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clinically and clinically adolescents on the free recall memory task. Since some research point out that depressed-related stimuli cause depressed mood and this could affect the results, further analysis was done using repeated measures ANOVA with Group (2: clinical anxious and sub-clinical anxious) and 3 Word Type (neutral, threat-related, and positive). This time, a significant effect was found for the interaction among Group and Word Type ($F_{(2, 108)} = 3.20, P < 0.05$), indicating that clinically anxious adolescents were significantly different from sub-clinically anxious participants in the free recall test. Further inspection using an ANOVA with Group (2: clinically anxious vs. sub-clinically anxious) by Word Type (2: neutral vs. threat-related words) revealed an interaction between Group and Word Type ($F_{(1, 54)} = 4.48, P < 0.05$), indicating that anxious patients recalled significantly more threat words ($t_{(54)} = 2.15, P < 0.05$) but not more neutral words ($t_{(54)} = 0.85, N.S.$) than sub-clinically anxious participants did, suggesting an explicit memory bias toward threat information for anxious patients, but not for adolescents high in trait anxiety group.

DISCUSSION

The main goal of the recall task was to establish whether or not there is a recall memory bias toward threatening stimuli in anxious adolescents, compared to normal controls. Clearly, the results support the *Williams et al.*'s theory, which predicts no explicit memory bias for anxiety. However, comparisons between the sub-clinically anxious adolescents and the clinically anxious adolescents showed a relative recall bias for the latter group, towards threat-related words. Although, this result should be interpreted with caution, since the results reached significance only when the data for a set of depression-related words were removed from the analyses.

Comparing the results of the present study with literature on adult anxious individuals shows a general similarity in the findings. In general, most studies with both anxious children and adults either clinical or sub-clinical do not find evidence for content-specificity memory bias. On the other hand, some forms of anxiety, such as PTSD, both in children (Neshat-Doost, Moradi, & Yule, 1995) and adults (McNally, Foa, & Donnell, 1989), show a tendency for such a memory bias. On the other hand, comparing the results of the present study with clinically and sub-clinically anxious adults reveals that for anxious adults, the latter group is more likely to show an explicit memory bias towards threat-related information (Eysenck, 1992) while for anxious youngster the results were vice versa which needs further inspections.

In sum, the results of the present study are more consistent with the *Williams et al.* (1997)'s model that elevated anxiety in children and adolescents is characterised by emotionally-congruent integrative processing or attentional bias as we can see in many researchs (e.g. Taghavi et al, 2003; Taghavi et al, 1999; Vasey et al, 1995) but not by emotionally-congruent elaborative processing or explicit memory bias as the present study showed. Further research is suggested to test implicit memory bias in children and adolescents with anxiety.

a usual comorbid disorder. There were no differences between anxious patients and sub-clinically anxious participants on these mood measures.

Table 1- Means (SDs) of age in years, academic average, and mood measures of the participants

Characteristics	Clinically Anxious	Control	Sub-Clinically Anxious
Age	14.53 (2.95)	13.82 (1.85)	14.89 (2.06)
Academic Average	13.86 (2.76)	14.34 (2.93)	13.77 (2.92)
RCMAS	17.44 (5.55)	9.93 (2.78)*	16.25 (4.14)
DSRS	15.51 (5.19)	8.62 (2.28)*	15.29 (5.95)

* $P < 0.0001$, the control group differs from the two anxious groups.

RCMAS: Revised Children's Manifest Anxiety Scale

DSRS: Depression Self-Rating Scale

Analyses of the Explicit Memory Task

For each participant the number of words correctly recalled was determined. The mean numbers of recalled words by the three groups of participants are shown in **Table 2**.

Table 2- Means (SDs) of recalled words by three groups

Words	Clinically Anxious	Control	Sub-Clinically Anxious
Depression-Related	3.46 (1.80)	3.36 (1.64)	3.31 (1.61)
Threat-Related	3.39 (1.97)	2.22 (1.25)	2.53 (1.25)
Positive	3.40 (1.71)	3.71 (1.57)	3.92 (1.68)
Neutral	4.18 (1.96)	3.87 (1.20)	4.61 (1.71)

To analyse the data further, a repeated measures ANOVA was performed with 3 groups and 4 types of word. The results revealed a significant effect of Word Type ($F_{(3, 246)} = 14.05$, $P < 0.001$). However, no significant main effect was found for Group ($F < 1$), nor there was an interaction between Group and Word Type ($F_{(6, 246)} = 1.80$, N.S.). Thus, the results of this study do support the hypothesis of *Williams et al (1997)*. The results of repeated measures ANOVA with Group and Word Type are shown in **Table 3**.

Table 3- The results of repeated measures ANOVA with Group and Word Type

Source	Sum of Squares	df	Mean Squares	F	Sig.
Group	8.70	2	4.35	0.80	0.45
Error	445.28	82	5.43	–	–
Group * Word Type	26.23	6	4.37	1.79	0.10
Word Type	102.23	3	34.07	14.05	0.001
Error	596.36	246	2.42	–	–

Differences between the memory performance of sub-clinically anxious and clinically anxious groups have been suggested by some authors (e.g. Eysenck and Mogg, 1993). To pursue this issue, a comparison was made between the performance of sub-

NORMAL CONTROL GROUP- The control group comprised 29 adolescents (14 females and 15 males) who had never experienced generalised anxiety disorder or any other psychiatric disorders. In the present study, the sampling method was according to the availability of the participants and then, the design of matched groups was used. The 3 groups were matched according to age, gender, and academic performance. All participants were between 11 and 18 years old. Sub-clinically anxious and normal control groups were recruited from the schools in Shiraz.

Procedures

The experiment was run using a LG computer. The words were shown to the participants on the centre of screen one after another randomly. Each of the words was presented for 7 seconds very clearly. The participant was asked to write down as many words as s/he could remember, for 5 minutes.

At the end of the session, participants completed the Revised Children's Manifest Anxiety Scale (RCMAS) (Reynolds & Richmond, 1978) and the Depression Self-Rating Scale (DSRS) (Birlleson, 1981) before being debriefed and thanked for their participation. Previous research showed that both RCMAS and DSRS have suitable validity and reliability in Iran (Taghavi, 2001a; 2001b).

The reliability of the RCMAS by test-retest (in 4-week interval) and split-half methods were 0.67 and 0.66 respectively (Taghavi, 2001a). Also, the discriminate validity of the RCMAS was quite satisfactory and the test distinguished significantly anxious patients from normal controls ($P < 0.001$) (Taghavi, 2001a). Taghavi (2001b) reported the validity and reliability of DSRS. He found the test-retest reliability coefficient of the scale, in 4-week interval, and the internal consistency of the DSRS 0.75 and 0.81 respectively. The concurrent validity of the DSRS, as measured by the Abbreviated form the Children Depression Scale (CDS-A) (Najarian, 1373 A.P.) was 0.72.

RESULTS

Participants' Characteristics

Means and standard deviations are shown separately for age, academic performance, and measures of psychopathology for the two anxious groups and the control group (**Table 1**). In order to clarify differences between the three groups, one-way analysis of variance and *post hoc* Multiple Comparison Tests (*Student-Newsman-Keuls* Test, $P < 0.05$) were used. There were no differences between the three groups for age ($F(2, 82) = 1.51$, N.S.), academic performance ($F < 1$), or sex ratio. However, as expected, the anxious patients and those high in trait-anxiety obtained significantly higher scores, as compared with normal controls, on RCMAS ($F(2, 82) = 25.21$, $P < 0.0001$) and on DSRS ($F(2, 82) = 19.81$, $P < 0.0001$) (**Table 1**). The two anxious groups obtained higher scores on DSRS, because depression accounts for anxiety as

The aim of the present study was to examine potential biases in memory processes in generalized anxiety disorder and sub-clinical anxiety in adolescents. Since there is no published research regarding this issue in adolescents making specific predictions are difficult; however, results from the adult literature fail to find a bias in explicit memory in anxious adult patients towards threatening stimuli, thus supporting the *Williams et al (1997)*'s theory of anxiety and cognition. *Williams et al (1997)* proposed that anxiety is associated with a cognitive bias toward threat, which operates primarily in automatic, pre-attentive stages of processing, rather than in later strategic, or explicit memory. Therefore, if *Williams et al*'s theory is correct, an explicit memory effect should not be associated with anxiety. On the other hand, if the Beck and Bower theories are correct, then it might follow that an explicit memory effect should be demonstrated for anxiety. In this research, a recall task was carried out to test whether there is any bias in the explicit memory of clinical and sub-clinical anxious adolescents. The specific question is whether anxious patients and/or adolescents high in trait anxiety show an explicit memory bias for emotional material in recall memory?

METHOD

Materials

Fifty six words including: 14 threat-related words (e.g. *horrible, scared*), 14 depression-related words (e.g. *hopeless, miserable*), 14 positive words (e.g., *kindness, brilliant*), and 14 neutral words (animal names such as: *horse, zebra*) were chosen as stimulus words. The length of the words in each category was matched with the other 3 categories of words.

The words were chosen according to the literature (e.g. Mathews & MacLeod, 1985). Moreover, six psychologists confirmed the content validity of the words. The criterion for this purpose was the completely agreement of 5 out of the 6 psychologists with the category of the words. In this study, the positive words were included to check whether the emotionality of the words is the main reason for any processing bias rather than the negativity of the words. Also, the depression-related words were included to see whether the possible memory bias, if any, is due to negative emotions in general or is specific just to the threat words.

Participants

GENERALIZED ANXIETY DISORDER GROUP- The GAD group comprised 29 adolescents (14 females and 15 males) meeting DSM-IV (American Psychiatric Association, 1994) criteria for GAD. The patients group was recruited from Mohammad Rasulollah Clinic in Shiraz.

SUB-CLINICALLY ANXIOUS GROUP- The SCA group consisted of 27 adolescents (12 females and 15 males) who had never experienced any psychiatric disorders. However, their score on the Revised Children's Manifest Anxiety Scale (RCMAS) (Reynolds & Richmond, 1978) was 15 or over.

INTRODUCTION

According to the cognitive models of *Beck* (Beck, Emery, & Greenberg, 1985) and *Bower* (1981) anxiety is associated with a cognitive bias towards threatening information. The content-specificity hypothesis (Beck, Emery, & Greenberg, 1985; Bower, 1987) states that stimuli whose affective valence matches the person's emotional state, will provoke greater attention which result in better remembering of the emotional stimuli. Thus, if the Beck and Bower theories are correct, then it follows that an explicit memory effect should be demonstrated for anxiety.

Williams et al (1997) tried to explain some inconsistencies between *Beck's* and *Bower's* theories and the results of research. Since evidence shows that anxiety is accompanied by an attentional bias towards threat-related information. That is why *Williams* et al (1997) proposed that anxiety is associated with a cognitive bias favouring threat, which operates primarily via automatic processes or implicit memory, rather than via strategic processes or explicit memory. Most research has typically been unsuccessful in showing an explicit memory bias that favours threatening information in adult patients with anxiety (e.g. Mogg, Mathews, and Weinman, 1987). A further implication is that the content-specificity hypothesis that has been assumed by theorists such as *Beck, Emery, and Greenberg* (1985) and *Bower* (1987) are not completely correct.

The findings on negative memory bias in sub-clinically anxious subjects have been equivocal. In essence, high trait anxious individuals sometimes exhibit a negative explicit memory bias toward threatening materials (e.g. Mayo, 1989) and sometimes do not (e.g. Dalglish, 1994). Overall results of research studies with anxious subjects on the memory are largely consistent with the *Williams* et al (1997) model in that anxious individuals should not have a negative bias in explicit memory.

There is very little research on memory bias towards threatening information in anxious children. In one study, *Neshat-Doost, Moradi, and Yule* (1995) investigated the recall memory bias in healthy and PTSD children. The results revealed that children with PTSD, as compared with normal controls, consistently remembered PTSD-related words more than neutral words.

In spite of lots of research on memory bias in both adult anxious patients and adult individuals high in trait anxiety, the memory bias of anxious children and adolescents is a relatively unexplored area of research. So far no research has investigated whether there is a memory bias for threat material in anxious children and adolescents to test the content-specificity hypothesis (Beck, Emery, & Greenberg, 1985) or the claims of other cognitive theorists (e.g. *Williams* et al., 1997) regarding the existence of such a bias associated with anxiety. The only research which bears on this suggests that there is a memory bias tendency in children with PTSD towards trauma-related information, but not for the control group (*Neshat-Doost, Moradi, & Yule, 1995*). However, the results of this research need to be replicated for other anxiety disorders. It might be possible that some forms of anxiety disorder show memory bias and others do not, as is the case in the adult literature (e.g. *McNally, Foa, & Donnell, 1998*).

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Explicit Memory in Anxious Adolescents

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Abstract

Explicit memory for threat and non-threat stimuli was examined in Iranian adolescents aged between 11 to 18 years. Clinically anxious (n=29), sub-clinically anxious (n=27), and normal controls (n=29) were matched for age, gender and academic performance. Participants asked to encode the stimuli words including threat, depression, positive and neutral words, presented on a screen one after another. Content-specificity hypothesis predicts anxious individuals should show a memory bias favouring anxiety information. However, Williams et al's theory does not predict such a bias. The present study conducted to examine the two different theories.

In sum, the results support the Williams et al's theory. Although, anxious patients compared to the sub-clinically anxious individuals, show a memory bias towards threat words. The difference between the two anxious groups and theoretical implications with regard to the two theories are discussed.

چکیده

حافظه‌ی آشکار برای محرک‌های تهدید کننده و غیر تهدید کننده در گروهی از نوجوانان ایرانی با اضطراب بالینی (n=29)، اضطراب غیر بالینی (n=27) و گروه بهنجار (n=29) مورد آزمایش قرار گرفت. سن آزمودنی‌های مطالعه‌ی حاضر بین ۱۱ تا ۱۸ سال بود و سه گروه آزمودنی برای متغیرهای سن، جنس و عملکرد تحصیلی هم‌تا سازی شدند. بر طبق فرضیه‌ی محتوای ویژه پیش بینی می شد که افراد مضطرب سوگیری در حافظه آشکار به نفع لغات تهدید کننده نشان دهند. از طرف دیگر، فرضیه ویلیامز و همکاران عدم وجود چنین سوگیری را در سامانه‌ی پردازش اطلاعات بیماران اضطرابی پیش بینی می نمود. بررسی وجود یا عدم وجود سوگیری در حافظه‌ی آشکار افراد اضطرابی بر طبق پیش‌بینی تئوری‌های مذکور هدف مطالعه‌ی حاضر بود. برای این منظور، از آزمودنی‌ها در خواست شد تا چهار دسته از محرک‌های لغت شامل لغات تهدید کننده، افسرده ساز، شادی آور و خنثی را که بر روی صفحه‌ی رایانه یکی پس از دیگری ارائه می شدند، رمزگذاری نمایند. نتایج مطالعه‌ی حاضر نشان داد که هیچ یک از دو گروه اضطرابی (بالینی و غیر بالینی) در مقایسه با گروه کنترل بهنجار سوگیری در حافظه‌ی آشکار، لغات تهدید کننده نداشتند. لیکن گروه بیماران اضطراب بالینی در مقایسه با گروه اضطراب غیر بالینی سوگیری در حافظه آشکار نشان دادند. در این مقاله تفاوت بین دو گروه اضطرابی و دلالت‌های ضمنی نتایج با توجه به نظریه ویلیامز و همکاران مورد بررسی قرار می‌گیرند.

Keywords: Explicit Memory; Anxious Adolescents; Shirāz (Iran);

کلیدواژه‌ها: حافظه‌ی آشکار؛ نوجوانان مضطرب؛ شیراز (ایران)؛