Evaluation of a Cognitive–Behavioral Intervention for Adolescents

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The aim of this study was to evaluate the effect of a cognitive–behavioral, biofeedback-assisted intervention to impart skills for coping with stressful encounters in a nonclinical adolescent population. Israeli Arab and Israeli Jewish participants completed pre- and postintervention questionnaires assessing state anxiety, test anxiety, behavior symptoms, hostility, and self-esteem. Electrodermal activity was recorded using biofeedback. From pre- to postintervention, scores of state anxiety, test anxiety, behavior symptoms, and self-esteem, but not hostility, changed significantly in the intervention group as compared with the control group. A significant Group × School effect was evident for state and test anxiety and behavior problems, indicative of higher reductions in the Arab group. The cognitive–behavioral program proved an effective preventive intervention for adolescents.

Keywords: adolescents, cognitive–behavioral intervention, biofeedback, state anxiety

Modern life imposes many stressors on adolescents. These include peer group relationships and family environments (Bowker, Bukowski, Hymel, & Sippola, 2000; Seiffge-Krenke & Shulman, 1993) and developmental stressors such as the separation–individuation process (Blos, 1967; Mahler, Pine, & Bergman, 2000). Adolescents experience stressors related to school, internal and external demands for achievement, time pressure, worries about school assignments and the future, conflicts with teachers, and difficulties with self-management (De Anda et al., 2000; Murberg & Bru, 2004). Test anxiety often develops or expands throughout the school years, generates unpleasant emotional and physical arousal (Spielberger, Gonzalez, Taylor, Algaze, & Anton, 1978), and impairs school performance and general functioning (Kaplan, Liu, & Kaplan, 2005).

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For Israeli adolescents, an additional and unique source of stress is life in the shadow of political conflict and repeated terror attacks (Cohen & Eid, 2007; Sharlin, Moin, & Yahav, 2006). A previous study showed that Israeli Arab and Israeli Jewish adolescents exhibit very similar stress responses to the continuous threat of terror (Cohen & Eid, 2007). Certain stressors are unique to either Israeli Jewish or Israeli Arab adolescents. For example, a major source of stress for Israeli Arab adolescents is their belonging to an ethnic and political minority (Azaiza & Titosh-Ben-Ari, 2000), whereas for Israeli Jewish adolescents a major source of stress may be the approach of mandatory military service (Friedman, 1991).

EFFECTS OF STRESS ON ADOLESCENTS

Studies have found a wide range of reactions to stressors in children and adolescents ranging from mild and transient reactions to significant and persistent emotional and behavioral disturbances (Grant, Compas, Thurm, McMahon, & Gipson, 2004; Phillips, Hammen, Brennan, Najman, & Bor, 2005) and health problems (Barr, Boyce, & Zeltzer, 1994). Common among distressed youngsters are symptoms of hostility, anger, and aggression (Aseltine, Gore, & Gordon, 2000). These long-term reactions to stress may in turn undermine academic achievement and harm self-esteem (Lindhal, Theorell, & Lindblad, 2005; Wachelka & Katz, 1999).

Psychological and behavioral reactions to adolescents' stressful encounters are generally defined by the coping processes adopted (Lazarus & Folkman, 1984; Seiffge-Krenke & Shulman, 1993).

Coping With Stress

Coping strategies represent behavioral and cognitive efforts to deal with stressful encounters (e.g., Lazarus & Folkman, 1984). Coping is a dynamic process, changing according to the cognitive appraisals of the stressful situation and available coping strategies (Lazarus & Folkman, 1984). Previous studies have suggested that better psychological outcomes from stressful encounters are related to the existence of a wider repertoire of available coping strategies and choosing the most appropriate strategies for a specific situation (Folkman & Lazarus, 1986). A range of coping strategies, such as relaxation techniques, distraction (listening to music, watching TV, or reading a book), problem-focused strategies (asking for help), humor, or cognitive restructuring are often used by adolescents and help them to reduce the effects of stress (De Anda et al., 2000). Expanding adolescents' repertoire of

available coping strategies may improve the outcomes of stressful encounters (Davidson, Boland, & Grey, 1997; De Anda, 1998). It may also reduce adolescents' coping with stressors they meet through negative activities such as use of drugs or alcohol, disengagement, leaving school, and aggressive behaviors (Cooper, Lutenbacher, & Faccia, 2000; De Anda et al., 2000).

Preventive Interventions With Adolescents

Stress management teaching programs consisting of cognitive–behavioral methods are used with clinical (e.g., Hampel, Rudolph, Stachow, & Petermann, 2003; Kessler et al., 2000) and nonclinical populations (De Anda, 1998; Kiselica, Baker, Thomas, & Reedy, 1994). With the latter, the interventions are for preventive purposes, but results of only few controlled studies have been reported. These have indicated a decrease in anxiety and stress in adolescents participating in stress management programs (De Anda, 1998; Kiselica et al., 1994) or autogenic relaxation training (Goldbeck & Schmid, 2003), as compared with control groups. However, these studies had only 36 participants (De Anda, 1998), 48 participants (Kiselica et al., 1994), or 50 participants (Goldbeck & Schmid, 2003), intervention and control groups combined.

Also, previous studies have shown that relaxation alone was efficient in reducing autonomic arousal indexes such as heart rate, peripheral temperature, and skin conductance level (Lee & Olness, 1996; Lohaus, Klin-Hessling, Vogele, & Kuhn-Hennighausen, 2001). Biofeedback-assisted relaxation training has likewise proved highly effective in alleviating stress and stress-related symptoms (Leahy, Clayman, Mason, Lloyd, & Epstein, 1998; Schwartz, 1995). Biofeedback is also used to teach self-regulation of autonomic and emotional arousal in anxiety-arousing situations (Auerbach & Gramling, 1998; Cotton, 1990; Leahy et al., 1998). It is an important tool in learning to identify and recognize arousal states and in mastering these sensations (Leahy et al., 1998). The biofeedback device provides immediate visual or auditory feedback for physiological responses such as temperature, muscle tension, heart rate, brain wave pattern, or skin conductivity, which rise in stress and fall in relaxed modes. The device accordingly serves to demonstrate the degree of relaxed state the individual has achieved and the steady progress in acquiring relaxation skills (Auerbach & Gramling, 1998). Biofeedback games use the changes in electrodermal activity (EDA), transmitted by electrode sensors to software and then translated into an animated game. The changes in EDA move the animated graphics on a computer screen (Leahy et al., 1998).

THE PRESENT STUDY

This study set out to assess the effect of stress management training by means of the cognitive model, together with biofeedback-assisted relaxation training to reduce levels of state anxiety, test anxiety, hostility, and behavior problems, and to enhance self-esteem in Israeli Arab and Israeli Jewish high school students. Using a pretest–posttest controlled design study, we hypothesized that levels of state and test anxiety and of hostility would fall and level of self-esteem would rise in adolescents participating in the stress management training, but not in those in the control group. These differences would be similarly evident in Arab and Jewish adolescents. We also hypothesized that change in the study variables would be related to better results achieved in biofeedback training.

METHOD

Participants

Participants were 255 ninth-grade students from two major schools in a big city in northern Israel. Of these, 124 adolescents (intervention group, $n = 68$; control group, $n = 56$) were from an Arab school and 131 (intervention group, $n = 58$; control group, $n = 73$) were from a Jewish school.

The adolescents' ages ranged from 14 to 16 (mean age = 14.6, $SD = 0.43$) and 14.7 ($SD = 0.52$) for the Jewish and Arab intervention groups, respectively, and 14.6 years ($SD = 0.43$) and 14.8 years ($SD = 0.56$) for the two control groups, respectively, $F(3, 250) = 5.22$, $p < .01$. Gender distribution was similar across groups, $\chi^2(3, N = 126) = 5.40$, $p > .05$: Male students constituted 51.7% ($n = 30$) and 52.9% ($n = 36$) of the Jewish and Arab intervention groups, respectively, and 50.7% ($n = 37$) and 35.7% ($n = 20$) of the two control groups, respectively. A minority of the adolescents reported that their parents were divorced (6.9% and 11.8%, respectively, in the Jewish and Arab intervention groups and 6.8% and 21.4%, respectively, in the Jewish and Arab control groups), with relatively more divorced parents reported in the Arab control group, $\chi^2(6, N = 129) = 19.49$, $p < .01$.

Arab adolescents in the intervention and control groups reported a significantly higher number of children in their families ($M = 2.9$, $SD = 0.8$, range = 2–6, for Jews compared with $M = 4.2$, $SD = 1.4$, range = 1–10, for Arabs), $F(3, 250) = 21.65$, $p < .001$).

Procedure

Two classes in each school were randomly assigned to the intervention program and another two served as control groups. Preparatory meetings were held with the teaching staff. Letters explaining the program's aims and content and asking parents' permission were sent. Parents also signed a document of informed consent. Parents of one girl in the Jewish school did not approve her participation. The aims and process of the project were explained to the adolescents. All participants completed questionnaires in Hebrew or Arabic before the workshops started and a week after they ended. The study was approved by the University of Haifa ethics committee.

The intervention program consisted of eight 1-hr weekly sessions. Groups consisted of 15 to 18 adolescents of both genders (each class was divided into two groups). The classes serving as controls did not receive any intervention.

The intervention program was constructed on the cognitive–behavioral model (Brad & Beck, 1997) and stress management model (Cotton, 1990). The major principles in its construction were its adaptation to adolescents (maintaining interest and motivation) in a relatively large group setting (15–18 adolescents) and a preventive orientation. The program combined didactic, experiencing, and group methods. The two groups at each school were conducted by psychologists with MA degrees (a man and a woman), specialists in stress management and biofeedback. An assistant, an MA student in social work, co-led the groups. The MA student produced a written report for each session. The group leaders were trained for the program, and they strictly followed the written instructions. Adherence to these instructions was ensured by a review of the written reports for each session.

The first of the eight sessions was dedicated to an introduction and familiarization with the program and the setting. In the two following sessions, the adolescents learned to identify sources of stress in their everyday lives (e.g., interactions with parents, siblings, and peers and academic stressors) and to identify emotional, physical, and behavioral reactions to stressful situations and the coping strategies they applied. During these early sessions, the distinction between emotions and thoughts, and identification of thoughts underlying emotions, were introduced. Sessions 4–8 were divided between working with the cognitive model and learning relaxation.

The cognitive part started with presentation of the cognitive model of stress, which emphasizes cognitive appraisals of different stressors. The participants then learned to identify the cognitive responses to stressors, analyze them, and then restructure them to more adaptive thoughts. The cognitive work was conducted on examples from the adolescents' daily lives, and group activities were used.

The second half of Sessions 4–8 focused on learning relaxation techniques and working with biofeedback. The adolescents learned progressive muscle relaxation and imagery-based relaxation techniques (Cotton, 1990; Payne, Donaghy, & Bellamy, 2000). The biofeedback program was introduced in Session 5, and in each subsequent session the adolescents continued to practice relaxation with the program. The computerized program translated the change in EDA during the relaxation session to onscreen graphs or games. The program included three animated games; the figures advanced whenever the arousal level became lower, changing every time a certain level of relaxation had been reached. Progress in the game was thus an indicator of relaxation progress and made the training enjoyable. For example, in one of the games a gaudy fish in the sea on the screen moved forward, then gradually turned into a mermaid. Then she came out of the sea and turned into a beautiful girl walking in a field.

Measures and Instruments

Demographic data included age, gender, parents' marital status, and number of siblings.

State anxiety was measured by the State subscale of the State–Trait Anxiety Inventory for children aged 8–15 (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). It consists of 20 items rated on a scale ranging from 0 (*not at all*) to 3 (*very much*; e.g., "I feel nervous," "I feel calm"). Internal reliability (Cronbach's alpha) was .91 at pretest and .92 at posttest.

Test anxiety was measured on the scale constructed by Spielberger et al. (1980) and adapted by Zeidner (1995). It consisted of 20 items regarding the cognitions and feelings that characterize test situations, rated on a scale ranging from 1 (*hardly ever*) to 4 (*almost always*; e.g., "I worry during an exam," "My heart pounds in exams"). Internal reliability (Cronbach's alpha) was .86 at pretest and .85 at posttest.

Hostility was assessed with the New–Buss hostility questionnaire (Gidron, Davidson, & Ilia, 2001). This is an eight-item version of the Buss–Perry aggression questionnaire (Buss & Perry, 1992). Responses were rated on a scale ranging from 1 (*do not agree at all*) to 5 (*strongly agree*; e.g., "If I am teased, I would likely hit the teaser," "My friends tell me that I am argumentative"). The New–Buss questionnaire was tested for concurrent, construct, and criterion validity and reliability (Gidron et al., 2001). The correlation between scores on the original questionnaire and the New–Buss was .93 ($p < .001$). Internal reliability (Cronbach's alpha) was .78 at pretest and .72 at posttest.

Behavior symptoms were assessed by Lapouse and Monk's (1964) list of 18 common behavior symptoms in children and adolescents (e.g., sleeping problems, fits of crying, stomachaches). Respondents rated whether they had experienced the symptoms during the previous month. Total number of symptoms was calculated from the positive answers. Internal reliability (Cronbach's alpha) was .90 at pretest and .92 at posttest.

Self-esteem was assessed with the Rosenberg Self-Esteem Scale (Rosenberg, 1965), a 10-item measure of positive and negative aspects of self-esteem (Cronbach's $\alpha = .87$). Responses were rated on a 5-point scale ranging from 0 (*strongly disagree*) to 4 (*strongly agree*; e.g., "Sometimes I feel that I am not worth anything at all," "I can do things as well as most of my peers"). Internal reliability (Cronbach's alpha) was .91 at pretest and .85 at posttest.

Skin EDA was measured using the Prorelax (version 2.0) interactive computer program (Mindlife, Israel). It is based on the Windows versions of RelaxPlus (Ultramind Technologies, Jerusalem, Israel) used in previous studies (Leahy et al., 1998; Nagai, Goldstein, Fenwick, & Trimble, 2004). Monitoring is by means of two electrodes on the fingertips. Velcro straps determine the pressure and prevent artifacts because of movement. Data are transmitted through infrared telemetry, and the device is electrically safe. The finger sensors measure EDA, electrical changes in the skin (affected by sweat gland activity) relating to physical, emotional, and mental states (Auerbach & Gramling, 1998; Leahy et al., 1998; Nagai et al., 2004). EDA changes were detected and reflected on the screen, through graphs, in numerical EDA data, or by animation. In the animation games, to ensure reinforcement of successful play—through small, successive steps in the beginning and increasing difficulty with successive trials—two parameters were adjusted for each student according to his or her progress. The first was sensitivity level, varying from 1 to 10, which set the number of EDA units required to affect (accelerate or slow) the animation movement. The higher the sensitivity, the faster the game responded to variations in relaxation levels. The second was the ascent/descent ratio, which is a factor for reducing the effect of negative differences. EDA units were converted into KOhm units. The adolescents exercised biofeedback three to five times in each session from the fifth to the eighth. They did so individually against the computer, with each session lasting 8–12 min. The mean score of the three final sessions was used for the analysis. The difference between beginning and end of the biofeedback exercise, which is indicative of ability to moderate level of arousal, was calculated.

Data Analysis

Data were analyzed with SPSS software. Descriptive statistics were calculated for the demographic variables. Differences between groups were

calculated at baseline, by group and by school, using two-way analysis of variance. Repeated measures multivariate analysis of variance assessed differences in the degree of change in study variables from pre- to postintervention. Correlations between the study variables were calculated. Multiple regression analyses assessed the explained variance of each of the study variables by age, gender, school, therapist, and EDA change. Correlational and regression analyses were conducted for the intervention group only.

RESULTS

Preintervention Scores

Preintervention scores are presented in Table 1. The study variables at baseline in the two groups (intervention and control) and at the two schools (Arab and Jewish) were compared. The intervention and control groups yielded very similar preintervention scores. Schools differed significantly in test anxiety, with higher scores for the Arab school, and in self-esteem, with higher scores for the Jewish school. The School × Group interactions also differed significantly in mean self-esteem scores, with the Jewish control group scoring higher and the Arab control group scoring lower than the intervention groups.

Change From Preintervention to Postintervention in Study Variables

The changes in mean scores of the study variables in the intervention and control groups and according to school are presented in Table 2. The groups differed significantly in changes in state anxiety, test anxiety, behavior symptoms, and self-esteem. These results indicated a significant decrease in

Table 1. Means and Standard Deviations of Preintervention Scores, by Group and School

	Intervention				Control				$F(1, 243)$		
	Jews		Arabs		Jews		Arabs				Group ×
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	Group	School	School
State anxiety	1.57	0.30	1.91	0.42	1.66	0.32	1.86	0.36	0.03	15.13	2.20
Test anxiety	1.05	0.66	1.65	0.55	0.98	0.76	1.61	0.57	8.38	185.48**	0.04
Behavior symptoms	4.53	3.09	3.12	2.84	4.25	2.40	3.45	2.96	0.04	12.92	0.76
Hostility	2.47	0.54	2.36	0.59	2.47	0.49	2.35	0.60	0.05	2.34	0.03
Self-esteem	2.85	0.90	2.78	0.56	3.12	0.83	2.49	0.52	0.01	12.59**	7.90*

* $p < .01$. ** $p < .001$.

Table 2. Means and Standard Deviations of Differences in Scores Between Pre- and Postintervention, by Group and School

	Intervention				Control				$F(1, 223)$		
	Jews		Arabs		Jews		Arabs				Group ×
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	Group	School	School
State anxiety	−0.10	0.30	−0.20	0.37	−0.06	0.23	−0.01	0.30	2.67	0.69	5.93*
Test anxiety	−0.05	0.63	−0.52	0.74	0.01	0.41	−0.09	0.70	6.39*	8.57**	3.96*
Behavior symptoms	−0.09	0.52	−0.18	0.69	−0.09	0.31	0.20	0.67	5.20*	1.22	4.90*
Hostility	−0.16	0.46	−0.13	0.70	0.03	0.43	−0.04	0.76	2.84	0.35	0.04
Self-esteem	0.11	0.61	0.12	0.73	−0.06	0.58	−0.12	0.70	4.03*	0.36	0.12

* $p < .05$. ** $p < .01$.

levels of these variables from pre- to postintervention, as compared with the control groups. Regarding schools, test anxiety decreased significantly more in the Arab intervention group than in the Jewish group. A significant interaction of Group × School was evident for the change in scores of state and test anxiety and behavior symptoms. This indicated significant changes in the Arab intervention group. During this time, behavior symptoms increased considerably in the Arab control group.

EDA Change in the Intervention Groups

The mean change in EDA during relaxation was 215.5 KOhm (SD = 186.85, range = −134.0 to 749.9) in the Jewish group and 89.4 KOhm (SD = 271.35, range = −840.2 to 843.2) in the Arab group. The difference was statistically significant, $t(109) = 2.78$, $p < .01$. More Jewish adolescents (90.6%; $N = 48$) succeeded in achieving EDA reduction in their biofeedback exercises, but only 75% of the Arab adolescents did so. This difference was statistically significant, $\chi^2(1, N = 119) = 4.40$, $p < .05$.

Associations Between Study Variables

Table 3 shows the correlations between the change from pre- to postintervention in study variables and the change in EDA. Changes in state anxiety, test anxiety, and behavior problems were positively and significantly associated. Changes in test anxiety and behavior problems, but not in state anxiety, were significantly and positively associated with change in hostility. Changes in test anxiety, behavior problems, and hostility, but not in state anxiety, were negatively associated with change in self-esteem. That is, the greater the decrease in test anxiety and behavior symptoms, the higher the

Table 3. Correlations Among Outcome Variables[a]

Variable	1	2	3	4	5	6
1. State anxiety	—	.22*	.35**	.18	−.14	−.19
2. Test anxiety		—	.34**	.35**	−.33**	−.31**
3. Behavior symptoms			—	.37**	−.24**	−.12
4. Hostility				—	−.30**	−.05
5. Self-esteem					—	.14
6. Electrodermal activity						—

* $p < .05$. ** $p < .001$.
[a] Intervention group only ($N = 93$).

increase in self-esteem. Change in EDA was negatively associated with change in test anxiety, but the correlation with change in the other study variables did not reach significance. That is, greater reduction in EDA (expressed as higher KOhm change) in the biofeedback exercises was associated with greater reduction in test anxiety levels.

Multiple Hierarchical Regression Analysis

Table 4 shows the results of multiple regression analyses for the change in study variables from pre- to postintervention. In the first step, the demographic variables age, gender, and school were entered, and in the second step the therapist variable and EDA change were added. The regression models were significant for state anxiety, $F(5, 89) = 3.06$, $p < .05$; test anxiety, $F(5, 93) = 3.11$, $p < .05$; behavior symptoms, $F(5, 93) = 3.02$, $p < .05$; and self-esteem, $F(5, 88) = 3.20$, $p < .05$, but not for hostility, $F(5, 93) = 2.16$, $p > .05$. Gender was significantly associated with changes in

Table 4. Multiple Regression Analyses for Changes in Outcome Variables

Step and variable	State anxiety		Test anxiety		Behavior symptoms		Hostility		Self-esteem	
	β	*t*	β	*t*	β	*t*	β	*t*	β	*t*
Step 1										
Gender	0.08	−0.77	0.03	0.30	0.31**	2.94	0.10	1.13	−0.09	−0.83
Age	−0.16	−1.48	−0.06	−0.59	0.13	−1.37	−0.12	−1.60	0.07	0.61
School	0.22*	2.04	0.33**	3.15	−0.12	−1.12	−0.04	−0.47	−0.03	−0.30
Step 2										
Gender	0.07	0.61	0.02	0.19	0.29**	2.72	0.09	0.77	0.06	−0.53
Age	−0.15	−1.36	−0.04	−0.36	−0.13	1.87	0.09	0.67	0.10	0.87
School	0.17	1.50	0.26*	2.40	0.12	1.15	−0.11	−0.89	−0.07	−0.60
Therapist	0.11	1.01	0.02	0.06	0.19	1.87	0.11	−0.87	−0.22*	−2.76
EDA change	0.14	1.18	0.20*	2.21	0.06	0.47	−0.10	−0.82	0.20*	2.31
R^2 (Step 1)	.10		.11		.12		.02		.02	
R^2 (Step 2)	.31		.16		.16		.04		.10	

Note. EDA = electrodermal activity.

behavior problems, indicating higher rates of change in girls. No significant associations appeared for age. School was significantly associated with state and test anxiety, indicating higher changes in these scores in the Arab school. However, when the variables of therapist and EDA were entered, school remained a significant factor for test anxiety only. The therapist variable was significantly associated with change in self-esteem, indicating higher changes in groups led by the male therapist. Achieved EDA change was significantly associated with changes in test anxiety and self-esteem scores. That is, the higher the EDA change achieved in the biofeedback exercises, the greater the decrease in test anxiety and the increase in self-esteem. The model for predicting change in hostility behavior was not significant.

DISCUSSION

This controlled study evaluated the effect of a cognitive–behavioral, biofeedback-assisted program on Israeli Jewish and Israeli Arab adolescents, aimed at teaching strategies to cope with stressful encounters. The intervention proved effective in reducing state anxiety, test anxiety, and behavior symptoms and in increasing self-esteem in the intervention groups as compared with the control groups. The decrease in test anxiety was especially notable among the Arab adolescents. Regression analyses revealed that change in test anxiety scores alone was higher among the Arab adolescents; school was not a significant contributor to any of the other outcome variables. Regarding the biofeedback measures, achieved EDA change in biofeedback training contributed significantly to the explained variance of the decrease in test anxiety and to an increase in self-esteem.

The efficacy of the intervention may be ascribed to its directly addressing everyday stressors encountered by the adolescents, through cognitive and behavioral means. Cognitive techniques (De Anda, 1998; Kiselica et al., 1994) and relaxation exercises (Goldbeck & Schmid, 2003) were previously found directly to reduce anxiety. Relaxation also effects a reduction in level of autonomic arousal (Lee & Olness, 1996; Lohaus et al., 2001). Moreover, the program equipped the adolescents with new and effective coping strategies that could increase sense of mastery, self-efficacy, and self-esteem and hence reduce anxiety (Muris, 2002). High levels of anxiety were previously found to relate to more behavior problems in children and adolescents and to lower self-esteem (Wachelka & Katz, 1999); these high levels therefore possibly fell, along with decreases in state and test anxiety.

Hostility levels were not significantly affected by the intervention program. In contrast to anxiety, hostility was not directly addressed in the present program. From previous reports, we assumed that decreasing anxiety

and increasing self-efficacy in coping with stressful encounters would lower the level of hostility (Aseltine et al., 2000). Lower hostility was in fact positively associated with decreases in state and test anxiety and in behavior problems, but its degree of change did not reach statistical significance. For a stronger impact on hostility, additional and more direct techniques may be needed that focus on self-regulation in conflict situations (Cooper et al., 2000).

Self-esteem increased significantly in the intervention groups. It was also associated with changes in all outcome variables (except state anxiety, where it did not reach significance). Previous studies have also shown that psychological and behavior problems are related to low self-esteem (Lindhal et al., 2005; Wachelka & Katz, 1999). The sense of achievement and acquisition of new coping skills, or even the improvement in coping with test situations, might have contributed to the increase in self-esteem.

Our program differed from previously reported stress management programs (De Anda, 1998; Kiselica et al., 1994) in the inclusion of biofeedback training. This has the advantage of providing visual feedback on the degree of relaxation and control achieved over physical arousal, so it is especially efficient with adolescents. The use of games adds interest and enthusiasm to the otherwise monotonous relaxation training. Winning better results in the biofeedback exercises proved to be directly associated with a decrease in test anxiety, but not in state anxiety. Relaxation and biofeedback training perhaps chiefly addressed the emotionality factor of test anxiety, as the physical sensations of test anxiety are more specific and easier to identify and target via relaxation than is the general state of anxiety. In addition, relaxation skills can be successfully implemented almost immediately in test situations. But how will this reduction in emotionality affect test performance? This question arises in light of previous studies indicating that the worry component of test anxiety, not the emotionality, was related to performance on tests (Bodas & Ollendick, 2005).

Comparing Arab and Jewish adolescents, at preintervention the levels of test anxiety were considerably higher in the former. This result accords with results of other studies in Israel (Peleg-Popko, Klingman, & Abu-Hanna Nahhas, 2003). Also, Bodas and Ollendick (2005) found in their review of studies on cross-cultural differences in test anxiety that Arab students in several Muslim countries had higher test anxiety than students in Western and Eastern countries. This may be explained by poor examination performance (Bodas & Ollendick, 2005) or heavier parental pressure for academic achievement (Peleg-Popko et al., 2003). This is especially relevant for the Israeli Arab parent, who may perceive academic status as an important means to improve opportunities for the future (Peleg-Popko et al., 2003).

In general, both Jewish and Arab adolescents benefited from the interventions. However, higher rates of change were achieved in the Arab inter-

vention group, as reflected in the Group × School effect in the repeated measures analysis. This difference was prominent for test anxiety, but was also evident for behavior problems: In the Arab school, the symptoms decreased in the intervention group but increased during the same time span in the control groups. The better results could be related to the markedly higher initial level of test anxiety and behavioral symptoms in the Arab adolescents, which created higher motivation for change. In addition, it was previously suggested that individuals from traditional societies (Atkinson, Bui, & Mori, 2001), including Arabs (El-Islam, 2004), tend to experience psychological distress more as somatic sensations. Bodas and Ollendick (2005) found that Indian students expressed the somatic symptoms of test anxiety more than Western students. Relaxation and biofeedback, which focused on somatic sensations, might therefore have afforded immediate and stronger relief from the anxiety symptoms for the Arab adolescents.

Regarding biofeedback, the Jewish adolescents did better in achieving EDA change. However, EDA results in both groups showed high variability among students. This points to the need to allow more time for computer work in such programs, which will improve the benefits of the biofeedback training. Note that because sensitivity levels were adjusted for each individual student, although the total change in EDA was negative for some students, they were rewarded for successful steps in the process. Biofeedback was a reinforcing and beneficial experience for them too.

The therapist factor was related only to change in self-esteem, with higher increases evident in the interventions with the male therapist. One possible explanation is that the therapist's gender contributed to the difference, but a more probable explanation may rest with the therapist's personality or attitude. It was previously reported that therapists with different personalities and different interpersonal approaches have a unique impact on patients, even in structured interventions (Hayes, Folette, & Folette, 1995). For example, the male therapist might have provided more reinforcement for students' successful steps, might have been more reassuring, or might have exhibited a warmer attitude.

Several limitations of the study should be addressed. The main one was the comparison of the cognitive–behavioral intervention group with the nonintervention control group. The present method impedes drawing a conclusion that the specific cognitive–behavioral intervention was responsible for the change that occurred. Theoretically, empathic listening by the therapist, ventilation of emotions, or even the change in daily school routine might have created changes in stress indexes or even in emotional symptoms. A second concern is the absence of a follow-up measure to assess the long-term effect of the intervention program. Also, although relationships were found between the fall in EDA and reduced anxiety, a causal link cannot be inferred from these results.

Nevertheless, the present results indicate a favorable outcome for the program. The results are in line with those of previous studies, indicating that cognitive–behavioral interventions can be successfully implemented with different cultural and ethnic groups. The study shows the additional effect of using biofeedback to practice relaxation in a rewarding and enjoyable way. It highlights the importance and effectiveness of prevention programs, which may be cost effective in the long run. According to the present results, we suggest that such programs be constructed in two parts. The first part should focus on imparting basic cognitive–behavioral coping skills, with an additional focus on test anxiety and state anxiety reduction. The second part should extend the acquired skills to mastering hostility and aggressiveness, with a focus on working with adolescents' experience of conflictual situations. From the present study, it is difficult to achieve these both aims in one short-term intervention. Further research, expanding the investigation of EDA measures and their relation to emotional and behavioral factors, will assist in adjusting such programs to adolescents' specific needs.

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