Abstract

Anorexia Nervosa is a life-threatening disease with a prevalence of 1%-3% among female adolescents and young women. The disease is classified as an eating disorder and is characterized by excessive concern about weight, body shape and food. The disorder manifests in a refusal to maintain normal body weight, intensified fear of gaining weight even when the person is underweight, disturbance in body image and the absence of at least three consecutive menstrual cycles due to under-eating. One of the prominent factors leading to the disorder is patients' denial of their excessive concern regarding weight, body shape, and food. Hence, it is difficult to identify the characteristics of the disease free of socially desirable bias and in an objective manner. One indirect method that may be used to measure these concerns is the emotional Stroop task.

The emotional Stroop refers to an increase latencies in color-naming in words that are emotionally charged for the respondent relative to color recognition time of neutral words. Studies have shown that depressive subjects increase latencies in color-naming when presented with depression-related words, while subjects with anxiety disorder are increase latencies in color-naming to danger related words.

Similar studies conducted among young female adolescents diagnosed with anorexia indicated that subjects showed retarded latencies in naming colors of words related to weight, body shape and food in contrast to naming colors of neutral words. The first goal of the present study was to revalidate these studies.

The reliability and validity of the computer software used to measure the emotional Stroop effect constitute an important factor when measuring the effect. The majority of software used in existing Stroop research is based on vocal reaction. The vocal reaction requires consideration of physical parameters that affect the measured reaction time, such as voice-level and time thresholds which define valid reaction as opposed to noise. However, these parameters have yet to be examined in emotional Stroop research. The current study did take the voice-level and time thresholds into account, in addition to the extent of the latency that appeared while color-naming the words. Thus, the second goal of this study was to examine the relevance of these

measures in identifying anorexia, and for improving the predictive validity of the Stroop latency effect as indicative of anorexia.

Another intriguing issue regarding the emotional Stroop interference among various clinical populations relates to the question of whether the interference is due to the emotionality of the relevant words or to their negative valance. Previous research with depressed and anxious subjects, reached conflicting results. However, this issue has not yet been examined with regard to anorexics. Therefore, the third goal of the present study was to examine the emotional valence of the words on the emotional Stroop interference effect among anorexic female subjects by comparing color-naming response time to positive (i.e. thin), neutral (i.e. waist) and negative (i.e. fat) body image words.

The way in which the emotional Stroop effect is measured, i.e. word color-naming response time, is an important factor. Presumably, inaccuracy in color-naming associated with an emotionally-charged word could indicate Stroop interference in a similar manner to the slowing of color-naming response time. Moreover, basing measurements solely on color-naming response time, while disregarding color naming accuracy, might skew results. To date, all emotional Stroop research has ignored word color-naming inaccuracies, thus, the number of word color-naming errors with regard to emotionally charged words, as opposed to the number of color-naming errors incurred with regard to emotionally neutral words. In light of this, the fourth goal of the present study was to examine emotional Stroop interference among anorexics based on word color-naming response time as well as on the number of word color-naming errors incurred.

One of the updates appearing in the revised version of the Diagnostic and Statistical Manual of Mental Disorders (DSM-4-R, American Psychiatric Society, 1994) subdivides eating disorders into two types: the restricting type, which is characterized by initial weight loss through dieting, fasting, and/or excessive exercise, and the binge-eating/purging type which is characterized by episodes of overeating and/or purging. The emotional Stroop interference has never been applied to these categories. The present study fills this gap by using words related to binge-eating and purging behavior.

This study is unique and significant in that it attempts to examine the emotional and cognitive aspects of anorexia nervosa through the use of unique computer software

that not only measures emotional Stroop based on reaction time, but also relates to the subject's voice level and reaction duration while color-naming words. These measures were examined while differentiating between the two subtypes of anorexia in relation to the unique word content of each type, their emotional charge, and to the focus of the disorder – naming time versus accuracy.

The research sample included 52 Israeli female adolescents ($N = 52$) who had been diagnosed with anorexia and were in inpatient or outpatient treatment programs. Twenty six of the subjects ($N = 26$) were diagnosed by psychiatrists and other trained health care providers with anorexia: restricting type, and the other twenty six ($N = 26$) were diagnosed with anorexia: binge eating/purging type. An additional group of twenty eight adolescent girls ($N = 28$) was chosen as a control group. A unique computer software program was developed for the purposes of this study. The program displayed words written in different colors on the screen, one after the other. Subjects' reactions were processed while measuring the color-naming time, voice level, and reaction duration. Subjects' reactions were also recorded, making it possible to measure color-identification accuracy levels. After completing the Stroop task, subjects were asked to fill out a questionnaire derived from the EDI-2, measuring their impulsiveness and perfectionism levels. The present study was based on four research hypotheses.

The first hypothesis compared the anorexic subjects to the control subjects in relation to emotional Stroop interference for words related to food and body shape. This hypothesis was partly confirmed. Although findings indicated that the adolescent girls and the anorexic girls indiscriminately displayed emotional Stroop interference in regard to words relevant to anorexia, the interference effect was significantly higher among the anorexic subjects than among the adolescent girls. In addition, significant Stroop interference was only found among the anorexic girls in relation to the positive body words and the purging words, which were presented in this study as anorexia-relevant stimuli for the first time. Moreover, a difference was found among the anorexic subjects between the color-naming time for positive and negative body words, while such differences were not present among the control subjects. Thus, it is possible to conclude that both the adolescent and the anorexic subjects were occupied by body image and food. However, exaggerated concern regarding thinness and an overwhelming need to

purge were unique to the anorexic subjects. Furthermore, the anorexic girls appeared to utilize a different data processing mechanism than did the adolescent girls. An additional new finding shows that anorexic girls named the word colors at lower voice levels than did the control subjects.

The second hypothesis related to differences in the emotional Stroop interference between subjects with binge eating/purging type anorexia and those with the restricting type in relation to words related to food, binging, and purging. It was hypothesized that the emotional Stroop interference for these words would be higher among the binge eating/purging type anorexics than among the restricting type subjects. Findings inidicated an opposite effect. The restricting type anorexics actually demonstrated greater Stroop interference than did the binge eating/purging type subjects with regard to purging words. That is to say, despite the fact that the content of these words is characteristic of the binge eating/purging type of anorexia, restricting type subjects are apparently more sensitive to them.

The third hypotheses dealt with the effect of emotional valence on Stroop interference. Two alternatives were suggested. In the first alternative, I hypothesized that emotional Stroop interference differences would be found in relation to negative, positive, and neutral body related words among anorexic subjects: binge eating/purge type, but not among those subjects belonging to the restricting type. The second alternative hypothesized that greater emotional Stroop interference would be found for negative body related words among binge eating /purging type subjects than among restricting type subjects, while greater emotional Stroop interference would be found for positive body related words among those with restricting type anorexia than among those with binge eating/purging type anorexia. Research findings partly supported the second alternative. The findings indicate that the restricting type anorexics demonstrated greater Stroop interference than did the binge eating/purging type subjects with regard to both positive and negative valence words, with no distinction between the two categories. Therefore, the restricting type subjects were more sensitive to both the positive and the negative emotional content than the girls belonging to the binge eating/purging type.

The findings related to the words that are unique to the anorexic type and to the emotional valence of those words, are especially important to differentiating between

restrictive and binge eating/purging type anorexics. Based on these findings, it may be concluded that the restrictive type anorexic girls' cognitive scheme is stronger and more stable than that of the binge eating/purging type subjects. Furthermore, the findings indicate that the two different types of girls deal differently with the eating disorder. In other words, binge eating/purging type anorexics adopt behavioral coping methods such as purging, use of laxatives and tranquilizers, and outbursts of rage. These behaviors permits them to decrease somewhat their contemplation of the actual disease content. On the other hand, restrictive type anorexics do not adopt purging behaviors, thus, they have obsessive thoughts related to their disease.

The fourth research hypothesis was that the subjects with binge eating/purging type anorexia would identify the relevant color names in the Stroop task more quickly but with a higher rate of error, while the restricting type anorexic subjects would display greater latency in color naming, but with greater accuracy. While the research findings were not significant, they did indicate a tendency toward the hypothesis. The Stroop interference displayed by restricting anorexics did tend to manifest in slower color naming response times than that displayed by the binge eating/purging anorexics, but with fewer errors. On the other hand, the binge eating/purging subjects' Stroop interference manifested in faster color naming response times than the restricting type subjects, with a greater number of errors. Different significant correlations between the time measure and the error measure were found for each of the research groups. Significant negative correlation was found between the error measure and the time measure in the binge eating/purging type group, while there was significant positive correlation within the control group and no significant correlation among the restricting type subjects. These findings support both the time and error measures as measures of emotional Stroop interference. Disregarding the distinction between the error measure and the response time measure may taint the reliability of emotional Stroop research and explain the inconsistency of previous findings with regard to the emotional Stroop effect in anorexia.

Another innovative finding in the current study is related to two new measures for emotional Stroop interference, those of voice level and reaction duration. The findings showed that anorexic girls of the restrictive type named the word colors at lower voice

levels and displayed longer reaction durations than the girls belonging to the binge eating/purging type. Thus, it may be said that these measures were found to differentiate between restrictive and binge eating/purging type anorexics.

In summary, the current study established a number of innovative findings in regard to the differences between restrictive and binge eating/purging type anorexics. Emotional Stroop interference as determined by the time measure was found to distinguish between restrictive and binge eating/purging type anorexics, as far as words that are unique to their types and in regard to words with emotional valence. Differences between the two types were likewise found according to the Stroop measure relevant to each, the time measure vs. the error measure. Moreover, differences were found between the restrictive and the binge eating/purging anorexics on two new measures; voice level and reaction duration. Finally, the ability of each of the two aforementioned measures to predict wether girls will be afflicted with restrictive type anorexia or binge eating/purging type anorexia was tested based on logistic regression analysis. From this analysis it may be concluded that for subjects who display greater slowing of color naming time, greater latency and lower voice level (RMS) for critical words, there is a higher likelihood of belonging to the restrictive type than to the binge eating/purging type, and vice versa.

The present study suggests a new and fascinating direction for future research in regard to differences between restrictive type anorexics and binge eating/purging anorexics. It could be argued that the differences distinguishing anorexia types are rooted in the quality and quantity of the disorder. Hence, the Stroop measure as tested in this study may be considered an additional measure for categorizing anorexic girls. However, this study requires replication while attending to methodological limitations.