Original Article

A Comparative study on growth pattern of Low Birth Weight and Normal Birth Weight neonates

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Abstract

INTRODUCTION: Low birth weight (LBW, birth weight<2500g) is a significant health problem in children all around the world. There is a direct relationship between low birth weight and infant mortality rate. One of the most important measures to prevent childhood morbidity is growth monitoring. The present study was planned to compare the growth rate of LBW neonates with those weighing 2500g and more at birth (normal birth weight (NBW)) during the first two years of life.

METHODS: This was a retrospective cohort study, which included 218 two years old infants (109 LBW, 109 NBW). Data gathering tool was a questionnaire. Data were analyzed by descriptive analytic statistical methods (the t- test and the $\chi2$ test).

RESULTS: Our findings revealed that there was a significant difference between the mean values of child weight, height and head circumference from birth until 2 years of age between the two groups (the LBW group had lower values than the NBW group). Height by age, weight by age and weight by height indices also had significant difference between the two groups until 2 years of age. Growth curves in LBW group were upslope until 2 years old. Moreover, the weight percentile of the LBW children at 2 years of age was deeper than the NBW group.

DISCUSSION: In the present study, comparison of growth parameters until 2 chart years of age and growth of both groups showed a better growth velocity in the LBW group. The LBW growth curve moved upslope and was more compatible with standard percentiles throughout the growth curve. However, growth of the NBW group was not fine and more investigation is needed in this field.

KEY WORDS: Growth, low birth weight, normal birth weight, neonate

One of the most serious problems of child health in the entire world is Low birth weight (LBW) [1]. According to WHO studies, about 25 millions LBW neonates are born each year. It means that from each six neonates one is born with LBW [2] and 90% of them belong to developing countries [3].

The birth weight is a highly important and useful factor in determining life expectancy of children as well as their future health status. LBW can result in illnesses and health problems and sometimes causes early death of child [2].LBW (as a result of preterm delivery and/or intra uterine growth recardation) is a major determinant of both neonatal and infant mortality rates and childhood morbidity [4] affects not only child's health status, but also his/her family member's mental health, as

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parents are deeply concerned about long term complications such as growth and developmental delay and other general health issues of their children [5].

Fortunately, from many years ago, medical policy makers have paid more attention on health services than medical managements and they have done important activities in the field of child health like monitoring children growth patterns [3].

By definition of W.H.O, child physical growth is a good determinant for public health status [6].

Child physical growth is a determinant for public health status in WHO documents [8] and medical policy makers consistently considered monitoring child growth patterns to prevent health problems [3].

Many studies have been carried out on growth and development patterns of LBW neonates worldwide, one of which, carried out in China in 1996. In this study, 132 LBW neonates were followed from birth until 3 years of age regarding their growth determinants. The results showed that values of growth parameters in LBW neonates were less than those in NBW group during that period [7].

In Iran, prevalence of LBW neonates is about 10%, but no studies have been carried out on these neonates growth so far [11]. This study compared the growth patterns of LBW neonates with NBW ones in Iran.
The objectives were:

1) Determining and comparing demographic characteristics of two groups of LBW and NBW neonates and their parents.

2) Determining and comparing mean values of weight, height, head circumference, weight by age, height by age and weight by height at 2nd, 4th, 8th, 12th, 18th and 24th months of age in the two groups.

3) Determining and comparing weight percentile curves at the age of two years in the two groups.

Methods
This is a cross-sectional descriptive analytic, longitudinal retrospective study. The major variables were weight, height and head circumference increases, weight by age, height by age, and weight by height and their corresponding percentiles. Other variables were gender, gestational age, child's rank among siblings, values of weight, height, and head circumference at the time of birth, birth spacing with previous child, family population, duration of breast feeding, type of milk (if not breast fed), the age of beginning supplemental food beginning age, job and educational level of parents, maternal age, mother's parity status, mother's weight at the last visit during pregnancy period and at the first visit after delivery, type of delivery.

Samples were 218 children (109 LBW and 109 NBW) who were randomly chosen from health care centers in Isfahan and who all met the include criteria.

Include criteria were: birth weight $\leq$ 2499g in LBW group and 2500 - 4000g for NBW group, single birth, regular and frequent visits to health care centers at 2nd, 4th, 8th, 12th, 18th, and 24th months of age, existence of necessary information in the family health file.

Exclude criteria were: child's apparent congenital abnormality, history of severe diarrhea and\or acute respiratory infection recorded in the child's health file, child's history of hospitalization, non- Iranian nationality and adopted child.

All necessary data were extracted from children's health files and were then recorded in special forms.

Data were analyzed via using descriptive analytic statistical methods (t-test and chi-square test) by SPSS.

P values of less than 0.05 were considered as significant.

Results
Findings revealed that in the LBW group, birth weight value was mostly at the ranges of 2001-2499g (75.2%) and 1501-2000g (20.2%). Only 4.6% of them were VLBW. The mean values of birth weight, length, and head circumference were 2173g, 46.14cm and 32.33cm retrospectively. 86.2% of neonates were full term and 62.4% of them female.

In the NBW group the most frequency for birth weight was in the range of 3001-3500g, the means value of birth weight, length, and head circumference were 3176.35g, 49.65cm and 34.85cm retrospectively. 99% of neonates were full term and 41.2% were female.

Regarding child's rank among sibling, the most frequency in the two groups was the first with the mean value of 1.69 in the LBW group and 1.84 in the NBW group.

In both groups, birth spacing was mostly more than 24 months, most babies were breast fed (57.8% LBW and 55.8% NBW), supplemental food beginning time was mostly at the range of 4-6 months of age (LBW 79.8%, NBW 90.8%).

There were not statistical significant differences between the two groups for birth spacing, type of milk, (chi- square test), and child's rank among siblings (t test).

There were significant differences between the two groups for gestational age ($\chi 2$ p=0.0002), duration of breast feeding (t test p=0.03), and the age of starting supplemental food (t test p=0.02).

In the LBW group, the mean age of mothers at the neonates' birth time was 24.75 years old. The mean of maternal parity was 2.06, the mean value of mother's weight in the last visit during pregnancy was 67.72kg, and family population had the mean value of 3.73. In the NBW group these values were 24.83, 1.95, 69.95kg and 3.84 retrospectively.

There were significant statistical differences between the two groups in father's educational status ($\chi 2$ p=0.02), and mother's weight in the last visit during pregnancy (t test p=0.04). However, there were no significant differences between the two groups for other variables namely family population, educational level of mother, parents' job, maternal age, maternal parity, mother's weight in the first visit after delivery and type of delivery.

Comparing the mean values of birth weight, height, head circumference (p=0.00), the mean values of weight, height, and head circumference at 2nd, 4th, 8th, 12th, 18th and 24th months of age showed significant statistical

differences between the two groups (p=0.000) (table 1-3).

Comparing the differences in mean values of weight, length, and head circumference at birth and at two years old showed that during the first two years of age, the LBW neonates compensated approximately 20% of their weight, 50% of their length, and 40% of their head circumference (table 1-3).

Comparing weight by age, height by age, and weight by height indices revealed significant statistical differences between the two groups from birth to 2 years of age and their mean values were lower in the LBW group than the NBW group.

Weight percentiles of the two groups were statistically different at 2 years of age (p=0.02). Since there were significant differences regarding variables such as gestational age, duration of breast feeding and the age of beginning supplemental food between the two groups. Since these factors could affect on post natal growth, another statistical analysis was done to delete them. This analysis showed that the mean values of differences in weight, height and head circumference between the two groups were significant, too.

Table 1. the mean value of weight in the two groups

	LBW		NBW		P value
	MEAN	SD	MEAN	SD	
Birth time	2177.81	297.43	3176.35	328.23	0.00
2nd month	4177.81	725.38	5304.68	654.60	0.00
4th month	5718.40	793.83	6730.55	790.46	0.00
8th month	7428.26	945.56	8318.44	967.56	0.00
12th month	8446.24	1070.56	9271.56	1071.18	0.00
18th month	9789091	1230.31	10621.10	1139.73	0.00
24th month	10919.22	1281.64	11693.21	1348.66	0.00

Table 2. the mean value of length in the two groups

	LBW		NBW		P value
	MEAN	SD	MEAN	SD	
Birth time	46.14	2.83	49.65	1.92	0.00
2nd month	53.25	2.87	57.11	2.50	0.00
4th month	58.80	2.94	62.38	2.54	0.00
8th month	66.42	2.86	68.96	2.63	0.00
12th month	72.02	2.87	74.2	2.96	0.00
18th month	78.32	3.7	80.30	2.8	0.00
24th month	83.89	3.98	85.60	3.17	0.00

Table 3. the mean of head circumference in the two groups

	LBW		NBW		P value
	MEAN	SD	MEAN	SD	
Birth time	32.33	1.83	34.85	1.29	0.00
2nd month	36.87	1.50	38.90	1.29	0.00
4th month	39.83	1.57	41.42	1.31	0.00
8th month	43.18	1.52	44.57	1.38	0.00
12th month	45.14	1.45	46.32	1.40	0.00
18th month	46.62	1.51	47.69	1.50	0.00
24th month	47.83	1.54	49.20	1.58	0.00

Discussion

Attention to children's growth and development is an important factor in preventing childhood mortality and it is also an important factor in preventing further psychological and somatic diseases [8]. This study showed that there are significant statistical differences between LBW and NBW neonates in values of weight, height, and head circumference during the first two years of age, as the means of these values were lower in the LBW group than the NBW group, Atkinson [9], Ford et al. [10], Finnstrom et al. [11], and Arifeen et al. [12] had also reached similar results.

In the LBW group, the means of weight was about 2.5 times of the birth time in the 4th month of age, 4 times in one year old and approximately 5 times in 2 years old; whereas in the NBW group these values were 2, 3 and 3.5 times retrospectively.

The reason for the fine weight gain in the LBW group may be that 95.4% of them were

moderately low birth weight (MLBW). In addition, the emotional status of parents, who probably provide special care for LBW neonates compared to NBW, may be responsible for that [5].

In the LBW group, the length had been increased 26cm during the first year and 11.9cm during the second year but in the NBW group 24.5cm during the first and 11.4cm during the second year of age. The expected length-increasing rate is about 25.5cm during the first year and 12.7cm during the second year [13]. By 1st year of age, length has increased by almost so [14] the LBW group had better length growth pattern than the NBW group. In the LBW group head circumference had been increased approximately 13cm during the first and 2.7cm during the second year of life and in the NBW group 11.5 during the first and 2.7cm during the second year of life. Comparing these values with the expected mean value increase of 10cm for the first year and 2.5 cm for the second year [15], we can say, this growth parameter in the LBW group is better than the NBW group during the first year of life. Since head circumference is a determinant for brain size, it is necessary to do further studies on developmental aspects in the LBW neonates.

Comparing indices of weight by age, height by age, and weight by height until 2 years of age and also weight percentile at 2 years of age showed that the LBW group had lower values than the NBW group. Although majority of children in both groups were weighted between 3 and 50 percentiles, the absolute number of Children who were under 3 percentile in the LBW group (7 child) was more than those in the NBW group (1 child). Hirta [16], Ferrari et al. [17], Orozco et al. [18], Sandler and Cooper [19] in their studies had the same results.

In the present study comparison between growth parameters until 2 years of age and growth chart of the two groups showed a better growth velocity in the LBW group, their growth curve moved upslope and was more compatible to standard growth curve percentiles throughout the period. However, the growth of NBW group was not fine and more investigation is needed in this field.

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