ORIGINAL REPORT

Ophthalmic, Hearing, Speaking and School Readiness Outcomes in Low Birth Weight and Normal Birth Weight Primary School Children in Mashhad-Iran

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Abstract- Low Birth weight infants are at risk of many problems. Therefore their outcome must evaluate in different ages especially in school age. In this study we determined prevalence of ophthalmic, hearing, speaking and school readiness problems in children who were born low birth weight and compared them with normal birth weight children. In a cross-sectional and retrospective study, all Primary School children referred to special educational organization center for screening before entrance to school were elected in Mashhad, Iran. In this study 2400 children enrolled to study and were checked for ophthalmic, hearing, speaking and school readiness problems by valid instrument. Data were analyzed by SPSS 11.5. This study showed that 8.3% of our population had birth weight less than 2500 gram. Visual impairment in LBW (Low Birth Weight) and NBW (Normal Birth Weight) was 8.29% vs. 5.74% and there was statistically significant difference between them (P=0.015). Hearing problem in LBW and NBW was 2.1% vs. 1.3 and it was not statistically significant. Speaking problem in LBW and NBW was 2.6% vs. 2.2% and it was not statistically significant. School readiness problem in LBW and NBW was 12.4% vs. 5.8% and it was statistically significant (P<0.001). According to the results, neurological problems in our society is more than other society and pay attention to this problem is critical. We believe that in our country, it is necessary to provide a program to routinely evaluate LBW children.

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Keyword: Infant, low; Birth weight; School, primary

Introduction

Annually 4.03 million babies born in United States which 12% of them are premature. Although these infants make up only a small percent of birth but, they add disproportionately to the mortality, morbidity and high cost of medical care (1, 2).

The absolute number of both healthy and neurologically impaired children in the population has been increased. A high incidence of transient neurologic abnormalities, ranging from 40% to 80%, occur in high risk infants (3, 4). Further problems could emerge during the school age. These include subtle motor, visual and behavioral difficulties even among children with normal intellectual state (4, 5). Prevalence of major disability in general population is 2-3% but in low birth weight infant is 24% (5).

The incidence of hearing impairment in very preterm infants ranges from 1% to 11%, depending on the population and used definitions. Hearing impairment is important to diagnose as early as possible before language acquisition (6). Myopias and strabismus are common in preterm infants and generally necessitate intervention (7). Despite normal intelligent children with learning disabilities may have difficulties in processing complex language, in perceiving or copying symbols or with the fine motor control involved in drawing and writing (8). Visual-perceptual abnormalities, sensory-motor integration problems and minor sensory-motor dysfunction usually detect in preschool and school-age period (9). Preterm children have a higher incidence of attention deficit disorder and behavioral problems, which can further interfere with school functioning and interpersonal relationships (10).

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By helping to maintain a child's self-esteem and improving the child's ability to cope with the demands of school many secondary physical and emotional problems can be prevented or ameliorated by evaluating and examining them before going to school. The aim of this study was determination of prevalence of ophthalmic, hearing, speaking and school readiness problems in children who were born low birth weight and compared them with NBW children.

Materials and Methods

From June 2005 to June 2006, in a cross–sectional study 2400 children were included among all children who referred to special educational organization center for screening before entrance to school in Mashhad, Iran. According to the prevalence of handicap in children, sample size were estimated 2400 with 95% confidence interval and d= 0.02%. Therefore by using Cluster random sampling method, from total 25 centers of special educational organization in Mashhad, 10 centers randomly were chosen and in each center 240 children were elected.

Weight, length and Occipito-frontal head circumference were documented at birth and in age of 6. Characteristics of birth were extracted from vaccination chart that had been prepared for all babies in delivery room including weight, length and head circumference**.** Anthropometrical parameters were checked and measured for each child in local centers. Occipito-frontal head circumference and length measured by meter and weight checked by digital balance. Neonatal, family and childhood characteristics such as breast feeding duration, toddler age, economic status, education of mother and father, family hearing loss and ophthalmic problem were recorded from interview with mother.

Each child was checked for eye, ear, speaking and school readiness problems. For eye screening, visual acuity checked by Snallen Chart in local center and if it was less than 20/30 referred to special educational center. Strabismus, nistagmus and visual field were checked too. In special educational center, glasses prescription detected with refraction technique. Color vision controlled by Ishihara test and ophthalmoscope used for examine of optic nerve and glaucoma. For ophthalmic examination they were checked for amblyopia, color vision disturbances and refractive errors. For hearing screening at first they were checked in local center. If they had problem in 35 db at 4 frequent 500, 1000, 2000 and 4000 then, they referred to special educational center for more evaluation and base of hearing was determined by audiometers. For speaking screening, children at first checked by phonetic test, oral test and speech test in local center. If they had any problems were referred to special educational center. In this center children checked by special phonetic test, Dipp test and Alouette test.

For school readiness screening they checked by Daberon test. It is a standardized assessment of school readiness in children ages 4 through 6.

The anthropometric data are presented as mean (SD). For quantitative variables, compare between groups was performed by using independent t test. Categorical variables were analyzed using the chi square and fisher's exact test. For control of confounder variables, logistic regression was used. The cut-off level for significance was chosen at $P \leq 0.05$.

Results

In this study 81 of 2400 children were excluded because of non available their birth weight. From primary school children before entrance to school 2319 were studied which 8.3% have been born LBW and 91.7% NBW. In LBW group, 85.5 % had 1500-2500 gram birth weight, 13.5 % had 1000-1500 gram and 1% had been below 1000 gram birth weight.

Mean birth weight in LBW children were 1999.7±353.2 gram and in NBW children were 3294.8± 401 gram. Mean birth height in LBW children was 47.3± 3 cm and in NBW children was 50.6± 2.3 cm. Mean birth head circumference in LBW children was 33.24 ± 2.8 cm and in NBW was 34.58± 1.68 cm. There were no significant difference between two groups according to speech problem, hearing loss and ophthalmic problem background. But in economic status, preschool training and child head circumference there was significant difference between two groups (Table 1).

Ophthalmic problems in all children were 5.43%. LBW children had more ophthalmic problem than NBW children and the different was significant (P=0.029) (Table 2).

The most common ophthalmic problem in LBW and NBW children was refractive errors 81.5% and 68.8% respectively. Prevalence of myopia in our population was 4.4% but, 6.8% in LBW and 4.2% in NBW. Chi-square test showed significant difference between two groups ($P \leq 0.001$). Prevalence of Amblyopia was higher in LBW children than NBW children, 1.036% vs. 0.188% ($P<0.05$).

Table 1. Demographic, family and childhood characteristics of two groups

Variable	Groups		Result
	≥2500gr	<2500gr	
weight (kg); Mean(SD)	21.12(3.09)	19.8(2.83)	*P*<0.001*
head circumference(cm); Mean(SD)	51.46(1.47)	50.68(1.67)	*P*<0.001*
Height (cm); Mean(SD)	125.99(3.26)	117.41(6.32)	*P*<0.001*
Sex(male); N (%)	1127(53)	94(48.7)	*P*=0.251
Low economic status N (%)	1058(50.4)	125(65.1)	*P*<0.001*
Ophthalmic problem background N (%)	893(42.0)	71(36.8)	*P*=0.171
Hearing loss background N (%	87(4.1)	13(6.7)	*P*=0.119
Motor problem background N (%)	40(1.9)	4(2.1)	*P*=0.98
Preschool training N (%)	1260(59.7)	94(49.9)	*P*= 0.005*

*significant

Color vision disturbances in LBW children were 4.1% and in NBW children were 2.7%; however chi-square test showed no statistically significant differences between two groups(*P*= 0.26).

Hearing problem in all children was 1.4 % that 77.4% had no special problem, 6.5% need to trumpet, 9.7% had hearing loss in low frequency, 3.2% had problem in one or two frequencies and 3.2% had one side hearing loss. In LBW children 2.1% and in NBW children 1.3 % had hearing problem which was not significant between two groups (*P*=0.255) (Table 2). The rate of speaking problem was 2.5% totally, 2.6% in LBW children and 2.2% in NBW children. This difference was not significant between two groups (*P*=0.42) (Table 2).

School readiness problems had a rate of 6.3%. LBW children had more school readiness problems than NBW children and it was significant between two groups (*P*≤0. 001) (Table 2).

Influence of confounder variables on birth weight was controlled by logistic regression; head circumference and preschool training had significant role on school readiness and head circumference and weight had significant played role on ophthalmic problems (Table 3).

Table 2. Prevalence of Ophthalmic, hearing, speech and school readiness problem in two groups

Variable; N (%)	Group		*P* value	Total
	<2500gr	≥2500gr		
Ophthalmic problem	16(8.29)	110(5.74)	*P*= 0.015*	5.34%
Hearing problem	4(2.1)	27(1.3)	*P*=0.255	1.3%
Speech problem	5(2.6)	46(2.2)	*P*=0.421	2.5%
School Readiness	24(12.4)	123(5.8)	*P*<0.001*	6.3%

*significant

Table 3. Control of confounding variables by logistic regression

Variable	Ophthalmic State		School readiness	
	p-value	B	*P*-value	B
Group	0.048*	-0.271	0.385	-0.255
Child Head circumference	0.038*	-0.128	0.013*	0.176
preschool training	0.537	-0.117	0.002*	0.614
Breast milk duration	0.6	-0.006	0.131	0.025

*significant

Discussion

This study showed that 8.3% of our population had birth weight less than 2500g and in this group 85.5% were LBW, 13.5% VLBW and 1% were ELBW. In children which were born Low Birth Weight, visual impairment was 8.29%, hearing problem was 2.1%, and speaking problem was 2.6% and school readiness problem was 12.4%. In United States, the prevalence of neurodevelopment disabilities in general population is: severe visual impairment 0.4- 0.6%, hearing impairment 1.5-2%, speech defect 4-11% and learning disability 5-10%. Roth (1993), Gross (1992), Erickson (1998) and Hack (2002) reported prevalence of visual impairment 1%, 1%, 15% and 15% respectively and hearing impairment 9%, 1%, 1% and 7%, respectively (11-14). In our study visual Impairment (8.29%) was more than Roth and Gross and less than Erickson and Hack study and hearing impairment (2.1%) was more than Gross and Erickson study and less than Roth and Hack study. Subjects in our study were low birth weight children, whereas Ross and Gross studied preterm, and Erickson and Hack studied very low birth weight children. Prevalence of myopia in total population was 4.4% but in children which were born LBW and NBW was 6.8% and 4.18% respectively. Robinson reported 6% myopia in 6 years old children that significantly increased among children whose birth weight was <2500 grams (15). Feldelius also reported high prevalence of myopia in LBW adult (16). O'Connor *et al.* also reported that low birth weight children were at increased risk of visual impairments compared with children who were born at full term (17). So these studies confirmed our finding and have stated that myopia increases in LBW children. Hearing problems in all children were 1.4 % but, 2.1% in LBW and 1.3 % in NBW children. Engdahl *et al.* showed that birth weight less 1500 as compared with NBW children gave an adjusted 6.3 odds ratio for sensorineural hearing loss and concurrent defects. The risk of hearing loss decreased with increasing birth weight (19). Most of our population had birth weight 1500-2500gr, so according to Engdahl study the risk of hearing loss decreased with increasing birth weight. Anderson (2003), Ortiz– Mantilla (2008), Johnson-Verkasal (2004) determined language development in very low birth weight preterm children. They concluded that VLBW infants were poorer on cognitive and language measures (20-22). Our population was low birth weight and there is not any study that done on low birth weight children speech. Therefore in this study there was not significant difference in speaking problem in LBW and NBW children.

Morse and colleagues reported late preterm infants were more likely to have a diagnosis of developmental delay within the first years of life and were referred more for special needs in preschool duration. They are also more likely to have problem with school readiness (23).

Holloman determined influence of birth weight on educational outcomes at age 9. He reported LBW children had poorer school outcomes than NBW children (24). In our study school readiness problem was higher in LBW children. All of these studies confirmed our data and show that LBW children have problem in school readiness. Logistic regression showed that child head circumference and preschool training could influence on school readiness problems more than birth weight.

Subnormal head circumference has been associated with poor neurologic and developmental outcomes. Peterson and colleague determined subnormal head circumference in very low birth weight children and they reported subnormal head circumference was associated with poorer IQ equivalent, perceptual motor skills, academic achievement and adaptive behavior (25). As studies frequently show birth weight has some effects in child hood and adolescence (26-28), indeed it is noticeable for every physician to pay attention for each baby with LBW. But, preschool training had influence on school readiness problems more than birth weight. Our study showed that both low birth weight and child head circumference can influence on visual outcomes of primary school children. Indeed preschool training and child head circumference also can influence on school readiness outcome of children. But hearing and speech outcome had no significant difference in LBW and NBW children.

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