was a cross-sectional household survey where retrospective information was sought from the respondents who were women of childbearing age and have given birth to at least two children prior the survey. A well structured questionnaire containing relevant questions was administered on 1450 women of reproductive age (15-49 years) using a multi-stage area probability sampling technique. At the first stage, one Local Government Area (LGA) was randomly selected from each of the three senatorial districts in Ekiti-State. These are Emure, Oye and Ekiti-West LGAs. Based on the 2008 projected figures for population of women of childbearing age in each of the selected LGA and using sampling with proportion to population size, the samples selected were 319 from Emure LGA, 522 from Oye LGA and 609 from Ekiti-West LGA. The value was used to divide the selected sample from each of the selected LGA. Consequently, 11, 18 and 21 Enumeration Areas (EAs) were randomly picked from Emure, Oye and Ekiti-West LGAs respectively. Thereafter, 29 households were chosen from each selected EA using a systematic random sampling technique. Standardized weighing balance and tape-rule were used to capture the weight and height of the respondents respectively for the determination of Body Mass Index (BMI) of the respondents.

Data entry and analyses were performed using EPI INFO and SPSS software packages. In the analysis, Cox and logistic regression models were employed to correlate the relationship between the maternal nutritional status and birth spacing. Logistic regression was used by defining dichotomous for nutritional status as a dependent variable. The independent variable used is birth interval. For applicability of logistic regression model, maternal nutritional status was dichotomized as shown in Table 1.

Table 1: Classification of respondent's nutritional outcomes

Pair groups	Mothers nutritional outcome	
A	Normal vs Underweight	Normal = 1 Underweight = 0
B	Normal vs Overweight	Normal = 1 Overweight = 0
C	Normal vs Obesity	Normal = 1 Obesity = 0
D	Normal vs Overweight and obesity	Normal = 1 Overweight and obesity = 0
E	Normal vs Others	Normal = 1 Others = 0

Measuring Parity Progression Probabilities (PPP): Survival analysis technique was used to provide estimate of PPP. The quantitative term used in the analysis is the survivorship function S(t) which gives the probability that a woman survives longer than some specified time t without given birth to a child in a particular order. Mathematically S(t + 5) represents the probability of surviving from the initial event (time zero) until (t + 5) time units later. Then,

$$S(t + 5) = P_0 \times P_1 \times P_2 \times \ldots \times P_t = \prod_{j=0}^{t} P_j$$

$$\text{Therefore, } S(t) = P_0 \times P_1 \times P_2 \times \ldots \times P_{t-5}$$

$$\Rightarrow S(t + 1) = S(x)P_t \quad \text{for } x > 0 \text{ Hence,}$$

$$S(1) = P_0;\ S(2) = P_0 \times P_1;\ S(3) = P_0 \times P_1 \times P_2 \text{ and so on.}$$

The value of a PPP may vary from zero to unity. A value of zero means that no women of the specified parity had an additional birth. The higher the value, the more births of the next higher order took place. In this study, the focus was on the length of time at which a particular outcome occurs i.e. birth. The analysis was done by number of births by age and also by women's Body Mass Index

(BMI). The essence is to know whether the childbearing momentum has impact on BMI.

Measuring maternal nutritional status of women: Anthropometric data on height and weight were obtained from 93.0% of the 1450 respondents. Body mass index was defined as weight in kilogram divided by height in meters squared (kg/m^2). A cut-off of less than 18.5 was used to define thinness or acute under-nutrition and a BMI of 25.0 or above usually indicates overweight or obesity. However, to investigate the effect of birth-interval on maternal nutritional status, the Body Mass Index (BMI) computed from weight and height of the respondents was disentangled into different ranges using international standard.

Each of the classified groups was then combined with the normal BMI to dichotomize the variables. If the maternal nutrition outcome is normal it attracts code 1 and 0 if otherwise as shown in the Table 1. This provided means for establishing the association between birth intervals and Nutritional status of women.

Measuring spacing of childbearing: Spacing of childbearing was measured as the inter-birth interval (Time in months between the delivery of the previous child irrespective of the surviving status of the child and the index child). Women who gave birth in the last five years, preceding the survey were considered for the analysis of child spacing. Women who lost their index child were examined for their nutritional status. Thereafter, a sequential birth history of the arrival of the index child was constructed for each woman. The index child was the most recent delivery by the woman and has not had any other pregnancy since his/her delivery as at the time of the survey. Selected socio-demographic variables were then considered in relation to nutritional status of the index child. This paved way for the analysis of the effect of child spacing on maternal nutritional status in the study area. For each child in the study, time (t) starts with a value of zero at birth to the first 59 months of life.

Exclusion criteria: The analysis excludes women for whom there was no information on height/weight and women for whom their BMI could not be determined because they were pregnant, breast feeding or had given birth in the preceding two months. Also, small number of births were recorded for 7 or higher parities, this may bias the result and as such discarded from the discussion.

RESULTS

Table 2 shows the differentials in Parity Progression Probability (PPP) and Parity Progression Rate (PPR) according to respondent's Body Mass Index. The incidence of first births i.e. transition from parity zero to parity 1 represented by P_0 is 947 births per 1,000 women in the sample. The parity progression rate for all women studied is 0.057 (p<0.05). To study the parity progression probabilities with respect to women nutritional status, separate PPPs for different nutritional categories were computed (underweight, normal and overweight/obese).

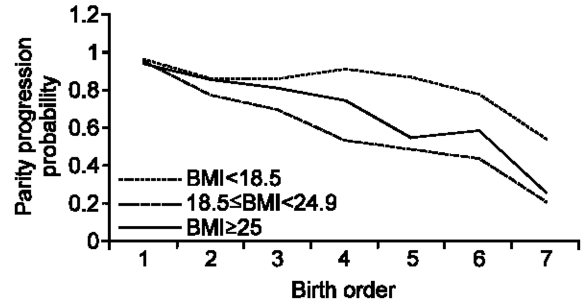

Fig. 1: Parity progression probabilities by birth order according to nutritional status

The data revealed that the percentage of women who progress from parity 0-1 (P_0) is highest among underweight women. The least value of P_0 recorded among normal BMI probably reflects the high proportion of educated women in the subgroup. The probabilities of progressing through higher order parities (up to parity 6) are consistently higher among underweight women than normal weight women. The Parity Progression Rate (PPR) of women with normal nutritional status (0.048, p>0.05) is also lower than that of underweight women (0.067, p<0.01). Similar pattern was observed when the parity progression probabilities and rates of normal weight women were compared with overweight/obese women (0.071, p<0.01). Figure 1 shows a clear indication that woman with normal BMI progress in parity than those who are either underweight or overweight.

Nutritional status of women: Table 3 presents nutritional indicators for women by various background characteristics. The variables such as current age, place of residence, levels of education, income, parity and husband's income were associated with the women nutritional status at 5% level of significance. Overall, the mean height of women in the study area was 160 centimeters and 2.8% fell below the cut-off of 145 centimeters. Women in age group (15-19) were slightly shorter than women in the other age groups. More than 5 in 10 (57.3%) of respondents had normal BMI, approximately one in eight women (12.6%) were undernourished or thin and one in ten (9.5%) were obese.

There were large differentials across background characteristics in the percentage of women assessed as under-nourished (BMI<18.5) and overweight or obese (BMI≥25). Among different categories of women, the percentage of undernourished women was higher in

Table 2: Parity Progression Probabilities (PPP) and Parity Progression Rates (PPR) by birth order according to date of childbearing and maternal nutritional status

Year of birth	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	PPR
Nutritional status												
BMI<18.5												
1976-1978	0.982											
1979-1981	0.927	0.971	0.992									
1982-1984	0.807	0.873	0.933	0.972								
1985-1987	0.648	0.735	0.832	0.873	0.968	0.986						
1988-1990	0.436	0.534	0.643	0.744	0.843	0.904	0.949					
1991-1993	0.264	0.335	0.405	0.551	0.653	0.753	0.803	0.882	0.875			
1994-1996	0.130	0.173	0.221	0.332	0.442	0.523	0.617	0.675	0.547			
1997-1999	0.051	0.065	0.089	0.163	0.247	0.320	0.364	0.397	0.342	0.500		
2000-2002	0.015	0.015	0.021	0.042	0.096	0.124	0.131	0.187	0.086	0.250	0.500	
2003-2005	0.004	0.002	0.002	0.006	0.018	0.024	0.024	0.033	0.011	0.000	0.000	
2006-2008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
PPP	0.959	0.858	0.856	0.908	0.861	0.774	0.542	0.436	0.471	0.500	0.500	0.067; p = 0.001
BMI (18.5-24.9)												
1976-1978	0.995	0.998										
1979-1981	0.985	0.985	0.995									
1982-1984	0.962	0.967	0.980	0.990	0.980							
1985-1987	0.908	0.936	0.958	0.961	0.951	0.977						
1988-1990	0.791	0.860	0.903	0.914	0.892	0.931						
1991-1993	0.637	0.715	0.777	0.835	0.820	0.866	0.889					
1994-1996	0.458	0.529	0.599	0.656	0.696	0.785	0.790	0.750	0.667			
1997-1999	0.265	0.326	0.398	0.433	0.485	0.602	0.703	0.562	0.445			
2000-2002	0.113	0.146	0.183	0.206	0.279	0.294						
2003-2005	0.025	0.037	0.051	0.052	0.093	0.068	0.121	0.105	0.198			
2006-2008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
PPP	0.946	0.770	0.690	0.532	0.481	0.434	0.209	0.494	0.75			0.048; p = 0.103
BMI (25+)												
1976-1978	0.987	0.997										
1979-1981	0.955	0.975	0.992	0.995								
1982-1984	0.875	0.936	0.958	0.970	0.991							
1985-1987	0.757	0.846	0.904	0.925	0.963							
1988-1990	0.575	0.682	0.783	0.843	0.900	0.938						
1991-1993	0.364	0.476	0.597	0.713	0.764	0.859	0.938					
1994-1996	0.185	0.265	0.373	0.502	0.555	0.651	0.586					
1997-1999	0.069	0.118	0.176	0.276	0.351	0.399	0.257					
2000-2002	0.016	0.033	0.057	0.099	0.132	0.180	0.064	0.400	0.667			
2003-2005	0.002	0.004	0.009	0.022	0.017	0.047	0.008	0.000	0.222			
2006-2008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
PPP	0.936	0.855	0.806	0.740	0.549	0.585	0.258	0.313	0.600			0.071; p = 0.006
Total												
1976-1978	0.991	0.998										
1979-1981	0.971	0.982	0.994	0.998								
1982-1984	0.922	0.949	0.967	0.979	0.986							
1985-1987	0.839	0.887	0.923	0.931	0.963	0.989						
1988-1990	0.692	0.767	0.827	0.855	0.880	0.934	0.969					
1991-1993	0.514	0.595	0.663	0.732	0.747	0.818	0.848	0.923	0.929			
1994-1996	0.332	0.396	0.463	0.532	0.562	0.628	0.636	0.746	0.663			
1997-1999	0.170	0.218	0.265	0.316	0.359	0.408	0.378	0.516	0.474	0.500		
2000-2002	0.061	0.083	0.105	0.127	0.144	0.178	0.148	0.258	0.203	0.250	0.500	
2003-2005	0.011	0.017	0.023	0.029	0.024	0.039	0.025	0.040	0.058	0.000	0.000	
2006-2008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
PPP	0.947	0.800	0.736	0.652	0.416	0.808	0.362	0.406	0.539	0.286	0.500	0.057; p = 0.021

PPP: Parity Progression Probability; PPR: Parity Progression Rate

age group 15-19 (33.9%) than that of women in any other age group. Rural areas (18.6%) also had higher percentage of underweight women than those in urban areas (11.8%). The percentage of undernourished women fell consistently with increase in level of education and women's income. The parity of a woman showed a differential in nutritional status, with higher parity women exhibiting higher percentage of undernourishment than those with lower parity.

The mean BMI varied across the subgroup of women, increasing with the increase in age, income and level of education. Women in urban areas had slightly higher mean BMI (24.3) than their counterparts in the rural areas (23.3).

Table 3: Percentage distribution of women by nutritional status according to background characteristics

Background characteristics	Mean height in cm	Mean BMI	Nutritional status: Under weight (<18.5)	Normal (18.5-24.9)	Over weight (25.0-29.9)	Obese (30+)	Total number of women
Current age*	χ^2 = 126.567, p = 0.000						
15-19	155.3	20.9	33.9 (19)	60.7 (34)	5.4 (3)	0.0 (0)	100.0 (56)
20-24	158.4	22.5	12.0 (22)	69.9 (128)	15.3 (28)	2.7 (5)	100.0 (183)
25-29	160.5	23.5	7.5 (22)	70.4 (207)	17.3 (51)	4.8 (14)	100.0 (294)
30-34	161.1	24.7	10.2 (28)	56.7 (156)	22.2 (61)	10.9 (30)	100.0 (275)
35-39	160.9	24.4	9.9 (23)	52.4 (122)	24.0 (56)	13.7 (32)	100.0 (233)
40-44	160.6	24.1	16.9 (33)	45.1 (88)	25.1 (49)	12.8 (25)	100.0 (195)
45-49	161.6	24.9	20.4 (22)	32.4 (35)	26.9 (29)	20.4 (22)	100.0 (108)
Place of residence**	χ^2 = 13.916, p = 0.003						
Rural	158.2	23.3	17.4 (56)	57.0 (183)	19.6 (63)	5.9 (19)	100.0 (321)
Urban	161.2	24.3	11.0 (113)	57.4 (587)	20.9 (214)	10.7 (109)	100.0 (1023)
Levels of education*	χ^2 = 154.734, p = 0.000						
None	159.2	22.2	36.9 (41)	36.9 (41)	18.9 (21)	7.2 (8)	100.0 (111)
Primary	159.6	23.7	23.6 (68)	42.4 (122)	24.7 (71)	9.4 (27)	100.0 (288)
Secondary	160.3	23.9	8.9 (54)	64.7 (391)	17.2 (104)	9.1 (55)	100.0 (604)
Higher	162.0	25.1	1.8 (6)	63.3 (216)	23.8 (81)	11.1 (38)	100.0 (341)
Income**	χ^2 = 32.227, p = 0.001						
None	157.3	21.3	17.9 (53)	59.8 (177)	14.5 (43)	7.8 (23)	100.0 (296)
<5000 Naira	158.8	23.4	16.8 (55)	54.6 (179)	20.1 (66)	8.5 (28)	100.0 (328)
5000-7499 Naira	159.8	23.9	14.0 (31)	54.8 (121)	20.4 (45)	10.9 (24)	100.0 (221)
7500-14999 Naira	161.3	24.2	8.3 (19)	57.4 (132)	24.8 (57)	9.6 (22)	100.0 (230)
15000-19999 Naira	161.7	24.5	6.0 (7)	61.5 (72)	23.9 (28)	8.5 (10)	100.0 (117)
≥20,000 Naira	163.3	25.2	2.6 (4)	58.6 (89)	25.0 (38)	13.8 (21)	100.0 (152)
Parity*	χ^2 = 204.215, p = 0.000						
0-1	158.6	23.2	9.1 (29)	65.6 (210)	17.2 (55)	8.1 (26)	100.0 (320)
2-3	160.7	24.5	6.0 (31)	68.2 (350)	18.9 (97)	6.8 (35)	100.0 (513)
4-5	160.2	23.9	11.0 (37)	49.7 (167)	25.9 (87)	13.4 (45)	100.0 (336)
6+	161.6	22.7	41.1 (72)	24.6 (43)	21.7 (38)	12.6 (22)	100.0 (175)
Husband's income*	χ^2 = 60.003, p = 0.000						
None	157.3	22.3	16.8 (44)	52.3 (137)	19.1 (50)	11.8 (31)	100.0 (262)
<5000 Naira	158.1	23.4	14.5 (8)	54.5 (30)	20.0 (11)	10.9 (6)	100.0 (55)
5000-7499 Naira	158.2	23.0	18.5 (24)	59.2 (77)	14.6 (19)	7.7 (10)	100.0 (130)
7500-14999 Naira	159.8	23.5	18.2 (62)	52.9 (180)	19.7 (67)	9.1 (31)	100.0 (340)
15000-19999 Naira	161.0	23.5	12.7 (20)	60.8 (96)	20.3 (32)	6.3 (10)	100.0 (158)
20,000-29,999 Naira	160.1	24.1	3.5 (6)	64.9 (111)	24.6 (42)	7.0 (12)	100.0 (171)
30,000+ Naira	162.7	25.0	2.2 (5)	61.0 (139)	24.6 (56)	12.3 (28)	100.0 (228)
Total	160.1	23.8	12.6 (169)	57.3 (770)	20.6 (277)	9.5 (128)	100.0 (1344)

*Significant at 0.1%; **Significant at 5%

Table 4 shows the logistic regression relating the effects of birth interval on nutritional status of women in the study area. The risk of underweight was lower in those women with previous birth interval of 24-35 (RR = 0.51, p<0.01), 36-60 (RR = 0.23, p<0.001) and above 60 months (RR = 0.18, p<0.001) than the interval less than 24 months. Across all mothers nutritional status outcomes; the relative risk associated with an interval above 60 months was consistently lower than that of intervals of 24-35 and 36-60 months. The risk of overweight and obesity was lower among women with previous birth interval less than 24 months.

When women with normal BMI were compared with those with adverse nutritional outcomes as classified in Table 4 (BMI less than 18.5 and above 24.99), the result showed that the higher the interval between births the lower the risks associated with adverse nutritional outcomes. The relative risk fell consistently with increasing birth intervals. To ascertain the effects of birth interval on maternal nutritional status, the potentially confounding effects of variables such as education, income, parity and current age of the woman were considered. The pattern of relative risks still remained the same, but the significant difference disappeared across all groups.

Table 5 shows the Cox regression model of the under-five mortality experience by maternal nutritional status. Across all nutritional status categories of women, women that are normal in terms of nutrition were least likely to have experienced under-five mortality in the last 59 months preceding the survey. The hazard of under five mortality experience among women with normal BMI is significantly lower (HR = 0.166, p<0.001) than those who were underweight (Fig. 2).

DISCUSSION

The mean height and BMI of women in the study area were 160 centimeters and 23.8 respectively. Only 2.8% of the respondents fell below the cut-off of 145

Table 4: Logistic regression model of effect of birth spacing on maternal nutritional status in Ekiti communities, Southwestern Nigeria, 2008

					95.0% CI for Exp (β)	
Birth intervals (Months)	β	S.E	Sig.	Exp(β)	Lower	Upper
Maternal nutritional status (Normal) vs (Underweight)						
<24 (Ref.)	R.C	R.C	R.C	1.000	R.C	R.C
24-35	-0.682	0.243	0.005**	0.506	0.314	0.815
36-59	-1.490	0.277	0.000*	0.225	0.131	0.388
60+	-1.745	0.464	0.000*	0.175	0.070	0.433
(Normal) vs (Overweight)						
<24 (Ref.)	R.C	R.C	R.C	1.000	R.C	R.C
24-35	0.232	0.261	0.823	1.262	0.756	2.105
36-59	0.099	0.258	0.373	1.104	0.666	1.831
60+	0.114	0.330	0.701	1.121	0.587	2.141
(Normal) vs (Obesity)						
<24 (Ref.)	R.C	R.C	R.C	1.000	R.C	R.C
24-35	0.053	0.365	0.884	1.055	0.516	2.155
36-59	0.173	0.349	0.620	1.189	0.599	2.358
60+	-0.013	0.465	0.978	0.987	0.397	2.455
(Normal) vs (Overweight and obesity)						
<24 (Ref.)	R.C	R.C	R.C	1.000	R.C	R.C
24-35	0.179	0.230	0.436	1.196	0.763	1.876
36-59	0.123	0.225	0.584	1.131	0.728	1.757
60+	0.075	0.291	0.795	1.078	0.610	1.907
(Normal) Against (Underweight and Overweight and Obesity)						
<24 (Ref.)	R.C	R.C	R.C	1.000	R.C	R.C
24-35	-0.217	0.181	0.230	0.805	0.565	1.147
36-59	-0.507	0.180	0.005**	0.602	0.423	0.857
60+	-0.561	0.244	0.022***	0.570	0.353	0.921

*Significant at 0.1% (p<0.001), **Significant at 1.0% (p<0.01), ***Significant at 5% (p<0.05)

Table 5: Cox regression of maternal body mass index and under-five mortality experience

							95.0% CI for Exp(B)	
Maternal BMI	B	SE	Wald	df	Sig.	Exp (B)	Lower	Upper
<18.5	0.000	Ref.	136.936	3	0.000	1.000	Ref.	Ref.
18.5-24.9	-1.798	0.169	112.675	1	0.000	0.166	0.119	0.231
25.0-29.9	-1.633	0.217	56.783	1	0.000	0.195	0.128	0.299
30+	-1.628	0.290	31.622	1	0.000	0.196	0.111	0.346

Ref.: Reference category

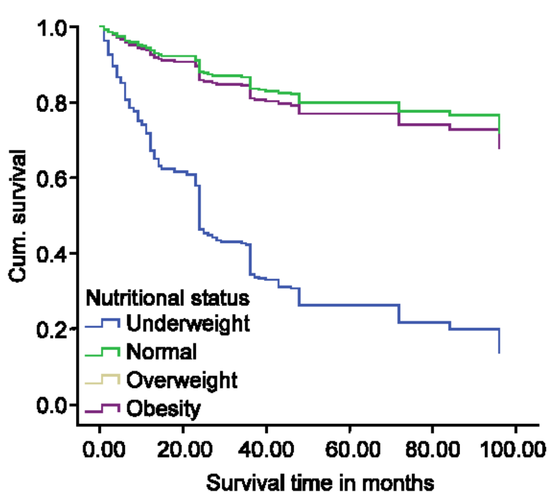

Fig. 2: Survival function for patterns of maternal nutritional status and under-five mortality experience in Ekiti, Southwestern Nigeria

centimeters in height. As expected, women in age group (15-19) were slightly shorter than women in the other age groups. The prevalence of normal BMI, undernourishment and obese were 57.3, 12.6 and 9.5% respectively. Significant association existed between women nutritional status and variables such as current age, place of residence, levels of education, income, parity and husband's income. Although, there were differentials across these background characteristics.

The effects of parity progression rates and interval between births on maternal nutritional status in Ekiti communities revealed that the progression intensity was higher among underweight women. The birth interval of at least 24 months may not bring the best nutritional outcome among women. This view was also evident in the study by DaVanzo *et al.* (2004). Also, leaving an interval 60 months and above may reduce under-nutrition when compared with an interval of 36-59 months.

As revealed by this study, the likelihood of experiencing under-five mortality among women who spaced their children for between 24 and 35 months is higher than those who left 36-59 months interval. Across all nutritional status categories of women, women that are normal in terms of nutrition were least likely to have experienced under-five mortality in the last 59 months. The hazard of under five mortality experience among women with normal BMI is significantly lower (HR = 0.166, p<0.001) than those who were underweight (Fig. 2).

Low pre-pregnancy BMI and short stature are risk factors for poor birth outcomes and obstetrics complications. In developing countries maternal underweight is the leading risk factor for preventable deaths and diseases (Marston, 2006). A wide gap of risk exists between an interval of less than 24 months and 36-59 months relative to maternal nutrition, the women who spaced their children for at most 23 months being at higher risk of underweight than those who left an interval of 36-59 months. There is no significant difference in the effect of spacing for 36-59 months and 60 months and above on maternal nutrition (p>0.05).

Conclusion: Birth spacing and parity progression are well known, underutilized and not fully understood health intervention. Despite dearth of data in underlying biological mechanisms, longer birth intervals are associated with multiple health and nutritional benefits for both mother and her under-five children. It can play a significant role in helping Ekiti people achieve Millennium Development Goals. Longer birth intervals are associated with reduced risk of undernourishment among mothers.

Births interval of at least 36 months will produce best health outcomes for mothers in terms of nutrition and under-five mortality. In the light of the current evidence, birth spacing and parity progression probabilities are important, feasible and analytical intervention to address maternal health conditions in terms of nutritional status. The findings accentuate the importance of stimulating birth spacing as a central reproductive health concept; redeploying it as a new and justifiable focus of maternal nutritional services and adding it to the armory of interventions will scale-up a child and maternal survival revolution in Ekiti communities.

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