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A comparison of motor development of 7- and 10-year-old monozygotic, dizygotic twins and singletons in Kermanshah City

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ABSTRACT

The present study mainly attempts to compare the motion development of monozygotic twins, dizygotic twins and singletons of 7 and 10 years old in Kermanshah city. The population of the study was a total of 185 students, composed of 43 students of 7 year old boys and 46 students of 7 years old girl, 40 boys aged 10 and 56 daughters aged 10 years. The whole study population was categorized into three groups including monozygotic, dizygotic and non-twin. All of them participated in Test of Gross Motor Development Ulrich-2 (TGMD-2) which measured the Gross Motor Quotient (GMQ) through two subtests of Locomotor skills and object control skills. The data analysis indicated that there was no significant difference in relation to the GMQ score of 7-year monozygotic, dizygotic and non-twin groups of both sexes; whereas there was a significant difference in relation to the 10-year groups for both sexes. Also there was a significant difference between the GMQ scores for inter-pair 7-year twins of both sexes and those for 10-year pairs.

Introduction

Motor development is referred to as progressive changes in motor behavior across the life course that is the result of interaction between the needs of the task, the biological characteristics and environmental conditions of man (4). One of the major factors that contribute to the difference in motor development of children is maturity and genetic factors. Through personal development, each individual achieves individual characteristics that distinguish him from others. (2) The main element of motor development is the fundamental skills. (2) These skills are categorized into two main groups including the Locomotor skills and object control skills, which are regarded as the basis of routine motor skills and also specialized-athletic skills. (4)

Based on a clinical view, it is the genetic which is the sole responsible for all the motor development processes across the life course, and the environmental factors play highly insignificant and negligible roles. Whereas, in the area of data processing, environmental factors play very significant roles, and man as a source of processing observes his behavior through the fusion of the two elements namely environment and individual. On the other hand, scientists and practitioners who are involved in the theorization of dynamic systems underline the interactive role of influential systems in the field of motor development.

Environment encompasses factors such as experience, learning and opportunities which are created for an individual entire life, and from the perspective of dynamic systems, to have or not to have training program and experience is associated with the development of different systems. In addition, the perspective of static systems proves that movement pattern may be generated due to an almost unlimited combination of different interactions. (11)

Development is not an independent process. Although heredity determines the limits, environmental factors play an important role in achieving these limits. Factors such as nutrition, exercise and physical activity are important considerations affecting development. (10)

Motor-basic skills development and influencing factors is an issue of interest to researchers in recent years. Such skills are the basis for athletic skills. (9) In addition, the development of these skills can efficiently enhance the movements and activities of people in everyday life. (9)

Understanding the physical and motor characteristics of children and adolescents to develop athletic plans and goals are very important. A way to understand such traits is the study of heritability or correlation of physical and motor factors between the different groups of sibling. (1)

Developmental psychologists are in search of answers to two apparently contradictory questions. Firstly, why motor development among all people is almost the same? Second, which is the source of leading individual differences among people which? Comparing non-twin children with monozygotic and dizygotic children can help us to further clarify the developmental aspects of children, and to answer the question whether genetic-dependent developmental differences are the same among the twins or they are specific to the particular strengths of each individual and environment.

Various researches that has been done recently has indicated that anthropometric factors such as height (1, 3, 6, 7, 16, 25, 26), the chest (23) and fitness factors (3, 12, 13, 16, 26) are more similar in monozygotic twins compared to dizygotic twins and singletons and such works have considered the role of heredity more prominent than environment.

In addition, due to the lower rate of their physical growth at early days of birth, twins had a lower rate of motor development compared to singletons (13, 20, 24, and 26). The genetic factors

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strongly make monozygotic twins more dependent upon each other. This is because they less participate in individual activities, thus twins have a lesser development than dizygotic and singletons (1, 13, 20 & 24).

However, there was not a significant difference between monozygotic and dizygotic twins in relation to mental skills. (18) The monozygotic twins in terms of physical and motor capability had a high inter-pair collaboration compared to other groups. (1, 16, 17 & 21)

Research done on comparing monozygotic and dizygotic twins are more limited to growth in infancy; now the question is that by an increase in aging and environmental influences on child development, the differences observed during childhood and during the process of growth could be seen also in relation to motor development? Based on the above, the present paper attempts to compare motor development in monozygotic and dizygotic twins and singletons.

Methodology

The present study is descriptive and of causal-comparative type. The study population is composed of 7 and 10 year old students in Kermanshah, and the statistical sample is composed of all twins 7 and 10 years of age enrolled in primary schools, in 2013-2014 academic year in Kermanshah city. The sample size of the study was 185.

The survey instrument is Test of Gross Motor Development TGMD (Ulrich 2). This test is one of the most common tests in the area of measurement and motor development (Evagelino et al., 2002). The above test is composed of two sub-tests which each consists of six skills: Locomotor subtest (running, galloping, hopping, step elongated spring, vertical jump and sliding) and subtest of object control (hit a stationary ball with the hands, dribbling in place, receiving the ball, hit the ball with the foot fixed, throw the ball over the shoulder and roll the ball of the shoulder).

The total performance measures for each subtest are 24. The performance criteria score for each skill is added to obtain the score obtained for each skill, then the sum of scores for the skills of each subtest, raw subtest score for each test (total 48) is obtained (Ulrich, 2000).

Administration method: firstly, participants are provided with verbal explanation and then how to administer the test through a training film. The scores of participants were done concurrent with the administration of skills by examiner. Meanwhile, to ensure the scoring of the participants, their administration was recorded and then the scores were obtained again with slow playback of films, and scoring was re-done with a higher accuracy.

To analyze data, statistical software SPSS version 16 was used. One way ANOVA analysis method was used to compare the groups. Also, in case of the significance of variance analysis to examine the difference between groups, post hoc Tukey test was used. In all stages, the significance level was $\alpha=0.05$.

Results and findings

In the present study, the score for development quotient among monozygotic, dizygotic twins and singletons of 7 and 10 years old at both sexes (boy & girl) was analyzed and the results are shown in Tables 1, 2 and 3 in detail.

As Table 1 shows, the scores of GMQ (Ulrich 2) in the boys aged 7 were not significantly different among the three monozygotic and dizygotic twin and singletons, and also there was not a significant difference among the groups of girls. Whereas, the results in Table 2 indicate that the difference between the scores of GMQ at 10 years old male and female groups was significant.

As the result in Table 3 indicates the difference in the scores of GMQ (Ulrich 2) within pairs (the difference in the twins' score at each pair) in the groups of boy and girl was significant, which the inter-pair mean of the male dizygotic twins (5.547) and females (4.714) was significantly different from other groups.

Conclusion

As age 7 is concurrent with the first year of attending school as a rich source of motor experience and independence from family and also brain at the first days of birth acts as a source of motion refinement, so motor impacts are not so much evident in children motor performance. Furthermore, at pre-school years, due to safety considerations and continuous presence at school, children under 7 years cannot freely move in family environment same as in school and among peers, thus a lower score for GMQ is allocated to them. The fact that GMQ scores are a function of anthropometric measurements and motor experiences has been confirmed in the research by Amouzadeh et al., (2013), Farsi et al; (2012); Molanouri et al; (2011), Khosro Ebrahim (2000), and also Silventoinen et al., (2014), Ashlesha et al., (2009) and Heiser et al., (2006), and Chado Ri and his colleagues (1997).

The scores of the monozygotic and dizygotic twins are lesser than the scores of singletons due to the intrauterine pressure leading to delayed initial physical development and specially dimensions of anthropometry. And as this factor significantly affects motor mental development at later years, most of studies regard this issue as a critical factor in the lower scores MDQ in twins, compared to singletons.

On the other hand, the first three years of school is considered as an environment influencing motor development can increase scores for locomotor and the control object differently in different groups, so that the highest scores are allocated to 10-year old twins, dizygotic twins and monozygotic twins, respectively. Such difference could be associated with the effective environmental factors, due to the fact that as monozygotic twins are more dependent so they are less interested in participation in locomotor activities, compared to dizygotic twins. Therefore, they obtain lower locomotor score than two other groups and lower GMQ score as well.

The scores for GMQ in 10-year-old monozygotic and dizygotic twins and growth velocity of the development patterns was lesser than singletons, which this finding was in agreement with the findings of Sediqi (2011), Khosro Ebrahim (2001), Silventoinen et al., (2014), Ashlesha et al., (2009), Ayoub Ali et al., (2007), Yokoyama et al., (2007), Berver et al., (2006), Ooki et al., (2006), and Maz et al., (1996), while it is not consistent with the findings of Heiser et al., (2006).

The absolute difference between scores for inter-pair GMQ in pairs of 10-year-old monozygotic and dizygotic twins compared to 7-year-old monozygotic and dizygotic twins in both sexes of boys and girls is higher because scores in at age of 7 among inter-pairs are very similar to each other, and the distribution of scores is high at the age 10, and such distribution is higher in the dizygotic twins than monozygotic ones.

This item can be attributed to environmental causes. This is because the monozygotic twins due to high genetic similarity and greater dependency, refusing to participate in physical activities and prefer to be together. Therefore they achieve lower scores in the GMQ. On the other hand, by an increase in aging and other affiliations in life, dependency of 10-year-old children becomes less than 7-year-old children, and this causes the release of twins from each other and the resulting higher distribution of scores for motor quotient.

Table 1. Shows the average scores of the GMQ and one-way ANOVA of the 7-year-old boys and girls

Sex	Groups	Mean	Squared Mean		Degree of Freedom	F- Test	Significance
7-Year Boys	Monozygotic Twins	62.214	Between Groups	44.383	2	0.559	0.576
	Dizygotic Twins	66.667	Within Groups	79.329	40		
	Singletons	68.588					
7-Year Girls	Monozygotic Twins	64.300	Between Groups	27.946	2	0.667	0.518
	Dizygotic Twins	64.500	Within Groups	41.872	43		
	Singletons	66.611					

Table 2. Shows the average scores of the GMQ and one-way ANOVA of the 10-year-old boys and girls

Sex	Groups	Mean	Squared Mean		Degree of Freedom	F- Test	Significance
10-Year Boys	Monozygotic Twins	75.750	Between Groups	187.188	2	7.670	0.002✹
	Dizygotic Twins	79.500					
	Singletons	83.667	Within Groups	24.405	37		
10-Year Girls	Monozygotic Twins	73.357	Between Groups	185.587	2	5.916	0.005✹
	Dizygotic Twins	74.600	Within Groups	31.371	53		
	Singletons	79.0741					

Table 3. Shows the average scores of gross GMQ and one-way ANOVA of inter-pair difference among boys and girls

Sex	Groups	Mean	Squared Mean		Degree of Freedom	F- Test	Significance
Boys	7-Year Monozygotic Twins	1.000	Between Groups	92.151	3	16.255	0.002✹
	7-Year Monozygotic Twins	1.333	Within Groups				
	10-Year Monozygotic Twins	1.750	Between Groups	37.798	20		
	10-Year Dizygotic Twins	5.574✹	Within Groups				
Girls	7-Year Monozygotic Twins	1.100		63.847	3	10.465	0.001✹
	7-Year Monozygotic Twins	1.200					
	10-Year Monozygotic Twins	1.571	Between Groups	50.843	25		
	10-Year Dizygotic Twins	4.714✹	Within Groups				

One reason for explaining the lower scores for girls than boys is the higher dependency of girls even with an increase in their age, which has led to emotional attachment and physical proximity to each other, thus less distribution of scores.

Given the above, and the results from the study, it could be said that school can be regarded as a high proactive and rich source of mobility experiences for quantitative and qualitative development of basic growth patterns of children.

Also, to assess the effectiveness of mobility programs and school sports in compliance with research ethics, it is possible to use monozygotic twins groups in separate groups, due to the fact that the problem of the uniformity of groups with regard to absolute genetic similarities of monozygotic twins has been overcome and the net effect of the program can be easily viewed.

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