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Unwanted intrusive and worrisome thoughts in adults with Attention Deficit\Hyperactivity Disorder

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ABSTRACT

Attention Deficit/Hyperactivity Disorder (ADHD) is associated with deficient motor and cognitive inhibitory mechanisms. The aim of this article is to examine two symptoms associated with cognitive disinhibition, namely: intrusive unwanted thoughts, worrisome thoughts and their suppression. Thirty-seven college students diagnosed with ADHD and 23 healthy college students were compared on the Distressing Thoughts Questionnaire and on the Anxious Thoughts Inventory. Results show that in comparison to the control group, participants with ADHD experienced significantly higher ratings on all intrusive thoughts scales, and three worrisome thoughts scales. Our results suggest that worrisome intrusive thoughts are an important phenotypical expression of adults with ADHD. A neurobiological explanation for this phenomenon is suggested, and clinical implications are discussed.

1. Introduction

Attention Deficit/Hyperactivity Disorder (ADHD) is primarily a developmental disorder characterized prominently by inattention, impulsivity and hyperactivity (Barkley, 1990; American Psychiatric Association, 1994) that persist into adulthood (Wender, 1994; Kessler et al., 2006).

1.1. Anxiety, intrusive unwanted thoughts and worry in ADHD

Anxiety is a prominent symptom of ADHD in childhood as well as in adulthood (Barkley, 1990; Shekim et al., 1990; Wender, 1994; Richards et al., 1999; Young, 2000; Donnelly et al., 2006). Recently Kessler et al. (2006) analyzed results from the United States National Comorbidity Survey Replication. The authors found that within the adult ADHD population 47.1% were diagnosed with an anxiety disorder. However, it appears that most research on anxiety in individuals with diagnoses of ADHD primarily uses the following two exploratory approaches: The first examines anxiety disorders as a separate comorbid entity associated with ADHD. For example, Shekim et al. (1990) examined 56 adults diagnosed with ADHD for comorbid psychiatric disorders, and found that 53% had comorbid Generalized Anxiety Disorder (GAD). The second approach focuses primarily on anxiety as one component out of a cluster of personality traits of ADHD, in comparison to normal subjects (Perrin and Last, 1992). This study aims to explore the *cognitive* aspects of anxiety (e.g. anxious worrisome thoughts and intrusive unwanted thoughts) as an inherent phenotypic expression of ADHD.

Worrisome and Intrusive thoughts are two cognitive features of anxiety (Perrin and Last, 1997). Perrin and Last (1997) compared three groups of children: a non-clinical group, a group diagnosed with anxiety disorder, and a group diagnosed with ADHD. The authors found a significant difference between the non-clinical group and both clinical groups in the total number of intense worries. No difference was found between the anxious group and the ADHD group. To our knowledge no research to date has directly examined intrusive and anxious worrisome thoughts in young adults diagnosed with ADHD.

Borkovec et al. (1983) defined worry as "thoughts or images that generate a negative affect and are relatively uncontrollable." Wells (1994) outlined three aspects of worry: Meta-Worry, Social Worry, and Health Worry. Meta-Worry is defined by Wells as "worry about worry…worry about the controllability of thoughts and the appraisal of thoughts as intrusive" (Wells, 1994). Similar to Meta-Worry, intrusive thoughts are associated with the cognitive aspect of anxiety, (Wells and Davies, 1994).

Unwanted intrusive thoughts (IT) are typically attributed to an internal origin and are defined as repetitive, unacceptable or unwanted thoughts, images or impulses (Clark and Purdon, 1995). Intrusive Thoughts and Worry are functionally similar and share common processes over much of a continuum (Langlois et al., 2000), and are systematically associated (Talis and De Silva, 1992). Turner et al. (1992), suggest that there are some differences between the two phenomena. Among them are that Worry is more ego-syntonic than intrusive thoughts, and that Worry occurs as verbal thoughts, whereas intrusive thoughts occur as thoughts, images and impulses.

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An abundance of research suggests that individuals with ADHD are characterized by poor response inhibition (Frazier et al., 2004; Hervey et al., 2004). Response inhibition is usually defined as the ability to inhibit an already activated motor response (Aron and Poldrack, 2005). A common explanation for this deficit was motivated by neuroimaging research on ADHD, in which metabolic underactivity of prefrontal regions was identified (Bush et al., 2005). Thus, behavioral impulsivity and deficient response inhibition in ADHD stem from metabolic underactivity of the inhibitory/executive control system (Frazier et al., 2004; Muller et al., 2007). While extensive research focuses on a deficit in motor response inhibition in ADHD, little is known regarding the cognitive manifestation of this deficit with regards to anxious thoughts and the ability to suppress them.

The rationale for the present study stems from the following: 1) Intrusive anxious thoughts occur normally in the general population. 2) Some of the features of intrusive thoughts (especially frequency) are different in anxious individuals. 3) ADHD is associated with anxiety. 4) ADHD is characterized by poor motor *and* cognitive inhibitory control.

We hypothesized that the combination of the anxiety common in ADHD, together with the poor *cognitive* inhibitory control, would result in a significant increase in anxious intrusive thoughts. We hypothesized further that the content of intrusive and anxious thoughts, and not only the frequency, would differ in ADHD compared with controls.

The goal of the present research, then, was to explore the differences in unwanted intrusive thoughts and anxious worrisome thoughts, between normal controls and adults with ADHD. We hypothesized that young adults with ADHD would report higher rates of unwanted intrusive thoughts and anxious worrisome thoughts than normal subjects. In addition, we hypothesized that the above-mentioned differences would be expressed in content domains, such as meta- and social worry, as well as in depressive and anxious thoughts.

2. Method

2.1. Subjects

Thirty-seven male college students, who were diagnosed exclusively with ADHD, and who were enrolled in a special education program for students with learning disabilities and ADHD at a college in northern Israel, volunteered to participate in this study. All were pre-screened using a detailed semi-structured interview, as well as using available records, to rule out other comorbid psychiatric disorders, Exclusion criteria were as follows: 1) any formal diagnosis of any other DSM-IV psychiatric disorders, 2) any history of prescribed psychiatric medications and hospitalization, 3) any history of a serious medical condition such as traumatic brain injury or other neurological disorders, and 4) known or reported history of a full-blown learning disability. Only males were used due to the relatively small number of adult females with ADHD, and the difficulty in recruiting them (Biederman et al., 2002). Of the original 37 participants, only 31 participants fulfilled the diagnosis of ADHD using DSM-IV criteria [and confirmed by the Continuous Performance Test II (Conners, 2000)], and met inclusion/exclusion criteria. This final group constituted the experimental group. Diagnoses were established additionally by an experienced clinical neuropsychologist. The mean age for the group was 28.5 (S.D. = 6.93). The control group consisted of 23 male students, with mean age of 28.0 years old (S.D. = 2.4), who received class credit for their participation. Only students who reported no medical, psychiatric, developmental or ADHD symptoms were used as controls. The control group were administered the Mindstreams™ Cognitive Screening battery (NeuroTrax Cooperation, 2003; Schweiger et al., 2007) to exclude possible undiagnosed attentional or other disorders. All performed within normal limits. All participants signed an informed consent form approved by the Institutional Review Board (Helsinki committee) of the school prior to their participation, and all were debriefed at the end of their participation.

2.2. Instruments

2.2.1. Diagnostic instruments

Two instruments were used for the diagnosis of ADHD:

1) A *DSM-IV-based self-report questionnaire* was developed in the Hebrew language (American Psychiatric Association, 1994), to cover all the necessary criteria for a diagnosis of ADHD. Participants were asked to indicate whether they exhibited each presented behavior in the past 6 months and/or in childhood (ages 5–12).
2) *The Conners' Continuous Performance test* (*CPT II*, Conners, 2000) was used as a secondary assessment tool for the ADHD diagnostic process. The CPT II is a computer-based sustained attention test. Respondents are required to press the mouse button when any letter except the target letter "X" appears. The CPT II was administered using a laptop personal computer and took approximately 14 min to complete. The CPT II has adequate reported reliability (split-half coefficients on all measures ranging from 0.73 to 0.95; Conners, 2000).

2.2.2. Measures

3) The *Distressing Thoughts Questionnaire* (*DTQ*, Clark and de Silva, 1985), translated into Hebrew, measures six prominent anxious thoughts and six depressive thoughts, each along five dimensions: frequency, sadness, worry, removal and disapproval. The latter five are compiled by summing their values in each criterion (e.g. depressive and anxious). The DTQ subscales reported to have internal consistency coefficients above 0.70 (Clark and de Silva, 1985). The DTQ was found to correlate with State-Trait Anxiety Inventory-State scale ($r = 0.23$ to 0.62; Clark, 1992), with the Cognitive and Somatic subscale of the Cognitive-Somatic Anxiety Questionnaire ($r = 0.33$–0.57; Clark, 1992) and with the Beck Depression Inventory ($r = 0.31$–0.79; Clark, 1992). In addition the DTQ correlated with the Eysenck Personality Questionnaire-Neuroticism subscale ($r = 0.36$–0.59; Clark and Hemsley, 1985).
4) *Anxious Thoughts Inventory* (*AnTI*, Wells, 1994), evaluates three dimensions of worry: social worry, health worry and meta-worry (i.e. worry about worry). The AnTI has 22 items: nine items related to social worry, six items related to health worry, and seven items related to meta-worry. The responses were given on a 1 (almost never) to 4 (almost always) scale. The AnTI was translated into Hebrew as well. The focus of this study was only on the meta-worry scale, defined as "a subscale consisting of items relating to worry about the controllability of thoughts, and the appraisal of thoughts as intrusive" (Cartwright-Hatton and Wells, 1997). The Cronbach alpha coefficients of the subscales reported by the authors were all 0.75 and above (Wells, 1994). All four subscales of the AnTI (e.g. social worry, health worry, meta-worry and total worry) were reported to have significant correlations with the Spielberger Trait Anxiety subscale, the Eysenck Neuroticism subscale and the Self-Consciousness Inventory (Wells, 1994).

All of the three questionnaires listed above were administered to the group of Hebrew native speakers, age-matched normal controls, to ensure the equivalence of the translations. No significant differences were found between this group and the original normative populations of these questionnaires.

2.3. Procedure

All the ADHD participants initially completed the DTQ, the AnTI, and the DSM self-report questionnaire, following careful instructions. They were told that no time limit would be imposed on completion of the questionnaires. All subjects subsequently completed the CPT II

individually. The completion of the five questionnaires took approximately 35–45 min. Next, participants were given a 10-min break, and then were directed to another secluded classroom where they completed the CPT II. Each participant was seated in front of a computer and was given instructions concerning the test completion. Before the testing session, the experimenter asked each participant whether he took a stimulant or any other medications on that day. All the participants in this study were medication free during testing. The completion of the CPT II took an average of 14 min.

The non-ADHD control group completed the DTQ and the AnTI. All the participants were administered the Mindstreams™ battery (Neurotrax, 2003) of cognitive abilities to screen for undiagnosed cognitive deficits.

2.4. Statistical analysis

A multivariate analysis of variance (MANOVA) was conducted in order to examine the overall differences between the ADHD and the control group with regard to the AnTi and DTQ subscales (e.g. social worry, health worry, meta worry, total worry, frequency of intrusive thoughts, sadness about intrusive thoughts, feeling disturbed regarding the thoughts, removal difficulty, disapproval, overall index of intrusive thoughts with anxious content and the overall index of intrusive thoughts with depressive content). Subsequently, a multivariate discriminant function analysis (DFA) was conducted. We used an alpha level of 0.05.

3. Results

One ADHD diagnosed participant was omitted from all analyses due to a pattern of extreme outlying scores and eventual self-reported drug use on the day of testing.

The comparison between ADHD and non-ADHD groups on the average years of age did not yield a significant difference ($t(58)=0.333$, $P=0.740$). All subjects in the present research were males and were at the same education level. Thus, all further statistical analyses did not include any covariates. The MANOVA results revealed an overall significant difference between the ADHD and non-ADHD group (Hotelling's Trace = 0.583, $F(11,41)=2.174$, $P=0.036$). All dependent variables combined explained 36.8% of the variance. As can be seen in Table 1, the ADHD group scored significantly higher than non-ADHD participants on the social-worry ($F(1,51)=6.049$, $P<0.017$), the meta-worry ($F(1,51)=9.079$, $P<0.004$) and the total worry scales ($F(1,51)=6.274$, $P<.015$); the frequency of intrusive thoughts scale ($F(1,51)=16.421$, $P<0.0001$), the sadness about the thoughts scale ($F(1,51)=8.479$, $P<.005$), the disturbed about the thoughts scale ($F(1,51)=10.216$, $P<0.002$), the removal difficulty scale ($F(1,51)=13.754$, $P<0.001$), the disapproval scale ($F(1,51)=9.061$, $P<0.004$), the anxious content scale ($F(1,51)=11.579$, $P<0.001$) and the depressive content scale ($F(1,51)=12.135$, $P<0.001$). No significant differences between the groups were found in the health worry scale ($F(1,51)=0.317$, $P<0.05$).

Table 1
Means and standard deviations of the AnTI, and the DTQ for the ADHD and control groups.

	Control		ADHD		$F(1,51)$	Adjusted R^2
	M	S.D.	*M*	S.D.		
AnTI						
Social worry	16.09	5	20.27	6.9	6.049*	0.088
Health worry	9.5	3.8	8.97	3.4	0.317	0.013
Meta worry	11.43	3.2	15.37	5.6	9.079**	0.134
Total worry	36.6	8.6	44.6	13.32	6.274*	0.092
DTQ						
Frequency	30.3	8.2	44.73	15.57	16.421***	0.229
Sadness	33.43	15.24	47.77	19.45	8.479**	0.126
Disturbed	30.82	11.78	45.03	18.62	10.216**	0.151
Removal difficulty	26.65	10.89	43.17	19.08	13.754***	0.197
Disapproval	30.69	11.36	44.13	18.93	9.061**	0.126
Total anxious[a]	78.7	30	111.23	37.53	11.579***	0.169
Total depressive[b]	71.39	30	113.57	51.7	12.135***	0.176

*$P<0.05$, **$P<0.01$, ***$P<0.001$. [a]Total rating of six anxious intrusive thoughts. [b]Total ratings of six depressive intrusive thoughts.

Table 2
Discriminant function analysis of the DTQ and AnTI subscales.

Variable	DFA coefficients
DTQ frequency	0.743
DTQ removal difficulty	0.680
DTQ Total Depressive	0.639
DTQ Total Anxiety	0.624
DTQ disturbed about thoughts	0.586
AnTI Meta Worry	0.552
DTQ disapproval	0.552
DTQ sadness	0.534
AnTI Total Worry	0.459
AnTI Social Worry	0.451
AnTI Health Worry	−0.103

Table 2 displays the results of the DFA conducted between the ADHD and non-ADHD groups on the above 11 subscales. Results show a significant discriminant function between the ADHD and no-ADHD group (Wilk's Lambda = 0.632, Chi-Square (11) = 20.907, $P<0.034$). Using this model, 73.6% of the participants were classified correctly to the ADHD and non-ADHD groups. As can be seen in Table 2, intrusive thoughts frequency and removal difficulty held the highest discriminant power. Using the two latter variables alone yielded a classification hit rate of 69.8%.

4. Discussion

The results of the present study support our hypothesis that young adults diagnosed with ADHD experience significantly more intrusive and worrisome thoughts. Specifically, ADHD adult participants report significantly more symptoms of Meta-Worry, social worry and overall worry symptoms and significantly more intrusive thoughts (e.g. depressive intrusive thoughts, anxious intrusive thoughts, frequency of intrusive thoughts, removal difficulty, and disturbance about the intrusive thoughts). As presented in Table 1, there is no significant difference in health worrisome thoughts between ADHD and normal individuals. The lack of difference in the Health-Worry variable could be explained by the relative lack of interest in health problems in the relatively young age groups that constituted both samples.

These findings support a *cognitive/behavioral* impulse control deficit in ADHD individuals (Logan, 1989; Rutter, 1989). ADHD individuals display deficits in inhibitions of actions as well as in inhibiting anxious, intrusive and worrisome thoughts. Furthermore, results of both statistical analyses in this study reveal that the two factors that possess the highest discriminating power between the groups are the frequency of thoughts and the inability to remove them. These findings support current neurobiological and neuropsychological research that suggests prefrontal underactivity in ADHD individuals that manifests itself in part by deficient inhibitory mechanisms. (Willcutt et al., 2005). Although research on the neurobiology of thought suppression of intrusive thoughts is scarce, one study that addressed this issue using functional magnetic resonance imaging found that thought suppression involves that anterior cingulate cortex (ACC) (Wyland et al., 2003). This structure (e.g. the ACC) was found by a number of neuroimaging studies to be hypoactive in ADHD individuals (Bush et al., 2005). Thus, it is reasonable to assume that an underactive ACC hinders effective suppression of intrusive thoughts in individuals with ADHD.

Turner et al. (1992) suggested that although intrusive thoughts and worrisome thoughts differ in some features, what distinguishes clinical

and non-clinical populations is the frequency of these thoughts. This assertion is supported by our findings regarding the clinical phenotypic characterization of ADHD in which frequency of intrusive thoughts was found to hold the highest discriminating power between non-ADHD and ADHD individuals.

4.1. Limitations of the present study

It is important to note that this exploratory study contains some limitations. First, the small sample used in this research requires cautious interpretation. Second, the difference in group sizes seems to be problematic. This is usually due to the assumption that smaller groups will produce inflated variance. However, in the present study, variances of all variables were higher in the ADHD group. Furthermore, in examining ADHD undergraduate students, there is an inherent limitation that is almost unavoidable, because of the relatively low prevalence of young adults with full-blown ADHD symptoms who attend and graduate from college. There is some recent evidence that only 5–10% of ADHD students ever complete college (Barkley et al., 2002). In addition, the tests in the present study were in Hebrew translations. Although such use of translated scales is not new in the field, a translation without re-validation can pose a limitation on the generalizability of the results. However, since the major thrust of the study is a comparison of the ADHD group to the controls, and the latter were administered the same tests, it stands to reason that if changes in some questions occurred in the translation, the comparison would still be valid, although the generalization to the English-speaking world might be somewhat limited.

4.2. Conclusions and implications

The present exploratory study provides support to the notion that young adults diagnosed with ADHD experience more anxious worrisome thoughts and intrusive unwanted thoughts. In our view, these symptoms should not be viewed within the classical diagnostic framework (e.g. a comorbid disorder), but as symptoms that directly stem from the specific neurobiological deficit that characterizes ADHD. This study leads to two new directions for inquiry regarding ADHD in adults, in students and also in children with ADHD: first, there is a need to further investigate the phonotypical and cognitive aspects of thought suppression in ADHD individuals. Second, further research is needed examining the neurobiology of these processes, as well as the impact of psychostimulants on their reduction. Third, our results show that although individuals with ADHD experience significantly more intrusive thoughts and worrisome thoughts, the former show more differentiating power. With regard to Turner et al. (1992), the nature of unwanted thoughts in the ADHD population appears to incline more to the ego-dystonic side. Given that ego-dystonic intrusive thoughts are a prominent symptom in Obsessive- Compulsive Disorder (American Psychiatric Association, 1994), we suggest that research is needed exploring the clinical utility of evidence-based Cognitive Behavior Therapy interventions (which have been shown to diminish obsessive-compulsive OCD symptoms) in reducing intrusive and worrisome thoughts in individuals with ADHD.

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