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A Comparative Study of Impulse Control and Metacognitive Thinking between Hyperactive and Normal Adolescents

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Abstract

Background: The significance of hyperactivity disorder lies in its widespread occurrence, its long-lasting effects, and how it affects the well-being of children and their families.

Objectives: This study aims to analyze the differences in impulse control and metacognitive thinking among teenagers with hyperactivity and normal teenagers.

Methods: This study was conducted as one of the case-control investigations. The research was carried out in Rasht City, Iran, between July and October 2023, focusing on teenagers with hyperactivity. The study involved purposefully choosing 139 teenage boys and girls, who were then divided into four groups according to their levels of hyperactivity. Data collection instruments included the Meta-Cognition Questionnaire-30 and Barratt Impulsiveness Scale-11. Statistical analysis was performed using ANOVA and Tukey's post-hoc test in SPSS27 software. A significance level was considered at 0.05.

Results: According to the research results, there was a significant difference in the mean of all variables among the four groups: girls with hyperactivity, girls without hyperactivity, boys with hyperactivity, and boys without hyperactivity (P<0.001). The only variable where the difference between the groups was not significant was unplanned impulsivity (P=0.108). Hence, it can be inferred that both groups displayed unplanned impulsivity.

Conclusion: The findings revealed that teenagers with hyperactivity, positive beliefs, cognitive uncertainty, and the need to control thoughts exhibited higher levels of impulsivity when compared to their peers. However, their positive beliefs and cognitive self-consciousness processes were not as developed as those of typical adolescents.

Keywords: Hyperactivity disorder, Impulse control, Metacognitive thinking

1. Background

Attention deficit hyperactivity disorder (ADHD) is a neurodevelopmental condition characterized by deficits in executive functions, such as motor inhibition, attention, and working memory. The prevalence of this disorder globally ranges from 2% to 7%, with up to 65% of cases continuing to experience its detrimental symptoms into adulthood and facing negative social and occupational outcomes (1). Children with ADHD struggle to regulate their behavior and attention, impacting their academic and social performance, with many symptoms persisting into adulthood (2). Individuals with ADHD display inappropriate levels of inattention, hyperactivity, and impulsivity, making them three times more likely to attempt suicide compared to the general population (3). Research suggests that young individuals with hyperactivity and co-occurring anxiety face higher social and academic impairments than those without anxiety. Differences in attention and impulse control may contribute to the increased challenges experienced by this group (4).

Attention deficit hyperactivity disorder is a prevalent neurodevelopmental disorder known for various symptoms, such as hyperactivity, attention deficit, distractibility, relationship issues, and impulsive behavior (5). The persistence of these executive function deficits and impulsive behavior in hyperactivity can lead to a decline in the quality of life and disruptions in interpersonal relationships and social functioning (6). In fact, impulsivity is viewed as a tendency towards exploration, seeking sensation, and participating in new and exciting activities, which is a significant flaw and a key long-term symptom in hyperactivity characterized by acting without conscious thought (7). Impulsivity is categorized into three components: non-planning, motor, and cognitive, representing "lack of planning," "uninhibited action," and "action without consideration" (8). It has been suggested in a study that various conditions, including hyperactivity disorder, schizophrenia, and substance abuse, are marked by deficiencies in attention and impulse control (9). Additionally, another study proposed that short-term fundamental motor skills training could be beneficial for managing movement and impulse control in children exhibiting symptoms of ADHD (10).

Individuals with hyperactivity exhibit impaired development of metacognitive skills, a crucial part of executive functions, unlike those who are considered

normal (11). Metacognition refers to the knowledge and cognitive activities related to regulating cognitive actions. It influences cognitive processing by facilitating control, monitoring, planning, and correction, while also interacting with emotional processing to impact mental health and vulnerability to disturbances (12). Recent research by Aydin et al. (2022) revealed that individuals with hyperactivity disorder tend to have lower metacognition scores in specific sub-dimensions compared to healthy individuals (13). Additionally, studies have shown that children with ADHD struggle with metacognition, leading to the adoption of inappropriate strategies to manage attention and impulsive behavior. Moreover, children with ADHD have been found to have lower levels of metacognitive awareness and emotional resilience (14). Other research, such as that conducted by Butzbach et al. (2022), has highlighted deficits in various aspects of metacognition among individuals with ADHD (15). It has also been suggested that addressing incompatible schemas and promoting positive metacognitive and meta-emotional beliefs could alleviate symptoms of ADHD in adults (12).

Given the high prevalence and impact of ADHD on individuals and families, understanding the differences in impulse control and metacognitive thinking among adolescents with hyperactivity is crucial. Despite variations among adolescents with ADHD, few studies have been dedicated to comparing impulse control and metacognitive thinking in this population and normal adolescents.

2. Objectives

This study aims to fill this gap by investigating potential disparities in impulse control and metacognitive thinking between adolescents with hyperactivity and their typical counterparts.

3. Methods

This case-control study was conducted on teenagers divided into case and control groups based on hyperactivity status, and then the results were compared in terms of exposure history. The research population included all hyperactive teenagers in Rasht City, Iran, from July to October 2023. A sample of 139 boys and girls was selected using purposive and random sampling methods and divided into four groups based on hyperactivity status. Sample size adequacy was determined using G-Power software with F tests, α = 0.05, effect size = 0.4, power test = 0.95, and 4 groups [16] [Figure 1].

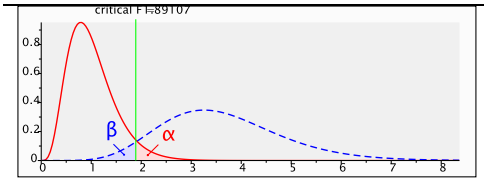

Figure 1. Determining the sample size with G-Power software

By this, the researchers considered 164 individuals, with 41 individuals in each group. Those adolescents diagnosed with hyperactivity disorder who had received counseling services from the beginning of the solar year 1402 until July of the same year at psychology and counseling clinics were listed in the research file. Specialist clinicians at these clinics diagnosed the presence of the disorder in adolescents based on the Diagnostic and Statistical Manual of Mental Disorders before the commencement of the study. Meanwhile, the control group consisted of healthy students from 10th to 12th grades studying at schools located in Rasht. The research sample was selected based on specific inclusion and exclusion criteria. The inclusion criteria were being under the age of 18, having a psychological file related to hyperactivity for those in the Case group, giving informed consent to participate in the study, and possessing adequate literacy and comprehension skills to respond to the survey questions. Those who had any physical or mental health issues that prevented them from participating or continuing the study were excluded from the research.

Following the necessary approvals and university authorization, the researchers began their study by visiting three psychology clinics in Rasht. These specific clinics were chosen to undergo a method established by the university professors who introduced the researcher. After explaining the research goals and techniques to the clinic management (whose names were kept confidential), the researchers received initial approval to identify adolescents with hyperactivity disorder at the clinics. Subsequently, messages were relayed through the clinics to the parents of these teenagers detailing the research objectives and seeking their participation.

The researchers carefully selected participants who showed an interest in participating in the study. They focused on 41 girls and 41 boys with hyperactivity. Before conducting the study, the researchers ensured that the research goals and ethical guidelines were understood by all involved, answering any questions during phone interviews with parents and sometimes teenagers. Afterward, the participants and their parents were invited to

attend in-person clinics where 80 people took part, and an informed consent form was obtained from them. The researchers then used different research instruments to measure the research variables.

Individuals in the control group were randomly chosen from high school students in District 10 of Rasht, separated by gender. Before assessing the variables and filling out the surveys, it was confirmed that these students lacked a history of hyperactivity disorder after an initial interview. The interviews and survey completion lasted approximately 82 hours, with the researcher conducting the study over 46 days within 3 months. Subsequently, the data of 31 teenage girls with hyperactivity, 37 teenage boys with hyperactivity, 36 normal teenage girls, and 32 normal teenage boys were examined. The total number of participants was 139, with 25 teenagers being eliminated because of incomplete surveys, intentional errors, or withdrawal. To adhere to ethical guidelines, participants were required to sign a consent form before completing the surveys, emphasizing that participation was voluntary and that they could withdraw at any time. Additionally, they were assured of the confidentiality of their personal information.

Measures

Meta-Cognition Questionnaire 30: Cartwright-Hatton et al. designed a self-report questionnaire to measure differences in metacognitive beliefs (17). The questionnaire included 30 items divided into 5 sub-scales of positive beliefs about worry (items 28, 23, 19, 10, 7, and 1), negative beliefs about the uncontrollability of thoughts (items 21, 15, 11, 9, 4, and 2), cognitive uncertainty (items 29, 26, 24, 17, 14, and 8), the need to control thoughts (items 27, 25, 22, 20, 13, and 6), and metacognitive processes of cognitive self-consciousness (items 30, 18, 16, 12, 5, and 3). Responses are rated on a 4-point Likert scale (from 1=completely agree to 4=completely disagree), and each sub-scale is scored separately, with scores ranging from 6 to 24. In a study in Iran, the overall validity of the questionnaire was reported to be 0.91, with sub-scale validity ranging between 0.71 and 0.87, determined using internal consistency and Cronbach's alpha formula (18). The researcher in this study found the reliability of the entire scale to be 0.71, based on Cronbach's alpha.

Barratt Impulsiveness Scale-11: Barrett et al. (1995) developed a self-report questionnaire to assess impulsivity levels in individuals (19). This 30-item questionnaire consists of three dimensions: unplanned impulsivity, motor impulsivity, and cognitive impulsivity. Responses are rated on a 5-point Likert scale ranging from 1=never to 5=always, with scores for each dimension calculated separately. The total scale score falls between 30 and 150, with each dimension score ranging from 10 to 50. A higher score shows a higher level of impulsiveness. In an Iranian study, the convergent validity of this questionnaire was confirmed through correlation coefficients between its subscales. The overall validity of this tool was assessed using Cronbach's alpha and test-retest methods, resulting in coefficients of 0.81 and 0.77, respectively (20). In the same study, the researcher determined the reliability of the scale with a Cronbach's alpha of 0.73.

Statistical analyses

ANOVA and Tukey's post-hoc test were employed for data analysis using SPSS software (version 27). The normal distribution of the research variables was assessed using the Kolmogorov-Smirnov test. The sampling method was random, thereby upholding this assumption. A significance level of 0.05 was deemed appropriate for this study.

4. Results

The study involved a total of 139 individuals, consisting of hyperactive girls, hyperactive boys, normal girls, and normal boys. Initially, the researcher analyzed the descriptive statistics of the research variables. The participants were categorized based on age into groups of 15-16 years old, 16-17 years old, and 17-18 years old. Similarly, they were divided into three groups according to their education level in high school: 10th, 11th, and 12th grade. The researcher also compared the demographic variables of the four groups, finding no significant differences among them based on the Kruskal-Wallis Test ($P>0.05$). Therefore, the groups exhibited similarities in all aspects [Table 1].

According to Table 2, the normal group had higher average scores in positive beliefs about worry compared to the hyperactive group. There was a difference in mean values of negative beliefs about the controllability of thoughts between hyperactive girls and boys, with lower scores in the normal group. The average cognitive uncertainty did not show significant differences among the groups, with the highest value seen in hyperactive boys. Need to control thoughts had higher mean scores in boys and girls with hyperactivity than the normal group. The Normal boy group had the highest mean for metacognitive processes of cognitive self-consciousness. Unplanned impulsivity scores did not vary much between the groups. Movement impulsivity was highest in hyperactive boys, while other groups had no significant difference in this regard. Cognitive impulsivity was higher in the hyperactive group compared to the normal group.

Table 1. Demographic characteristics in the groups

Variables	Demographic information	Hyperactive girl	%	Hyperactive boy	%	Normal girl	%	Normal boy	%	Kruskal-Wallis test	P-value
Age (year)	15-16	12	35.3%	15	40.5%	14	38.9%	10	31.3%	0.587	0.899
	16-17	13	38.2%	13	35.1%	13	36.1%	13	40.6%		
	17-18	9	26.5%	9	24.3%	9	25.0%	9	28.1%		
Education	10th grade	12	35.3%	17	45.9%	14	38.9%	12	37.5%	0.558	0.906
	11th grade	13	38.2%	11	29.7%	13	36.1%	12	37.5%		
	12th grade	9	26.5%	9	24.3%	9	25.0%	8	25.0%		

Table 2. Descriptive statistics of the variables

Variables	Groups	n	Mean	SD	Min	Max
Positive beliefs about worry	Hyperactive girl	34	16.9118	1.92854	13	20
	Hyperactive boy	37	16.0541	1.94288		
	Normal girl	36	18.6944	1.95404		
	Normal boy	32	18.0000	2.19971		
	Total	139	17.3957	2.23483		
Negative beliefs about the controllability of thoughts	Hyperactive girl	34	17.1176	1.70142	14	22
	Hyperactive boy	37	18.0811	1.93475		
	Normal girl	36	15.4722	1.53969		
	Normal boy	32	16.3750	1.60141		
	Total	139	16.7770	1.95249		
Cognitive uncertainty	Hyperactive girl	34	17.5588	1.02073	14	20
	Hyperactive boy	37	18.3784	1.84619		
	Normal girl	36	16.1389	1.88457		
	Normal boy	32	17.0000	1.60644		
	Total	139	17.2806	1.82188		
Need to control thoughts	Hyperactive girl	34	17.2059	1.06684	14	20
	Hyperactive boy	37	18.3243	1.74887		
	Normal girl	36	16.2778	1.71733		
	Normal boy	32	15.6562	1.59858		
	Total	139	16.9065	1.84898		
Metacognitive processes of cognitive self-consciousness	Hyperactive girl	34	16.6176	1.95424	14	20
	Hyperactive boy	37	17.5135	1.88004		
	Normal girl	36	16.6111	1.93136		
	Normal boy	32	18.3437	1.57827		
	Total	139	17.2518	1.96009		
Unplanned impulsivity	Hyperactive girl	34	27.3529	5.73074	18	38
	Hyperactive boy	37	28.5405	5.56574		
	Normal girl	36	25.1111	6.70513		
	Normal boy	32	27.2500	5.84752		
	Total	139	27.0647	6.05196		
Movement impulsivity	Hyperactive girl	34	26.3235	4.98920	18	37
	Hyperactive boy	37	32.2432	3.77422		
	Normal girl	36	24.4444	5.32082		
	Normal boy	32	26.3125	5.48569		
	Total	139	27.4101	5.72157		
Cognitive impulsivity	Hyperactive girl	34	30.0294	5.71275	18	38
	Hyperactive boy	37	31.9189	6.27773		
	Normal girl	36	26.9167	4.57556		
	Normal boy	32	26.3750	4.12506		
	Total	139	28.8849	5.69907		

Table 3 presents the results of the ANOVA test to compare group differences, following the examination of necessary assumptions. Outliers were checked, and there were not many outliers in the analysis. The Kolmogorov-Smirnov test results indicated a normal distribution of scores. Levene's Test of Equality of Error Variance showed no significance in the equality of variance among groups for any variable.

Based on the data in Table 3, there was a significant discrepancy in the mean values of all variables among the four groups: girls with hyperactivity, girls without hyperactivity, boys with hyperactivity, and boys without hyperactivity ($P<0.001$). The magnitude of these differences, as indicated by the Partial Eta Squared value for each variable, was determined to be significant. However, the only variable that did not display a significant contrast between the groups was unplanned impulsivity ($P=0.108$), indicating that the groups were similar in this aspect. Subsequently, the researcher utilized the Tukey HSD post hoc test to further analyze and compare these two groups, with the results summarized in Table 4.

Table 3. Analysis of variance test to check the difference between groups

	Sum of Squares	df	Mean Square	F	P-value	Partial Eta Squared
Positive beliefs	146.971	3	48.990	12.196	P<0.001	0.2130
Negative beliefs	133.328	3	44.443	15.276	P<0.001	0.2530
Cognitive uncertainty	96.667	3	32.222	12.037	P<0.001	0.2110
Need to control thoughts	141.676	3	47.225	19.313	P<0.001	0.3000
Metacognitive processes of cognitive self-consciousness	69.140	3	23.047	6.748	P<0.001	0.1300
Unplanned impulsivity	221.908	3	73.969	2.066	0.1080	0.0440
Movement impulsivity	1259.610	3	419.870	17.398	P<0.001	0.2790
Cognitive impulsivity	726.181	3	242.060	8.700	P<0.001	0.1620

Table 4. Tukey's post hoc test to compare the means of two groups

Variables	Group 1	Group 2	Mean Difference	Std. Error	P-value
Positive beliefs	Hyperactive girl	Hyperactive boy	0.8577	0.47613	0.277
		Normal girl	-1.7827*	0.47929	0.002
		Normal boy	-1.0882	0.49362	0.127
	Hyperactive boy	Normal girl	-2.6404*	0.46919	0.000
		Normal boy	-1.9459*	0.48382	0.001
	Normal girl	Normal boy	0.6944	0.48693	0.485
Negative beliefs	Hyperactive girl	Hyperactive boy	-0.9634	0.40521	0.086
		Normal girl	1.6454*	0.40790	0.001
		Normal boy	0.7426	0.42010	0.293
	Hyperactive boy	Normal girl	2.6089*	0.39931	0.000
		Normal boy	1.7061*	0.41176	0.000
	Normal girl	Normal boy	-0.9028	0.41440	0.134
Cognitive uncertainty	Hyperactive girl	Hyperactive boy	-0.8196	0.38870	0.156
		Normal girl	1.4199*	0.39127	0.002
		Normal boy	0.5588	0.40298	0.510
	Hyperactive boy	Normal girl	2.2395*	0.38303	0.000
		Normal boy	1.3784*	0.39498	0.004
	Normal girl	Normal boy	-0.8611	0.39751	0.138
Need to control thoughts	Hyperactive girl	Hyperactive boy	-1.1184*	0.37149	0.016
		Normal girl	0.9281	0.37396	0.067
		Normal boy	1.5496*	0.38514	0.001
	Hyperactive boy	Normal girl	2.0465*	0.36608	0.000
		Normal boy	2.6681*	0.37749	0.000
	Normal girl	Normal boy	0.6215	0.37992	0.362
Metacognitive processes of cognitive self-consciousness	Hyperactive girl	Hyperactive boy	-0.8959	0.43903	0.178
		Normal girl	0.0065	0.44194	1.000
		Normal boy	-1.7261*	0.45516	0.001
	Hyperactive boy	Normal girl	0.9024	0.43263	0.163
		Normal boy	-0.8302	0.44612	0.250
	Normal girl	Normal boy	-1.7326*	0.44899	0.001
Unplanned impulsivity	Hyperactive girl	Hyperactive boy	-1.1876	1.42137	0.837
		Normal girl	2.2418	1.43080	0.401
		Normal boy	0.1029	1.47359	1.000
	Hyperactive boy	Normal girl	3.4294	1.40065	0.073
		Normal boy	1.2905	1.44434	0.808
	Normal girl	Normal boy	-2.1389	1.45361	0.458
Movement impulsivity	Hyperactive girl	Hyperactive boy	-5.9197*	1.16707	0.000
		Normal girl	1.8791	1.17481	0.382
		Normal boy	0.0110	1.20995	1.000
	Hyperactive boy	Normal girl	7.7988*	1.15006	0.000
		Normal boy	5.9307*	1.18593	0.000
	Normal girl	Normal boy	-1.8681	1.19354	0.402
Cognitive impulsivity	Hyperactive girl	Hyperactive boy	-1.8895	1.25309	0.436
		Normal girl	3.1127	1.26140	0.070
		Normal boy	3.6544*	1.29913	0.029
	Hyperactive boy	Normal girl	5.0023*	1.23482	0.000
		Normal boy	5.5439*	1.27334	0.000
	Normal girl	Normal boy	0.5417	1.28151	0.975

According to the data in Table 4, when comparing different groups in terms of positive beliefs, a significant difference was observed between hyperactive girls and normal girls (P=0.002); however, there were no significant differences between hyperactive girls, hyperactive boys, and normal boys. The hyperactive boys showed a significant difference from the non-hyperactive groups (P=0.001). The normal group exhibited elevated levels of positive beliefs in contrast to the

hyperactivity groups. Regarding negative beliefs, hyperactive girls and normal girls had a significant difference (P=0.001), while no difference was found between the other groups. The boys with hyperactivity displayed distinct differences from non-hyperactive groups (P<0.001), and the normal group exhibited reduced levels of negative beliefs in comparison to hyperactive groups. Regarding cognitive uncertainty, a significant difference was observed between hyperactive and normal girls (P=0.002), with the normal group having lower levels than hyperactive groups. As for the need to control the thoughts component, hyperactive girls differed significantly from normal boys and hyperactive boys (P<0.05); nevertheless, they had no significant difference from normal girls. The hyperactive boys showed a significant difference from the non-hyperactive groups (P<0.001).

Considering the metacognitive processes of the cognitive self-consciousness component, the Hyperactive girl group showed a significant difference compared to the Normal boy group (P=0.001). However, there was no difference between the Hyperactive girl group, Normal girl group, and Hyperactive boy group (P>0.05). Additionally, the Hyperactive boy group did not significantly differ from the two groups without hyperactivity (P>0.05). No difference was observed between groups without hyperactivity (P=0.001). The difference in means indicates that the amount of this component varied between the Normal boy group and the Hyperactive girl group.

In terms of the unplanned impulsivity component, normal and hyperactive groups showed no difference. Moving on to the movement impulsivity component, the Hyperactive girl group had a significant difference from the Hyperactive boy group (P<0.001). However, no difference was found between the Hyperactive girl group and the Normal and Non-hyperactive groups (P>0.05). The Hyperactive boy group was significantly different from the two groups without hyperactivity (P<0.001). There was no difference found between groups without hyperactivity (P=0.402). The difference in mean scores confirmed that this component was lower in the Normal group than in the Hyperactive boy group.

Lastly, considering the cognitive impulsivity component, the Hyperactive girl group showed a significant difference from the Normal boy group (P=0.029). However, no difference was found between the Hyperactive girl group and the Hyperactive boy group (P>0.05). Additionally, the Hyperactive boy group was significantly different from the two groups without hyperactivity (P<0.001). No difference was observed between groups without hyperactivity (P=0.975). The difference in mean scores demonstrated that this component was lower in the Normal group than in the Hyperactive boy group.

5. Discussion

The current study aimed to compare impulse control and metacognitive thinking in adolescents with hyperactivity and those without. Results from the study showed that the normal group had more positive and fewer negative beliefs compared to the hyperactive groups. Additionally, cognitive uncertainty was lower in the normal group than in the hyperactive group. The need to control thoughts was also lower in the normal group than in the hyperactive groups. Considering cognitive self-consciousness, normal boys showed more metacognitive processes than girls in the hyperactive group. Furthermore, unplanned impulsivity, cognitive impulsivity, and motor impulsivity were lower in the normal group than in hyperactive boys.

The results of the current study revealed that hyperactive adolescents had higher levels of negative beliefs, cognitive uncertainty, and the need to control thoughts compared to normal adolescents. Additionally, hyperactive adolescents exhibited lower levels of positive beliefs and cognitive self-consciousness in metacognitive processes compared to their normal counterparts. These findings are in line with previous research studies (11-14). One study mentioned that children with hyperactivity had low metacognitive awareness and emotional resilience (11). Another study found that normal adults had higher mean scores in metacognition and positive meta-excitement compared to adults with hyperactivity disorder (12). The results of research by Aydin et al. (2022) also demonstrated that individuals with hyperactivity disorder exhibited lower metacognition scores for the need to control thoughts and cognitive uncertainty than healthy individuals (13). Another study indicated that children with hyperactivity struggled with metacognition, leading them to adopt inappropriate strategies to regulate attention and impulsive behavior (14).

Adolescents with hyperactivity often struggle with planning, impulse control, and executive functions, leading to negative metacognitive beliefs that are more prevalent in these individuals than in those without the disorder. This includes uncontrolled spontaneous thoughts that can disrupt tasks, such as listening to a lecture (21). People with hyperactivity show signs of a deficit in self-awareness compared to their peers without hyperactivity, impacting cognitive processing through processes, including control, monitoring, and planning, which can affect mental health and vulnerability to mental disturbances (12). Metacognitive interventions can help identify cognitive strengths and weaknesses, provide feedback, and implement strategies that leverage cognitive strengths, although some

metacognitive beliefs are weaker in adolescents with hyperactivity than in normal individuals. Individuals with ADHD may perceive more cognitive impairment in self-reports than what is revealed through performance tests. Positive metacognitions, which involve seeing the benefits of engaging in coping strategies for cognitive and emotional regulation, are more prevalent in normal individuals than in those with hyperactivity (22). Moreover, negative metacognitions, which relate to the uncontrollability and dangers of thoughts and consequences of coping strategies, are more common in individuals with hyperactivity. These negative beliefs can include statements such as "When I start to worry, I can't stop" or "Thoughts of drinking alcohol interfere with my functioning" (23).

The results of the latest studies revealed that in proactive male adolescents, the level of impulsivity in terms of motor impulsivity and lack of planning cognitive impulsivity was higher than in normal adolescents among the various components of impulsivity. This conclusion is in line with previous findings of other research (9, 24-26). According to research, adults with ADHD exhibit more deficiencies in executive functions and emotional impulsivity, such as prior intention, persistence, and urgency, compared to normal adults (24). Another research found a strong positive association between hyperactivity and impulse control deficits (25). Hyperactivity has also been linked to destructive disorders and impulse control issues and behaviors, according to one study (26). Additionally, another study suggested that many human conditions, including hyperactivity disorder, schizophrenia, and substance abuse, are characterized by a lack of attention and impulse control (9).

Impulsivity is defined as a behavior characterized by seeking new and exciting activities, which is a core issue and a long-term symptom of hyperactivity. Adolescents with high levels of hyperactivity-impulsivity symptoms are more likely to drop out of school and have fewer years of education. In addition, they have a higher risk of accidents and delinquency and struggle in educational and work settings, leading to lower job status and social problems with family and peers. Antisocial and impulsive behaviors play a role in various social and academic outcomes. ADHD is associated with impulsivity, reward processing, and attention (7). Impulsivity is linked to neuropsychological measures, such as response inhibition and working memory, indicating externalizing mental health problems (27). The main symptoms of hyperactivity in adolescents include difficulties in maintaining goals and plans, inability to control impulsive responses, and trouble focusing attention, resulting in task failures. Hyperactive individuals struggle to anticipate future events and often fail to recognize the impact of their behavior due to deficits in regulating vigilance, sustaining effort, and processing information at an appropriate pace (28).

One limitation of this study is that the findings are limited to adolescents with hyperactivity disorder and may not be applicable to individuals with other disorders. Another limitation is that the data was collected through a questionnaire, which may lead to unrealistic answers due to the participants' misunderstanding of the questions. However, efforts were made to mitigate this issue by providing clear explanations and allowing enough time for responses. Additionally, some parents and teenagers might have been hesitant to participate due to concerns about confidentiality and a lack of trust in psychology. Some adolescents with hyperactivity disorder also had difficulty completing the questionnaires due to issues with behavior control and attention. It is recommended that future studies include subjects with other disorders for comparison. Furthermore, conducting similar research on adults of both genders is advised for further comparison.

6. Conclusion

The findings of the current study indicated that adolescents with hyperactivity exhibited negative beliefs, cognitive uncertainty, and a need to control their thoughts, along with higher impulsivity compared to their peers without hyperactivity. These adolescents also had fewer positive beliefs and lower levels of metacognitive processes related to cognitive self-consciousness. It is recommended that psychologists specializing in ADHD adopt effective techniques to alleviate symptoms and promote better adaptation in their clients. Additionally, it is advised to conduct courses and workshops for families having hyperactive teenagers and school personnel to increase understanding of these differences and learn how to properly support teenagers with hyperactivity disorder. Given the tendency for hyperactivity to persist into adolescence, early interventions in school programs for this age group are recommended to prevent complications associated with hyperactivity extending into adulthood.

Acknowledgments

The ethical standards set by the institutional and/or national Research Committee governed all procedures conducted in studies involving human participants under the code IR.IAU.RASHT.REC.1402.232.

Conflicts of interest

The authors stated that they have no conflicts of interest.

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