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 9 (12): 1157-1161, 2010
ISSN 1680-5194

Impact of Birth Weight on the Nutritional Status and Academic Performance of School Age Children

U.M. Odenigbo, C.C. Nkwoala and O.C. Okpala
Department of Human Nutrition and Dietetics, Michael Okpala University of Agriculture, Umudike, Abia State, Nigeria

Abstract: This study compared the nutritional status and academic performance of Low Birth Weight (LBW) and Normal Birth Weight (NBW) school-aged population in Nigeria. A total of 119 subjects were involved in this study from a purposely selected one rural and one urban school in Abia state. Pre tested and validated questionnaires were used in data collection. Academic performance was obtained from their school records, while birth weights and ages were obtained from health/immunization cards. SPSS version 15.0 was used for data analysis. The subjects comprised of 57.1% males and 42.9% females, of 9-12 years old. Low prevalence (14.3%) of LBW was found. All three indicators used for nutritional status assessment (weight for age; height for age; BMI) showed more than 50% of study population as having normal nutritional status (96.64, 74.79 and 63.03% respectively). Stunting was 10.08%, overweight 2.52% and 6.72%, while obesity was 0.84%. This study revealed a significant ($p<0.05$) influence of birth weight on nutritional status with the use of BMI and weight for age indicators. The only child found underweight (<-2SD weight for age) had a LBW. The NBW group had higher percent of normal nutritional status than LBW group (Weight for age: 98.04% Vs 88.24%, BMI 65.69% Vs 47.06%). Stunted was found among 11.77% of the LBW and 9.80% of NBW groups ($p>0.05$). The subjects' birth weight had no significant ($p>0.05$) influence on their academic performance. The findings of this study emphasize more attention to children born with LBW for improvement in their growth and academic performance.

Key words: Children, LBW, nutritional status, academic performance

INTRODUCTION

At birth, fetal weight is an important determinant of the chances of the newborn to survive and experience healthy growth and development. This is because low birth weight has been shown to be directly related to both immediate, long-term and very long-term development and well-being (Wilcox and Skaeven, 1992).

Low Birth Weight (LBW) according to WHO(2004) refers to children who at birth had a weight of 2,500 g or less, which may be caused by preterm birth, Intra Uterine Growth Retardation (IUGR) or both. These children are in a higher risk for mental retardation, sensual, cognitive and developmental defects (Manoochehr *et al*., 2009). At school age, these complications can be observed prominently in VLBW (Very Low Birth Weight = BW of 1,500 g or less) children, in the form of poor physical growth, cognitive function and school performance, which appear to persist into adulthood (Stoll, 2007). There are some studies that evaluated effect of birth weight on growth of children and most of them have reported that birth weight is a significant marker on delayed growth and short stature (Gutbrod *et al*., 2000; Ranke *et al*., 2007; Brandt *et al*., 2005; Takeuchi *et al*., 2001). The growth of children has been reported as a sensitive index of health (Tanner, 1994). Children's health is tomorrow's wealth" is one of WHO's slogans of recent years. However, children's health is to a great extent determined by factors that operate in utero, well before they are born. According to World Health Organization (WHO) and United Nations Children's Fund (UNICEF) in 2004, the prevalence of LBW in developed, developing and least developed (undeveloped) countries are 7, 16.5 and 18.6%, respectively.

However, in Nigeria, the prevalence of LBW is recorded as 12% by United Nations Standing Committee on Nutrition (SCN, 2004). Other researchers revealed LBW prevalence in different parts of country as 12% (Ngwu and Opara, 2009), 11.4% (Ngwu and Ezekiel, 2005) and 12.6% (Olowonyo *et al*., 2006). A comprehensive review (Hack, 1998) of low birth weight follow up studies of children under 18 years of age showed that the children had lower scores or higher rates of mental retardation or learning deficits than their counterparts who were born with normal birth weight. But these differences were sometimes small and not significant (Hawdon *et al*., 1990).

As many developing countries, Nigeria inclusive, have signed on to the World Education Forum declaration promising basic education for all citizens by the year

Corresponding Author: U.M. Odenigbo, Department of Human Nutrition and Dietetics, Michael Okpala University of Agriculture, Umudike, Abia State, Nigeria

2015, the educational impact of poor health and poor nutritional status among school children has been relatively neglected. Nevertheless, governments are making massive efforts to improve basic education, a core component for building development capacity.

However, these efforts raise urgent questions which this study aimed to address on impact of low birth weight on nutritional status and academic performance of school-aged population in Nigeria.

MATERIALS AND METHODS

The study population was purposely selected from a rural and urban school in Umuariaga and Oboro villages respectively in Ikwuano Local Government, Abia State. The subjects, 119 school aged children were simply randomized and included in the study. Sixty of the subjects (50.4%) were pupil in Michael Okpara University of Agriculture, Staff School, Umuariaga community. The remaining 49.6% were from Oboro Primary School, Oboro community.

This study was carried out from May 25-26th, 2009 with a validated questionnaire to elicit information from the subjects. Data on their anthropometric measurements and socioeconomic characteristics were collected with the use of the validated and pretested questionnaire. Data on the subjects' academic performance were obtained from their school records. Their birth weights as well as their ages were obtained from their health/immunization cards. Anthropometric measurements included height, weight, triceps skin fold thickness and mid-upper arm circumference. These indices of each subject was measured twice and the average taken. A 150 cm vertical wooden rod was used for height measurement with a tape rule fixed to the vertical wood. Height measurement was taken with the subject standing erect on bare feet (removing their shoes and stockings). The weight of the subject was taken to the nearest 0.1 kg using a portable bathroom scale (HANSON MODEL). The subjects were weighed standing erect in minimal clothing without shoes. The scales were checked daily with the same known weight to ensure it's in perfect order.

Analysis of data: The nutritional status of children are assessed using anthropometric indices; weight for age, height for age and weight for height indicating underweight, stunting and wasting respectively. However, in this study, the weight for height index was replaced with Body Mass Index (BMI) since it still reflected weight with respect to height and considering the age of the children studied. Body Mass Index (BMI) is a number calculated from a child's weight and height. BMI is a reliable indicator of body fatness for most children and teens. BMI does not measure body fat directly, but research has shown that BMI correlates to direct measures of body fat, such as underwater weighing and dual energy x-ray absorptiometry (DXA). BMI can be considered an alternative for direct measures of body fat. For children and teens, BMI is age- and sex-specific and is often referred to as BMI-for-age. The nutritional status of children was obtained from the National Center for Health Statistics/U.S. Center for Disease Control (NCHS/CDC 2000) BMI for age percentile chart for boys and girls. BMI greater than 95th percentile or 85th percentile was considered obese or overweight respectively while BMI less than 10th percentile was considered underweight (NCHS/CDC 2000).

All data were coded and entered into the SPSS (Statistical Package for Social Sciences) version 17.0. The categorical variables were presented as frequencies and percentages. The differences in mean values of height, weight and birth weight were compared between the LBW and NBW groups by ANOVA analysis. The difference among their class performance was also evaluated with ANOVA. Chi- square analysis was used to comparing their levels of nutritional status (underweight, overweight, stunted, normal) based on their birth weight. Statistical significance was set at 95% confidence interval.

RESULTS

Table 1 revealed that most of the subjects studied were males (57.1%) and majority (62.2%) of the population was within the ages of 9-12 years. Low prevalence of LBW (14.3%) was found in this study and 85.7% were of normal birth weight. The class performance indicated that only 10.1% of the children ranked top 5 in the class academic position while more (35.3% and 25.2%) ranked last 5 and last 10 position respectively in the class.

The nutritional status of these subjects is shown in Table 2. Generally, the three indicators used revealed that more than 50% of study population has normal nutritional status (96.64, 74.79 and 63.03%). However, low prevalence of stunting (10.08%), overweight (2.52%, 6.72%) and very low prevalence of obesity (0.84%) were found in this study. However, weight for age indicator showed a lower prevalence of underweight (0.84%) compared to BMI indicator (29.41%).

Table 3 revealed a significant ($p<0.05$) association of birth weight with nutritional status among the subjects studied only with BMI and weight for age indicators whereas the height for age indicator revealed non significant difference ($p>0.05$). The only child who was underweight among the weight for age indicator had a low weight at birth, while none of the NBW group was underweight. But with BMI as an indicator, same percent (29.41%) were underweight among the LBW and their

counterpart NBW subjects. The percent of normal nutritional status among subjects born with normal weight was higher than those with low birth weight (Weight for age: 98.04% Vs 88.24%, BMI 65.69% Vs 47.06%). However, for Height for age indicator, the reverse was the case but not statistically significant. LBW subjects had higher percent (82.35%) of normal nutritional status than the NBW subjects (73.53%). Stunted was found among 11.77% of the LBW and 9.80% of NBW groups ($p>0.05$). Only one subject (5.88%) among the LBW group was tall while 16.67% were found tall among the NBW group. Prevalence of overweight was higher among the LBW group compared to the NBW group with both indicators (BMI 23.53% Vs 3.92%; Weight for age 5.88 Vs 1.96% respectively).

Table 4 indicated no significant differences ($p>0.05$) in the class performance between the LBW and NBW subjects. The LBW subjects had 11.77% among the first 5 academic position and 29.41% among the last 5 position in class. Among the NBW group, 9.8% took the first 5 academic position and 36.28% the last 5 position in class. Higher percent took the first 10 position among the LBW group (35.29%) compared to the NBW group (28.43%).

Table 1: Characteristics of the subjects

Characteristics	Attributes	Frequency	Percentage
Sex	Male	68	57.1
	Female	51	42.9
Age range (years)	6-8	45	37.8
	9-12	74	62.2
Birth weight	LBW (<2.5 kg)	17	14.3
	NBW (>2.5 kg)	102	85.7
Class performance	First 5	12	10.1
	First 10	35	29.4
	Last 10	30	25.2
	Last 5	42	35.3

LBW = Low Birth Weight, NBW = Normal Birth Weight

Table 2: Nutritional status of the subjects

Indicator	Attributes	Frequency	Percentage
Weight for age	Underweight	1	0.84
	Normal	115	96.64
	Overweight	3	2.52
	Total	119	100.00
Height for age	Stunted	12	10.08
	Normal	89	74.79
	Tall	18	15.30
	Total	119	100.00
BMI	Underweight	35	29.41
	Normal	75	63.03
	Overweight	8	6.72
	Obese	1	0.84
	Total	119	100.00

Table 3: Nutritional status of subjects according to their birth weight

		LBW		NBW		Total	
Indicator	Attributes	Frequency	%	Frequency	%	Frequency	%
Weight for age	Underweight	1	5.88	0.0	0.00	1	0.84
	Normal	15	88.24	100.0	98.04	115	96.64
	Overweight	1	5.88	2.0	1.96	3	2.52
	Total	17	100.00	102.0	100.00	119	100.00
	$Chi^2 = 6.96$, df = 2, p = 0.031						
Height for age	Stunted	2	11.77	10.0	9.80	12	10.08
	Normal	14	82.35	75.0	73.53	89	74.79
	Tall	1	5.88	17.0	16.67	18	15.13
	Total	17	100.00	102.0	100.00	119	100.00
	$Chi^2 = 5.139$, df = 2, p = 0.162						
BMI	Underweight	5	29.41	30.0	29.41	35	29.41
	Normal	8	47.06	67.0	65.69	75	63.03
	Overweight	4	23.53	4.0	3.92	8	6.72
	Obese	0	0.00	1.0	0.98	1	0.84
	Total	17	100.00	102.0	100.00	119	100.00
	$Chi^2 = 9.302$, df = 3, p = 0.026						

LBW = Low Birth Weight; NBW = Normal Birth Weight

Table 4: Relationship between academic performance and birth weight of the subjects

	Academic performance					
	LBW		NBW		Total	
Academic position	Frequency	%	Frequency	%	Frequency	%
First 5	2	11.77	10	9.80	12	10.08
First 10	6	35.29	29	28.43	35	29.41
Last 10	4	23.53	26	25.49	30	25.21
Last 5	5	29.41	37	36.28	42	35.30
Total	17	100.00	102	100.00	119	100.00
$Chi^2 = 0.506$, p = 0.918						

DISCUSSION

The observed prevalence of LBW (14.3%) among these school aged population (6-12 years) in this study is similar to the report of 16.5% prevalence in developing countries (WHO, 2004). In Nigeria, Dawodu and Laditan (1985) reported a prevalence of 8.2% low birth weight. The advances in newborn medical care have greatly reduced the number of deaths associated with low birth weight but Pryor *et al.* (1995) reported that a small percentage of survivors develop mental retardation, learning problems, cerebral palsy and vision and hearing loss.

However, this study found no statistical difference ($p>0.05$) in academic performance between the children born with LBW and their counterpart with NBW. This finding is in agreement with an earlier study by Tong *et al.* (2006). These researchers found a statistically significant association between birth weight and cognitive performance at age 2 years but the magnitude of this association gradually decreased and became statistically non-significant at later childhood.

Another researcher, Stoll (2007) reported that at school age, the effects of LBW in the forms of poor cognitive function and school performance can be observed prominently only in VLBW (Very Low Birth Weight = BW of 1,500 g or less) children. However, our study did not obtain information on VLBW.

The class performance of the general study population indicated that only 10.1% of the children ranked top 5 in the class academic position while more (35.3% and 25.2%) ranked last 5 and last 10 position respectively in the class. The finding of low academic performance of these study population could be attributed to other factors rather than nutritional status and birth weight. This is because majority of the subjects had normal nutritional status, significantly influenced by their birth weight. And their birth weight had no statistical significance on their academic performance in class. The lack of association between LBW and school performance could be because of the small LBW sample size in our study. This study found significant relationship between birth weight and nutritional status ($p<0.05$). The significance was observed in both BMI and weight for age indicators. These results are similar to the findings of Emond *et al.* (2006), Elgen *et al.* (2005), Manoochehr *et al.* (2009), Peng *et al.* (2005), Cooke and Foulder-Hughes (2003). However, the height for age indicator applied in this study revealed non significant difference between birth weight and nutritional status ($p>0.05$). This finding was in contrast to the study of Manoochehr *et al.* (2009) were significant difference was observed in the ratio of height to standard height for age between LBW and NBW.

The higher prevalence of overweight among the LBW groups may be attributed to the catch up growth in the subjects. Children who experience catch up growth are often seen to be heavier than those who did not. The low prevalence of stunting may be an indicator of past insults in the nutritional status of the children. The found no significant influence of birth weight on stunting suggests that birth weight has no effect on children's height.

Conclusion: This study found significant influence of birth weight on childhood growth. We recommend more attention to be paid to nutritional status of children born with LBW for improving growth and academic performance of children in our society.

REFERENCES

Brandt, I., E.J. Sticker, R. Gausche and M.J. Lentze, 2005. Catch-up growth of supine length/height of very low birth weight, small for gestational age preterm infants to adulthood. J. Pediatr., 147: 662-668.

Cooke, R.W. and L. Foulder-Hughes, 2003. Growth impairment in the very preterm and cognitive and motor performance at 7 years. Arch. Dis. Child., 88: 482-487.

Dawodu, A.H. and A.A.O. Laditan, 1985. Low birth weight in an urban community in Nigeria. Ann. Trop. Paediatr., 5: 61-66.

Elgen, I., K.A. Johansonn and T. Markestad, 2005. A non-handicapped cohort of low birth weight children: Growth and general health status at 11 years of age. Acta Pediatr., 94: 1203-1207.

Emond, A.M., P.I. Lira and M.C. Lima, 2006. Development and behaviour of low birth weight term infants at 8 years in northeast Brazil: A longitudinal study. Acta Pediatr., 95: 1249-1257.

Gutbrod, T., D. Wolke, B. Soehne, B. Ohrt and K. Riegel, 2000. Effects of gestation and birth weight on the growth and development of very low birthweight small for gestational age infants: a matched group comparison. Arch. Dis. Childhood: Fetal and Neonatal Ed., 82: F208-F214.

Hack, M., 1998. Effects of intrauterine growth retardation on mental performance and behavior: Outcomes during adolescence and adulthood. Eur. J. Clin. Nutr., 52: S65-71.

Hawdon, J., E. Hey, I. Kolvin and T. Fundudis, 1990. Born too small-is outcome still affected? Dev. Med. Child Neurol., 32: 943-953.

Manoochehr, M., M. Noureddin and U. Amin-Gooran, 2009. Intelligence Quotient (IQ) and growth indices in children with the history of low birth weight. Iran J. Pediatr., 19: 387-392.

National Center for Health Statistics/U.S. Center for Disease Control (NCHS/CDC), 2000. www.CDC. gov/growthcharts.

Ngwu, E.K. and U.C. Opara, 2009. Birth weight of babies in relation to their mother's nutrition knowledge and place of residence. Nig. J. Nutr. Sci., 30: 36-42.

Ngwu, E.K. and N. Ezekiel, 2005. Birth weight of newborns: A case study of Bishop Shanahan Hospital, Nsukka and St. James Clinic, Lagos, Nigeria. J. Home Econ. Res., 6: 19-24.

Olowonyo, T., S. Oshin and B.I. Obasanjo, 2006. Some factors associated with low birth weight in Ogun State, Nigeria. Nig. Med. Pract., 49: 154-157.

Peng, Y., B. Huang and F. Biro, 2005. Outcome of low birth weight in China: A 16-year longitudinal study. Acta Pediatr., 94: 843-849.

Pryor, J., P.A. Silva and M. Brooke, 1995. Growth, development and behaviour in adolescents born small-for-gestational-age. J. Pediatr. Child Health, 31: 403-407.

Ranke, M.B., B. Vollmer and R. Traunecker, 2007. Growth and development are similar in VLBW children born appropriate and small for gestational age: An interim report on 97 preschool children. J. Pediat. Endocr. Metab., 20: 1017-1026.

Standing Committee on Nutrition (SCN), 2004. Low birth weight. 5th report on the world nutrition situation. Nutrition for improved development outcomes. Geneva: Standing Committee on Nutrition, pp: 20-22.

Stoll, B.J., 2007. The fetus and the neonatal infant. In: Kliegman RM, Behrman RE, Jenson HB, Stanton BF (Eds). Nelson Textbook of Pediatrics. 18th Edn., Philadelphia; Saunders, pp: 671-674.

Takeuchi, T., D. Tanaka and N. Saikawa, 2001. Growth and endocrine function during school age in very low-birth weight infants. Pediatr. Intern., 43: 128-133.

Tanner, J.M., 1994. Introduction: Growth in height as a mirror of the standard of living, in Stature, Living Standards and Economic Development, J. Komlos, Ed., The University of Chicago Press, London, UK, pp: 1-6.

Tong, S., P. Baghurst and A. McMichael, 2006. Birth weight and cognitive development during childhood. J. Peadiatr. Child. Health, 42: 98-103.

Wilcox, A.J. and R. Skaeven, 1992. Birth weight and perinatal mortality: The effect of gestational age. Am. J. Publ. Health, 82: 378-83.

World Health Organization (WHO) and United Nations Children's Fund (UNICEF), 2004. Low Birth Weight: country, regional and global estimates. Geneva, December.