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The Role of Birth Order and Birth Weight in the Balance of Boys Aged 9-11 Years Old

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ABSTRACT

Motor skills are always considered as one of the effective factors on human activities. The purpose of this research is to study the role of birth order and birth weight in the static and dynamic balance of boys aged 9-11 years old. 94 male students have been evaluated in this research. The personal information questionnaire and medical records were used to acquire data pertaining to birth order and birth weight. Also, parts of Lincoln-Oseretsky test pertaining to balance were used to evaluate static and dynamic balance. The results indicated that second children and children with normal weight had higher average scores rather than first children, only children, and children with low and high weight in most items of static and dynamic balance ($p < 0.01$). The superiority of second children over other children is probably because of the existence of older siblings which younger ones follow as models in families.

Key Words: Birth Order, Birth Weight, Static Balance, Dynamic Balance.

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INTRODUCTION

Many people believe that children's entering the elementary school is the beginning of their learning and flourishing in all aspects (1). Most of theories of child development agree that early motor experiences have a noticeable effect on the next stages of development. In other words, a high percentage of children's abilities in games, sports, jobs, and other aspects of life depend on the quality of their early experiences (2). In current century, physical and motor issues of children have been increased due to changes in the lifestyle and people becoming more sedentary because of a relative decline in sports spaces and games and also because of living in small apartments, video games becoming more popular, decrease in population and playmates in families (3). Children who are weak in locomotion skills perform most of fitness skills weakly (3). The main elements of motor development are the fundamental motor skills which are considered as fine and gross skills meaning skills including big and small muscles (4). The physical growth and child's history of motor experiences have a fundamental role in conveying these experiences to motor skills' models (5). Children and teenagers having motor disorders have problems performing motor skills, a fact which causes them not to take part in sports, to lose physical fitness, to isolate themselves from society, and to lose self-esteem (6). These people have problems in balance and adaptability while learning new motor skills. They perform the learnt skills less weakly than their peers and have slower moves and reactions at every level of doing the assignment (7). One of the factors seeming to affect the indices of physical and motor fitness is birth weight (8). This factor is considered to be one of the main factors predicting public health and infant's life chance (9). The importance of birth weight is to a degree which it is a very useful and important index in determining and announcing child's life expectancy factor and predicting child's health state in the future. It can be responsible for motor disorders and side effects which come out later in infant's life and may even cause premature death (10). Moreover, it has been clarified that those low weight babies who survived suffered from short-term and long-term disability two to three times more than other babies (7). Birth weight is one of the key factors of development in all aspects of intellectual and motor growth of child such as balance, adaptability, and precision in the lifetime. Mother's weight and proper nutrition is very important in breeding an infant with normal weight. Birth weight can be influenced by many factors including social-economical state, mother's nutrition, fetal and maternal diseases, too much physical activities done by mother, and being first born (11). Infants whose birth weights are less than 2500 grams are considered to be low birth weight, regardless of pregnancy age (9). 7% of all infants born in the world are low birth weight and are a lot more vulnerable than infants with normal weight. They are likely to get many disorders and problems pertaining to health. Also, some disorders have been observed in motor abilities in the rest of life (7). The highest percentage of low weight infants (8.8%) is the first pregnancy in terms of pregnancy rank and the lowest percentage of low weight infants is the third pregnancy. The percentage of low weight infants increases by increasing the pregnancy rank after the third and the highest percentage of low weight infants is amongst the infants of the tenth pregnancy and later (10). Another factor affecting physical and motor fitness indices is the birth order which has drawn researchers' attention nowadays (12). Birth order means first, middle, last, and only children who have different personal traits each one (12). Family can definitely impress individual's personal evolution because the first steps of forming individual's personality happen in the family texture. One of the memorable sayings by Adler is that the birth order is a social factor which is very importantly effective in childhood. It is a factor by which we form our lifestyle. Being older or younger than our siblings and being exposed to different viewpoints by parents create different childhood situations which help making the personality (13). Nowadays, one-child families are so sensitive that they do not easily the child to have activities outside the home, while it is not the same in populated families. And, can this disproportionate amount of attention affect their children's motor skills' performance? Undoubtedly, the birth weight and birth order are of factors whose influence on child's psyche, personality, and socialization has been recorded and it seems to impress children's motor skills developments, too. Given parents' different interactions with their children and premature births among infants and also different weight ranks in birth, studying the role of these factors on children's motor skills developments and evaluating them can have good outcomes for educational programs and guiding families. One of the important and effective motor fitness factors on motor skills is balance. Balance is an integral part of physical fitness in children and teenagers and is of controlling factors in childhood (14). Balance is a multi-dimensional structure which is used to describe the ability to maintain the center of gravity in reliance surface or in moving in the state of bearing weight without falling. Balance is divided into static and dynamic. The reliance surface is stood still in the static balance and the center of gravity moves only. In this case, balance's task is to maintain the center of gravity inside the reliance surface or a constant limitation. In dynamic balance, both the center of gravity and the reliance surface move, so the center of gravity is not always inside the reliance surface (7). In static and dynamic balance, the state of body is controlled by the movements of the center of gravity and starting proper responses for body to return to a stable position. It is a complicated process in which seeing, sensory-somatic, and vestibular senses and muscular-skeletal system play a very important role (15). The ability to maintain balance is one of the most important abilities affecting human movements from childhood to old age. Balance is a movement and basic skill which is learnt in other skills. Every physical activity needs some grades of balance (2).

Many researches have been conducted on balance in internal research (7), but the effect of birth order and birth weights on motor skills have not been studied in any of the researches, and this problem was one of the limitations the researcher encountered. However, the role of birth order and birth weight has been paid attention to in some foreign researches.

Bayley (1965) compared the mental and motor test scores of 1409 infants aged 1-15 months based on age, gender, birth order, geographical location, and parents' educations to observe that there was no significance difference in scores made by girls and boys, first and second children, geographical location, and parents' different educations. There was no difference between black and white infants in the psychological scales, while black ones performed better than white ones in terms of motor scale (16). Bassett *et al.* (1997) studied the relationship between birth order and perceptual skills in a research on 547 babies. The results indicated that the second and third children were at a higher level than the first children in terms of intellectual and perceived goals (17). Finnstrom *et al.* (2003) studied the relationship between low birth weight and educational successes with self-esteem in elementary school children. No difference was seen in groups in terms of self-esteem, but the group with normal weight showed better results in terms of educational successes (18).

van Haastert *et al.* (2006) studied the initial development of motor skills of large premature infants through Alberta scale and inferred that premature infants had weaker performance than their peers of normal ages in terms of large moves in the first 18 months of life (4). Krombholz (2006), in a research named "The relationship of physical activities with age, gender, birth order, and social activities in pre-elementary children", observed that children who had older siblings performed better than only and first children (6). Datar and Jacknowitz (2009) studied the effects of birth weight on mental, motor, and physical development in twins, and having controlled the maternal, genetic, and environmental factors, he observed that low birth weight had a slightly negative effect on the development of mental and motor skills of children in the first two years of life (19). de Kieviet *et al.* (2009) studied the motor development of premature and very low birth weight babies in a meta-analysis (20). The results indicated that these children got lower scores than their peers who were born at a certain time in all three types of physical tests. Premature and very low birth weight children encounter noticeable physical disorders throughout childhood. Oliveira, Magalhaes, and Salmela (2011) studied a subject named the relationship among very low birth weight, environmental factors, motor and intellectual development in 5-and-6-year-old babies. There was also a high correlation between the acquired scores and birth weight (11).

Given the fact that birth order researches conducted in Iran have more focused on intellectual, social, and economical factors and have not paid attention to motor development, not to mention the surveys carried out abroad have somehow been contradictory and have mentioned the birth weight as an important factor for motor and intellectual skills, the researcher decided to study the role of birth order and birth weight in one of the major physical-motor factors which is balance.

MATERIALS AND METHODS

Participants. The statistical society of this research consisted of all male students aged 9-11 years old of non-profit schools who in the 2nd district of Tehran in 91-92 academic year. The sample (n=94) was chosen at randomly in the cluster way out of north regions of Tehran. The subjects were free of any illness and injury in the last 6 months.

Instruments. The personal information questionnaire was used to collect data pertaining to this research to determine birth order and birth weight. Also, the standardized "Lincoln Oseretsky Motor Development Scale (LOMDS)" including 36 items was used to measure their motor skills. LOMDS has been designed to evaluate motor skills of children aged 6-14 years old. This scale includes 36 evaluating items which are performed individually, consisting of a broad range of motor skills. The validity coefficients have been stated 96% for male ones and 97% for female ones at all ages through using the split method (9). Precision, agility, balance, and adaptation are assessed in this scale. Items which assessed the static and dynamic balance were used in this research. In other words, items number 2, 3, 9, 15, 19, 28, 32, 34 which are used for the static balance and items number 1 and 36 which are used for the dynamic balance. The items of static balance include crouching on tiptoes of foot, standing on one leg, standing heel-toe, putting stick balance horizontally with index finger, jumping up and rounding and then landing on tiptoes of foot, having balance on tiptoes of foot, standing on one leg with eyes closed, while the items of dynamic balance include balancing the stick vertically with index finger and walking backward.

Statistical Analysis. After data collection pertaining to birth order, birth weight, and LOMDS test, the descriptive statistics like frequency distribution, central and dispersion measures were used. Kolmogorov - Smirnov test were used to determine the normal distribution of data. Also, the inferential statistics like two-way analysis of variance was used to determine the difference of means at the significance level of $p < 0.05$. The software SPSS was used to analyze data.

RESULTS

After Kolmogorov-Smirnov test showed the normality of data distribution, the two-way ANOVA test was used to check the static balance and birth order in different age groups. Given the reported results in table 1, the static balance is significantly different for various weight groups and birth orders (p=0.001). Also, the interactive effect between birth order and weight groups is significant for the static balance (p=0.002).

Table 1. The results of two-way ANOVA analysis for the static balance

Source of change	F	p
Weight	24.925	0.001**
Birth order	53.231	0.001**
Weight * Birth order	4.661	0.002**

**: Significance at $p < 0.01$.

Given the results of two-way ANOVA analysis (F=4.661) for the effect of interaction of birth order and weight and the significance level (p<0.05), it is concluded that the effect of interaction of birth order and weight of the static balance is significant. The significance of these two variables shows that the main effects of birth order and weight depend on each other. Therefore, their simple effects must be analyzed. For further study, the mutual reaction figure is presented first, and then the main simple effects of birth order and weight is check through Tukey test.

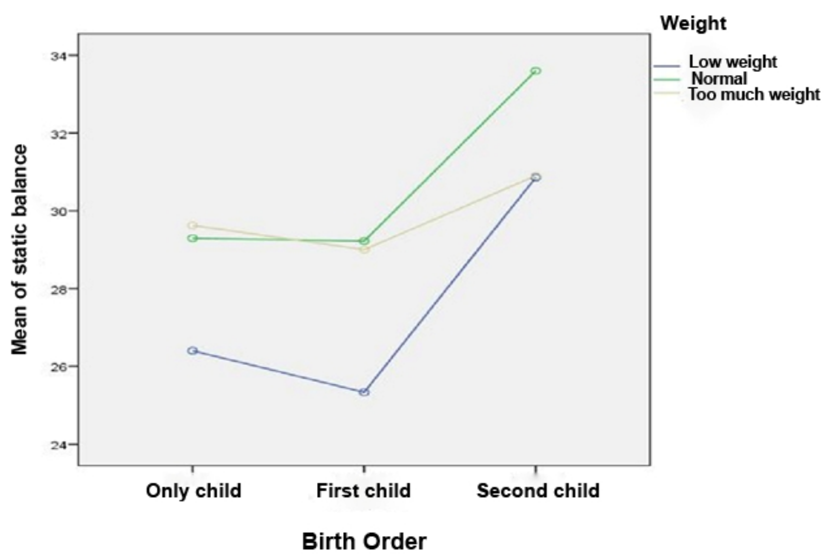

Figure 1. The effect of interaction of birth order and birth weight on static balance

Figure 1 indicates that the mean of static balance for second children is higher than the first and only children at all levels. But, the discrepancy between them is not the same for different weights. In high-weight people, the observed difference of birth order in static balance is less than the observed difference of low and normal weights. On the other hand, there is a high difference between low weight and high weight in only children and first children, while the mean of these two groups is almost the same in the second children.

Table 2. The results of Tukey test for the simple effects of birth order in static balance

weight	Birth order (I)	Birth order (J)	Mean difference (I-J)	p
Low weight	Only child	First child	1.07	0.603
		Second child	-4.46	0.001**
	First child	Only child	-1.07	0.603
		Second child	-5.52	0.001**
	Second child	Only child	4.46	0.001**
		First child	5.52	0.001**
Normal weight	Only child	First child	0.07	0.989
		Second child	-4.31	0.001**
	First child	Only child	-0.07	0.989
		Second child	-4.38	0.001**
	Second child	Only child	4.31	0.001**
		First child	4.38	0.001**
Extra weight	Only child	First child	0.63	0.594
		Second child	-1.28	0.142
	First child	Only child	-0.63	0.594
		Second child	-1.90	0.010**
	Second child	Only child	1.28	0.142
		First child	1.90	0.010**

**: Significance at $p < 0.01$. *: Significance at $p < 0.05$.

As it is observed in table 2, the mean of static balance of second children was higher than first and only children in low weight and normal subjects ($p \leq 0.05$). There was no significant difference between only children and first children at these two levels. Among extra weight subjects, the difference was significant only among first and second children, which means the mean of static balance of second children was higher than first children ($p < 0.05$). But, the difference of only children from first and second children was not significant at this level.

The results of table 3 shows that the mean of static balance in children with low weight is significantly lower than normal weight and extra weight in only-child and first-child subjects ($P \leq 0.05$). There was no difference between subjects with normal weight and those of extra weight at this level. The mean of static balance was significantly more than children with low and extra weight in second children ($P \leq 0.05$). The difference between subjects with low weight and those of extra weight was not significant at the level of second children.

Table 3. The results of Tukey test for the simple effects of weight in static balance (*P≤0.05)

Birth order	Weight (I)	Weight (J)	Mean difference (I-J)	p
Only child	Low weight	Normal weight	-2.89	0.007**
		Extra weight	-3.23	0.007**
	Normal weight	Low weight	2.89	0.007**
		Extra weight	-0.33	0.894
	Extra weight	Low weight	3.23	0.007**
		Normal weight	0.33	0.894
First child	Low weight	Normal weight	-3.89	0.001**
		Extra weight	-3.67	0.002**
	Normal weight	Low weight	3.89	0.001**
		Extra weight	0.22	0.922
	Extra weight	Low weight	3.67	0.002**
		Normal weight	-0.22	0.922
Second child	Low weight	Normal weight	-2.74	0.001**
		Extra weight	-0.04	0.997
	Normal weight	Low weight	2.74	0.001**
		Extra weight	2.70	0.001**
	Extra weight	Low weight	0.04	0.997
		Normal weight	-2.70	0.001**

**: Significance at $p < 0.01$.

Table 4 shows the results of two-way ANOVA analysis for dynamic balance. The results of this table suggest the significance of difference in weight groups, birth order, and interaction two groups.

Table 4. The results of two-way ANOVA analysis for dynamic balance

Source of changes	F	p
Weight	26.980	0.001**
Birth order	20.541	0.001**
Weight*birth order	2.620	0.040*

**: Significance at $p < 0.01$. *: Significance at $p < 0.05$.

The significance of interaction between two variables of weight and birth order shows that these two variables depend on each other. So, their simple effects must be analyzed. For further checking, figure 4 presented the mutual interaction first, and then the main effects of birth order and birth weight were studied in tables 5 and 6.

As it is observed in figure 2, the mean of dynamic balance for second children is totally higher than first children and only children, but the discrepancy between them is different for various weights. The observed discrepancy for birth order is lower than low weight and normal weight among people with extra weight. On the other hand, people with extra weight has greater mean among first children and only children, while the direction of discrepancy changes in second children and the mean of low weight people is bigger than those of extra weight.

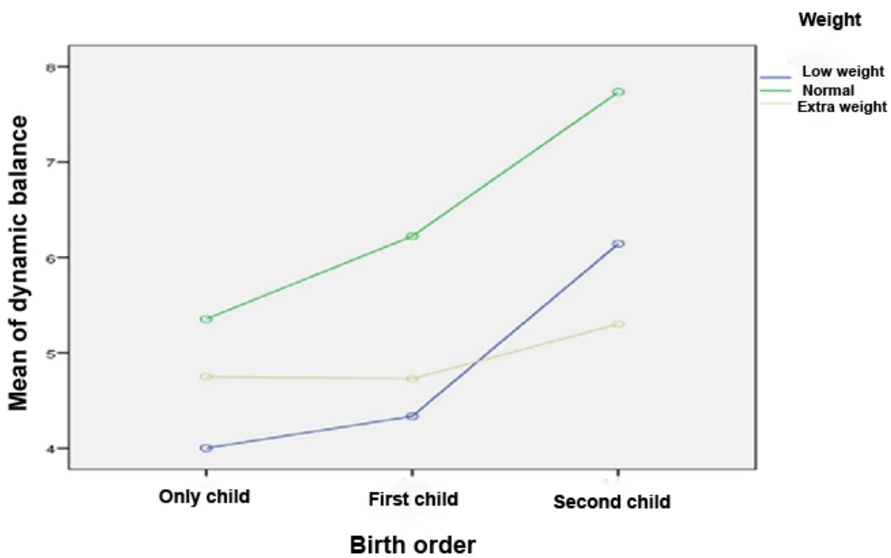

Figure 2. The effect of interaction between birth order and birth weight for dynamic balance

Table 5. The results of Tukey test for the simple effects of birth order in dynamic balance

weight	Birth order (I)	Birth order (J)	Mean difference (I-J)	p
Low weight	Only child	First child	-0.33	0.685
		Second child	-2.14	0.001**
	First child	Only child	0.33	0.685
		Second child	-1.81	0.001**
	Second child	Only child	2.14	0.001**
		First child	1.81	0.001**
Normal weight	Only child	First child	-0.87	0.042*
		Second child	-2.38	0.001**
	First child	Only child	0.87	0.042*
		Second child	-1.51	0.001**
	Second child	Only child	2.38	0.001**
		First child	2.38	0.001**
Extra weight	Only child	First child	1.51	0.001**
		Second child	0.02	0.999
	First child	Only child	-0.55	0.554
		Second child	-0.57	0.472
	Second child	Only child	0.55	0.554
		First child	0.57	0.472

**: Significance at $p < 0.01$. *: Significance at $p < 0.05$.

As it is observed in table 5, the significance level for mean difference of dynamic balance of second children with first and only children is lower than 0.05 among low weight subjects ($P<0.05$). Given the direction of discrepancy, the mean of dynamic balance of second children is greater than first and only children. There is no significant difference between only children and first children at this level. All differences are significant in subjects with normal weight ($P<0.05$). given the direction of difference of first children from only children, and of second children from only children, only children has greater mean of dynamic balance. There was no significant difference in subjects with extra weight.

Table 6. The results of Tukey test for the simple effects of birth weight in dynamic balance

Birth order	Weight (I)	Weight (J)	Mean difference (I-J)	p
Only child	Low weight	Normal weight	-1.35	0.035*
		Extra weight	-0.75	0.404
	Normal weight	Low weight	1.35	0.035*
		Extra weight	0.60	0.357
	Extra weight	Low weight	0.75	0.404
		Normal weight	-0.60	0.357
First child	Low weight	Normal weight	-1.89	0.015*
		Extra weight	-0.39	0.824
	Normal weight	Low weight	1.89	0.015*
		Extra weight	1.49	0.002**
	Extra weight	Low weight	0.39	0.824
		Normal weight	-1.49	0.002**
Second child	Low weight	Normal weight	-1.59	0.004**
		Extra weight	0.84	0.206
	Normal weight	Low weight	1.59	0.004**
		Extra weight	2.43	0.001**
	Extra weight	Low weight	-0.84	0.206
		Normal weight	-2.43	0.001**

**: Significance at p < 0.01. *: Significance at p < 0.05.

Table 6 shows that the mean of dynamic balance for low weight children is lower than normal weight children among only-child subjects (P>0.05). There was no significant difference among subjects of other weights at this level. The mean of dynamic balance for children with normal weight is significantly greater than children with low and extra weight among first-child subjects (P≤0.05). There was no significant difference in subjects of low and extra weight at this level. The mean of dynamic balance for children with normal weight is significantly greater than children with low and extra weight among second children (P≤0.05). There was no significant difference observed among subjects of other weights at this level.

DISCUSSION and CONCLUSION

The acquired results on static balance of boys aged 9-11 showed that the static balance of second children is greater than first and only children in the group of low weight and normal weight subjects, while there is no significant difference between only children and first children. The greatness of second groups' scores can suggest the existence of older siblings who improve their siblings' adaptability skills as a helper in the families of second groups' children. Also among the subjects of extra weight group, the only difference of static balance is among first and second children, which the mean of static balance of second children is greater than first children, and there is no significant difference between the subjects of the group including first children and only children. The results of this research are not compatible with sayings by Berglund, Eriksson, and Westerlund (2005), because they mentioned that first children show better performance than other children of the family do in their motor skills (21). The existence of these sorts of differences in various researches may be because of many factors like difference in statistical society and sample, age, gender of subjects, the type of families' cultures and their social-economical levels, and even the tests used to evaluate these motor skills. Also, the results of this research were compatible with the findings by Krombholz (2006) (6). Moreover, the mean of static balance of children with low weight was lower than children with normal weight in the group including only-child and first-child subjects. In the group including second children, the only significant difference was between static balance of subjects of normal weight with those of low weight and extra weight, too, which means the mean for normal-weight subjects was greater than that of other two groups. These results tell us some facts on the importance of birth weight once again. An infant with normal birth weight is better in terms of intellectual and motor factors and even signs of a healthy infant rather than infants with low weight and has better vitals. The foundations of life are made from the very beginning of infancy, and the birth weight is one of the key factors of infant's success in future life. The findings of this research were compatible with the results by van Haastert *et al.* (2006), Datar and Jacknowitz (2009), de Kieviet *et al.* (2009), and Oliveira, Magalhaes, and Salmela (2011) (4, 11, 19, 20), because they emphasized the importance of birth weight, too, and their findings showed that low-weight or premature infants perform weaker than their peers who have normal birth weight. Although the birth weight may bring infants threats and complications in the future, the results of present research on static balance indicated that subjects with extra birth weight have better and more successful performance than the subjects with low birth weight.

The acquired results on the dynamic balance of boys aged 9-11 indicated that second children have better average scores in the static balance test, while there was no significant difference among various birth orders in dynamic balance test in the group including extra weights. The dynamic balance test is of items which need nervous-muscular control so much and extra weight can have a reverse relationship with performance in dynamic balance. The second children usually has better motor chances due to being in more populated families and the existence of an older sibling as a model, too, and this can improve and grow their motor skills like dynamic balance. The results of this research were not compatible with sayings by Berglund, Eriksson, and Westerlund (2005), because they mentioned that first children showed better performance than other children in terms of motor skills, which their results may be due to more interactions of parents with their first children (21). Also, the results of this research were compatible with the findings by Krombholz (2006) (6). The average dynamic balance of children with low weight was lower than that of normal children in only-child subjects, and no significant difference was seen in other weights. Also, the average dynamic balance of children with normal weight was greater than low weight and extra weight children in the group including first-child and second-child subjects, a result which can be explained by the importance of birth weight for the development of motor and intellectual skills. The findings of this research were compatible with those by van Haastert *et al.* (2006), Datar and Jacknowitz (2009), de Kieviet *et al.* (2009), and Oliveira, Magalhaes, and Salmela (2011) (4, 11, 19, 20).

All in all and considering the acquired results, it can be inferred that second children performed better than only children and first children in every test of this research, although these results were inconsistent with sayings by Krombholz (2006) (6) and the existence of this sort of discrepancies in different researches may be due to different factors like diversity of statistical society and sample, age, gender of subjects, type of culture, social-economical level, and even tests used to evaluate these motor skills. Given the fact that there is an older child in the family of second-child group, this factor can be both as a helper and as a model for the second children to copy and improve motor skills with the help of the older sibling. Also in only-child families, it seems that parents spend more time with their child and this improves child's motor skills, but we've seen that the existence of an older sibling could be more effective on large and subtle motor performance of children rather than parents. Some problems which are out of parents' control may arise after the second child is born, but they can be detected and coped with in time by having knowledge toward them to take the proper action to reduce the reactions of the first child.

Children with normal weight make higher scores rather than other children with different weights in all tests, a result which was consistent with most of previous studies and reminds us that birth weight is one of the key factors of development in all aspects of intellectual and motor growth of the child such as balance, adaptability, and precision in the lifetime. Mother's proper weight and nutrition is very important in breeding an infant with normal weight. Consequently, families, officials of raising children, and sports coaches are recommended to be more cautious on the static balance of first children, only children, children with low weight, and children with more than normal weight. They are also advised to design separate exercises for this group of children and help them improve their performance in basic skills. Moreover, increasing the caring quality in pregnancy, mother's hygiene and nutrition, preventing premature birth, and planning and implementing instructive programs for young mothers are effective on birth of an infant with normal weight. By making mothers aware of complications of caesarean delivery, they can be warned that only 10% of deliveries done all over the world are caesarean section. Mothers could be sure that they take an effective step in their child's health with natural birth.

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تازه‌های علوم کاربردی ورزش
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نقش ترتیب تولد و وزن هنگام تولد در تعادل پسران ۱۱- ۹ سال

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چکیده

مهارت‌های حرکتی همواره به عنوان یکی از عوامل اثرگذار بر فعالیت‌های انسانی به شمار می روند. هدف از این تحقیق بررسی نقش ترتیب تولد و وزن هنگام تولد در تعادل ایستا و پویای پسران ۹ تا ۱۱ سال بوده است. ۹۴ دانش آموز پسر در این تحقیق مورد ارزیابی قرار گرفتند. به منظور اکتساب اطلاعات مربوط به ترتیب تولد و وزن هنگام تولد از پرسشنامه اطلاعات شخصی و سوابق پزشکی استفاده شد، همچنین به منظور سنجش تعادل ایستا و پویا از بخش‌های مربوط به تعادل آزمون لینکلن اوزرتسکی استفاده شد. نتایج نشان داد که فرزندان دوم و فرزندان با وزن نرمال در اکثر آیتم‌های تعادل ایستا و پویا دارای میانگین نمرات بالاتری نسبت به فرزندان اول، تک فرزندان، فرزندان با وزن کم و وزن زیاد بودند ($p \leq ۰/۰۱$). برتری فرزندان دوم نسبت به سایر فرزندان احتمالاً به خاطر وجود خواهر یا برادر بزرگ‌تر در خانواده می‌باشد که کودکان به عنوان الگو از آن‌ها استفاده می‌کنند.

واژگان کلیدی: ترتیب تولد، وزن هنگام تولد، تعادل ایستا، تعادل پویا.

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