

Birth Order and Sibling Gender Ratio of a Clinical Sample of Children and Adolescents Diagnosed with Attention Deficit Hyperactivity Disorder

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Objective: It is not clear whether sibling's gender ratio is associated with attention deficit hyperactivity disorder (ADHD). This study examines whether inattentiveness severity and hyperactivity/impulsivity severity are associated with birth order of children with ADHD .

Method: Participants are a clinical sample of 173 children and adolescents with ADHD and 43 ones without ADHD. Diagnoses were made using Diagnostic and Statistical Manual of Mental Disorders fourth edition-Text Revision (DSM-IV-TR), diagnostic criteria according to face-to-face interview with the children and their parents. ADHD DSM-IV checklist was used to measure inattentiveness and hyperactivity/impulsivity scores .

Results: The association of birth order and diagnosis of ADHD was not statistically significant after adjusting for covariate factors. The gender ratio of siblings is not associated with ADHD.

Conclusion: Birth order and siblings gender ratio are independent of ADHD diagnosis. The results of this study support the fact that genetic factors rather than environmental factor of birth order is associated with ADHD. Moreover, contrary to autism, the current results do not suggest the androgen theory for ADHD.

Key words: Attention deficit disorder with hyperactivity, Birth order, Sex ratio

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Attention deficit/hyperactivity disorder (ADHD) is very common in children and adolescents. According to Diagnostic and Statistical Manual of Mental Disorders fourth edition-Text Revision (DSM-IV-TR), there are two main categories of symptoms for ADHD including inattentiveness and hyperactivity/impulsivity (7). The etiology of ADHD is not clearly known; its heritability is 77% (21). Large family size is also a risk factor for ADHD (5).

ADHD screening symptoms in school-aged children is up to 10.1% (10). In both clinical and epidemiological studies, the rate of ADHD in boys is significantly more than girls. For example, the rate of ADHD screening symptoms in community in boys and girls is 13.6% and 6.5%, respectively (10). In addition, the "attentional performance" of children with ADHD is related to their gender (14). It is not clear why there is a high male to female ratio for ADHD. This high ratio is reported in another neurodevelopmental disorder, autism (16, 3).

Parental hormone levels around the time of conception impact mammalian sex ratios at birth (17). It is reported that testosterone-related problems in mothers of children with autism spectrum disorder is higher than the rate in mothers of typically developing children (16). ADHD symptoms are very common in children with autism. While autism and ADHD diagnostic criteria are completely different (12), about half of those with autism meet criteria for ADHD as well (20). Both environmental and genetic factors are the risk factors for autistic symptoms in children with ADHD (18).

If high intrauterine testosterone at least partially influences autism, can this influence be seen in other neurodevelopmental disorders such as ADHD? Therefore, it is hypothesized that the ratio of male siblings in probands with ADHD would be expected to be more than the ratio in control group. If this is true, it means that mothers of children with ADHD give birth to boys with ADHD more than the control group. In

other words, if androgen theory can be applied for ADHD, then, probands with ADHD have more brothers than the control group. To the best of author's knowledge, this matter has not been investigated.

Moreover, birth order is not well studied in children with ADHD. Only two studies were found on the association of birth order and ADHD. A chart-review study on a clinical sample of children with ADHD reported that vulnerability to ADHD was not correlated with birth order (4). Another study on a clinical sample of children with ADHD reported lack of association between ADHD and birth order. This study included parents aged between 19 and 35 years at the time of their son's birth. They reported that the first-born child was not at a risk for ADHD in the 32 individuals (19). However, there are several points about those studies. None of them included any comparison group. Moreover, while they reported lack of any association, they did not report any statistical analysis results. In addition, the number of children in each family can be associated with the age of parents. Older parents have had an opportunity to have more children compared to young parents. It means that the age of parents can be a covariate factor. This covariate factor was not considered in those studies. Furthermore, their samples were clinical. Therefore, parental educational level can be a covariate variable for referral bias (11). Additionally, children's age and gender are two other covariate factors. Therefore, the interference effects of mothers' and fathers' age, parental educational level, children's age and gender are the covariant factors to be considered in further studies. Therefore, it is reasonable to conduct further studies to overcome these limitations. The current study aimed to overcome the above-mentioned limitations in current literature regarding the association of ADHD and birth order.

In addition, there is a debate about the contribution of shared environmental factors and genetics factors to ADHD. The contribution of shared environmental influences is not supported in a meta-analysis (6); others provided further evidences against it (8).

This study tries to answer the following questions:

Is there any association between birth order and ADHD? Is birth order associated with the severity of inattentiveness? Is birth order associated with the severity of hyperactivity/impulsivity? Is there any association between the sibling's sex ratio and ADHD?

Materials and Method

Participants in this study were a clinical sample of children and their parents. There were two groups: one group was children and adolescents diagnosed with ADHD; another was a clinical sample of children and adolescents without ADHD from the same clinic affiliated to Shiraz University of Medical Sciences, Shiraz, Iran. The age range was 5 to 18 years for both groups. Those with clinically estimated or medically reported mental retardation were not included. Serious medical conditions such as epilepsy and

hypothyroidism and autism were among exclusive criteria. Written informed consent was obtained from the children and their parents. This study is part of a broader ongoing study approved by the Ethics Committee of Shiraz University of Medical Sciences.

ADHD diagnosis was made according to Diagnostic and Statistical Manual of Mental Disorders fourth edition-Text Revision (DSM-IV-TR)(7). Both children and parents were interviewed face to face. The number of inattentiveness and hyperactivity/impulsivity was evaluated through interview using DSM-IV-ADHD checklist (12). There was a Likert-type response to the symptoms of ADHD. The range of score was from never = 0, sometimes = 1, often = 2, to almost always = 3.

Statistical Analysis

Chi-square and t-test were used to examine the association of group with gender ratio and children's age, respectively. Birth order frequency was compared between the two groups using Chi-square test. The total number of siblings was compared by t-test.

A binary logistic regression analysis, backward method, was performed to examine the association of birth order with ADHD. Group was considered as dependent variable. The independent variables were birth order, gender, children's age, fathers' age, mother's age, fathers' educational level, mothers' educational level, and the total number of siblings.

Two separate linear regression analyses were conducted to examine the association of inattentiveness score and hyperactivity/impulsivity score with birth order. Birth order, probands' age and gender were considered as independent factors. P value less than 0.05 was considered as statistically significant.

Results

Participants were 173 children and adolescents with ADHD and 43 children and adolescents without ADHD diagnosis.

129(74.3%) of the ADHD sample were boys while 24(50.0%) of the comparison group were boys ($X^2=1.6$, $df=1$, $P<0.001$).

The mean (SD) of age in the ADHD and control group was 9.91(2.9) and 11.5(3.8), respectively, which was statistically different between the two groups ($X^2=3.1$, $df=215$, $p<0.002$).

Total number of probands' siblings was statistically different between the two groups ($t=2.5$, $df=209$, $P<0.01$). The mean (SD) of siblings number for ADHD and comparison group was 2.03(0.8) and 2.4(1.05), respectively.

Of the probands in ADHD group, 44(25.4%) were the only child, while in the comparison group, 9(18.8%) were the only child. This ratio was not statistically different between the two groups ($X^2=0.9$, $df=1$, $P=.3$).

Table 1. Total number of siblings in groups

Total number of siblings	Group	
	ADHD	Comparison
1	44	9
2	85	19
3	23	10
4	10	8
5	1	1
6	1	0
Total	164	47

Table 2. Total number of sisters and brothers in groups

Number of sisters	sisters		Brothers	
	ADHD	comparison	ADHD	Comparison
Without sister	94	19	87	23
1	53	17	62	12
2	10	6	9	6
3	2	1	2	2
4	1	0	-	-
Total	160	43	160	43

Table 3. The frequency of birth order of children in ADHD and comparison group

Proband birth order	ADHD group		Comparison group	
	Number	%	Number	
First	108	63.5	22	45.8
Second	41	24.1	11	22.9
Third	14	8.2	8	16.7
Fourth or more	7	4.1	7	14.6

Table 4. The association of proband's age and gender, birth order, total number of siblings, fathers' age and educational level, mothers' age and educational level with group

Independent variable [†]	B	Sig.	Exp(B)	95% C.I.for EXP(B)	
				Lower	Upper
Gender	-1.153	.003	.316	.146	.681
Mothers' age	-.131	.000	.877	.815	.944

[†] Variable(s) entered were: proband's age and gender, birth order, total number of siblings, number of sisters, number of brothers, fathers' age and educational level, mothers' age and educational level.

Table 5. The association of inattentiveness severity score and birth order in probands with ADHD

Independent variable	Significancy	95.0% Confidence Interval	
		Lower Bound	Upper Bound
Birth order	.108	-2.033	.201
Age	.165	-.583	.100
Gender	.269	-3.714	1.040

Table 6. The association of hyperactivity/impulsivity severity score and birth order in probands with ADHD

Independent variable	Significancy	95.0% Confidence Interval for B	
		Lower Bound	Upper Bound
Birth order	.342	-1.679	.585
Age	.000	-1.187	-.499
Gender	.039	-4.872	-.128

Birth Order

Total number of siblings, the number of sisters, and the number of brothers are displayed in Tables 1 to 2, respectively.

The frequency of birth order in both groups is displayed in table 4. It shows that the distribution of birth order is different between the two groups ($X^2=11.0$, $df=3$, $P<0.01$). The frequency of being the first child in ADHD and comparison group was 63.5% and 45.8%, respectively.

The rate for being fourth or more in the ADHD and comparison group was 4.1% and 14.6%, respectively. However, the results of regression analysis showed that birth order (after adjusting for probands' age and gender, and parental age and educational level) is not associated with group (Table 4).

Regression analysis showed that inattentiveness score was not associated with birth order (Table 5). Hyperactivity/impulsivity score was not associated with birth order in probands with ADHD either (Table 6).

Sex Ratio of Siblings of Proband

The number of brothers in the whole sample was statistically different between the two groups ($X^2=6.0$, $df=2$, $P<0.04$). The rate of one brother sibling for probands in ADHD and comparison group was 38.8% and 27.9%, respectively. Eighty seven (54.4%) children in the ADHD group and 23(53.5%) in the control group did not have any brother. Eleven children in the ADHD group and 8 children in control group had two or more brothers. However, the number of sisters in the whole sample was not statistically different between the two groups ($X^2=3.9$, $df=2$, $P=0.1$). The rate of children without any sisters in ADHD and control group was 94(58.8%) and 19(44.2%), respectively. The rate of children who had one sister in the ADHD and control groups was 53(33.1%) and 17(39.5%), respectively. Thirteen(8.2%) children in the ADHD group and 7 (16.3%) in control group had two or more sisters.

The ratio of sibling boys/girls was not statistically different between the two group ($t=1.08$, $df=88$, $P=0.2$). This ratio for ADHD and comparison group was 0.37 and 0.56, respectively.

Discussion

In order to answer our first question, one of the findings of this study is that birth order was associated with group. However, after adjusting for the covariate factors of probands' age, gender, parental age and educational level, and total number of siblings, birth order was not associated with ADHD. This is consistent with the findings of previous studies' results (4, 19). Current results support the previous findings indicating that birth order is not associated with ADHD.

Our second aim was to examine whether birth order is associated with inattentiveness score in ADHD children. Regression analysis indicated that there was

not any significant association between inattentiveness and birth order in children with ADHD.

The third aim of this study was to examine whether birth order is associated with the severity of hyperactivity/impulsivity score. Again, regression analysis showed that hyperactivity/impulsivity is independent of birth order as well. We could not find any published study on the association of birth order and inattentiveness and hyperactivity/impulsivity in children with ADHD to compare its results with ours.

The last aim was to understand whether the sex ratio of siblings is associated with ADHD. The rate of being the only child was not different between the two groups. Probands in ADHD group more the comparison group had one brother. The rate of sisters was not different between the groups. However, the current results show that the ratio of brothers to sisters is not different between ADHD and comparison group. Again, no previous published study was found to compare their results with ours. Therefore, this hypothesis that mothers of children with ADHD give birth to more boys than the control group was not accepted.

An important issue which should take into account in such studies is the effect of the birth order per se on the personality of individuals(2). Alfred Adler was the first who mention this subject. According to him, parent's responses to their children were affected by the order of birth. However, it is suggested that personality variables may relate more meaningfully to the roles that siblings play in the family rather than to actual birth order (2,15). That is, although a child may be the youngest one, the interplay among variables such as gender mix of the siblings and differences in ages can create a firstborn role for the youngest child. Studies shows that 45 percent of men and 52 percent of women have a distinctive sibling role in their families and that psychological and actual birth order is only accordant for 19 percent of people (22,9). Consequently, paying attention to the sibling and family roles may be more revealing than actual birth order.

To the best of authors' knowledge, this is the first study that included a considerable large numbers of children and adolescents with ADHD and a comparison group. In addition, many covariate factors are included in this study. Moreover, this is the first study to investigate the gender ratio of sibling in children and adolescents with ADHD. However, further studies with larger sample size are recommended.

Limitations

There are some limitations needed to be noticed. This is a clinical sample. However, it does not seem that the current results are influenced by referral bias because the gender ratio of boys and girls with ADHD was very similar to the ratio reported from the community sample.

Conclusion

Birth order and siblings gender ratio are not associated with ADHD. No published study was found on the possible association of inattentiveness and hyperactivity/impulsivity with birth order in ADHD.

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Conflict of interest

There is no conflict of interest to be declared.

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