Original Contributions

Anhedonia of Patients with Schizophrenia and Schizoaffective Disorder is Attributed to Personality-Related Factors Rather than to State-Dependent Clinical Symptoms

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Abstract

Purpose: The aim of the current study was to to explore the concurrent attribution of illness- and personality-related variables to the levels of physical and social anhedonia in patients with schizophrenia (SZ) and schizoaffective disorder (SA). **Method:** Eighty-seven stable patients with SZ/SA were assessed using the revised Physical Anhedonia Scale (PAS) and the Social Anhedonia Scale (SAS) illness- and personality-related variables. Correlation and regression analyses were performed. **Results:** Three subgroups of patients were stratified by level of hedonic functioning: 52.9% passed the PAS and SAS cut-off ("double anhedonics"), 14.9% the PAS cut-off and 18.4% the SAS cut-off ("hypohedonics"), and 13.8% did not reach the PAS or SAS cut-off ("normal hedonics"). Increased negative and emotional distress symptoms together with low levels of task-oriented and avoidance-coping styles, self-efficacy, and social support were significantly correlated with PAS/SAS scores. Multivariate regression analysis indicated that the contribution of illness-related predictors was 4.1% to the variance of PAS and 5.5% to SAS scores, whereas the contribution of personality-related predictors was 24.1% for PAS and 14.1% for SAS scores. The predictive value of negative symptoms did not reach significant levels. **Conclusions:** The hedonic functioning of SZ/SA patients is attributed to a number of personality-related factors rather than to state-dependent clinical symptoms. These findings enable better understanding of the multifactorial nature of anhedonia and might be of therapeutic relevance.

Key Words: Schizophrenia, Anhedonia, Symptoms, Emotional Distress, Self-Constructs, Coping Styles, Social Support

Introduction

Anhedonia, markedly diminished interest (pleasure), or deficits in hedonic functioning play a major role in pathological behavior such as schizophrenia (SZ), schizoaffective

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(SA), depression and substance use disorders (1-8). However, the phenomenon is poorly understood owing to the phenotypic heterogeneity of schizophrenia, the multidimensionality and multifactorial etiology of anhedonia, and the difficulties inherent in the scientific analysis of subjective emotional experiences (9).

The three most commonly used approaches to assess anhedonia in schizophrenia are interview-based measures, self-report questionnaires, and laboratory-based assessments of emotional experience (10). Anhedonia is most directly and comprehensively assessed by the Scale for the Assessment of Negative Symptoms (SANS; 11), and using the Chapman Physical and Social Anhedonia self-report questionnaires (12, 13). Self-reports of emotional experience

Clinical Implications

The present findings are consistent with the stress-vulnerability model (77). We assumed that anhedonia among schizophrenia (SZ) and schizoaffective disorder (SA) patients appeared to be a trait-like condition rather than a state-dependent phenomenon. This assumption is in accordance with the following evidence: 1) anhedonia is closely associated with poor premorbid adjustment, in particular, the relationship between some premorbid characteristics and physical anhedonia are significant, even ten years into the course of illness (24); 2) anhedonia apparently begins early in life in relation to pathological reactions within the core family (15); first-degree relatives of highly anhedonic schizophrenic probands have a high level of anhedonia (16); 3) self-report measures of physical and social anhedonia among first-episode psychotic patients revealed higher anhedonia in comparison to control subjects (14, 20-22); 4) hedonic functioning deficit did not show strong and consistent relationships with psychotic, negative, or depressive symptoms (24); anhedonia is a construct that is distinct and separate from depression and schizophrenic symptomatology in chronic schizophrenia (29). Pelizza and Ferrari (27) considered anhedonia as a specific subjective psychopathological experience of the negative and disorganized forms of schizophrenia; and, 5) physical anhedonia was a stable characteristic over a 10-year period and has been proposed to be a trait-like risk factor for the development of schizophrenia (27, 28).

This study suggests that personality-related predictors of hedonic functioning are factors that can potentially be ameliorated by focusing psychotherapy on improving hedonic deficits, thereby enhancing the well-being of SZ/SA disordered patients. Future studies should test the relationship of hedonic functioning with the personality-related factors among younger (prodromal, first-episode) patients with severe mental disorders, as well as the possible role of anhedonia as a candidate endophenotype to schizophrenia.

can be divided into two broad categories (reports of current feelings and reports of noncurrent feelings; 14), as well as into *physical anhedonia* that represents an inability to feel physical pleasures and *social anhedonia* that represents lack of capacity to experience interpersonal pleasure (5).

Previous research provides the following evidence regarding anhedonia:

1) anhedonia apparently begins early in life in relation to pathological reactions within the core family (15).

2) first-degree relatives of highly anhedonic schizophrenic probands have a high level of anhedonia (16). Furthermore, anhedonia was found to be elevated in unaffected relatives of schizophrenia probands (17, 18), and in patients at ultra-high risk for psychosis in comparison with patients who did not develop psychosis (19).

3) higher levels of anhedonia were observed among first-episode psychotic patients in comparison to control subjects (20-22).

4) several long-term prospective studies have shown that anhedonia constitutes a stable trait in schizophrenia (23-25).

Three questions about the relationship between anhedonia and other symptoms of schizophrenia have been evaluated. First, is anhedonia related to other symptoms that are typically included in the negative symptom construct? Second, is anhedonia distinguishable from other symptom domains, including positive, disorganized, and mood symptoms? Third, within the domain of negative symptoms, is anhedonia distinguishable from other negative symptoms (i.e., 10)? Although several studies indicated a negative relationship of anhedonia with the negative and disorganized symptoms of schizophrenia (26, 27), other studies reported that the level of anhedonia is not related to negative symptoms (23, 24, 28). For instance, Herbener and Harrow (24) found that *physical anhedonia* did not correlate with psychotic, negative, or depressive symptoms. Similarly, Blanchard et al. (8) and Katsanis et al. (20) reported that *social anhedonia* seemed to be relatively independent of psychotic and depressive symptoms. These discrepancies may be explained by substantive differences between types of anhedonia, the patient's current mental health, variability of scales used to assess anhedonia, and consequently, by distinctions in anhedonia constructs and SZ/SA dimensions. Indeed, anhedonia is not a negative symptom that covaries with the other "classical" negative symptoms to constitute a negative syndrome (29). Pelizza and Ferrari (27) considered anhedonia as a specific subjective psychopathological experience of the negative and disorganized presentations of schizophrenia. Strauss and Gold (30) suggest that anhedonia reflects a set of beliefs related to low pleasure that surface when patients are asked to report their noncurrent feelings. Encoding and retrieval processes may serve to maintain these beliefs despite contrary real-world pleasurable experiences. Thus, findings concerning these questions indicate that anhedonia mea-

sured with rating scales does appear to be associated with the broader construct of negative symptoms and is distinguishable from psychotic, disorganized, and mood disorder symptoms (10, 31).

Elevated emotional reactivity to stress was found in subjects vulnerable to psychosis (32) that was experienced by schizophrenia patients as elevated emotional distress and somatization (33-35). Recent work has suggested that anhedonia in schizophrenia may be associated with emotional distress over six months (36). Though the aforementioned findings focused on anhedonia are interesting, they do not address the concurrent association of hedonic functioning with illness-related and personality-related variables (emotional distress, self-esteem, self-efficacy, coping styles, and perceived social support), which were the focus of much research in the last decade (33, 34, 37-43).

The purpose of the present study was to examine physical and social hedonic deficits in individuals with schizophrenia and schizoaffective disorder (SZ/SA) as a function of the relationship between illness- and personality-related variables. Three specific questions were addressed in this study: 1) is hedonic functioning associated with illness-related variables, in particular, with psychopathological and self-reported emotional distress symptoms; 2) is hedonic functioning associated with personality-related variables; and, 3) is hedonic functioning of SZ/SA patients predicted by personality-related variables rather than by illness-related variables?

Method
Study Design

This is a cross-sectional designed analysis of data from a ten-year follow-up study that was initiated in 1998. A detailed description of the design, data collection, measures, cross-sectional and follow-up findings was reported elsewhere (41, 44, 45). Briefly, the initial sample was systematically selected from the hospital case register according to the following inclusion criteria: 1) fulfilment of *DSM-IV* criteria for SZ/SA and mood disorders (46); 2) age 18–65; and, 3) inpatient status in closed, open or rehabilitation hospital departments of a university hospital. Patients with mental retardation, organic brain disease, severe physical disorders, drug/alcohol abuse, and those with low comprehension skills were not enrolled. Patients that met inclusion criteria were assessed three times: prior to discharge from hospital (initial assessment), about two years later, and then ten years later. The Sha'ar Menashe Internal Review Board and the Israel Ministry of Health approved the study. All participants provided written informed consent for participation in the study after they received a comprehensive explanation of study procedures.

Assessments

Diagnosis was based on a face-to-face interview and medical records. Anhedonia was assessed using the Revised Physical Anhedonia Scale (PAS; 12) and the Revised Social Anhedonia Scale (SAS; 13), which showed adequate psychometric characteristics (47). Higher scores on the PAS and SAS indicate higher severity of physical and social anhedonia. Although there have been some concerns regarding the construct validity of these scales (48), there are many studies that used the PAS and SAS to evaluate anhedonia in schizophrenia. In the current sample, internal consistency and reliability (Cronbach α) were very good for the PAS (0.92) and the SAS (0.90).

Severity of illness was assessed using the Clinical Global Impression Scale (CGI-S; 49). Severity of psychopathology was assessed using all 30 items of the Positive and Negative Syndrome Scale (PANSS; 50). The PANSS five-factor model was used: negative factor, positive factor, activation, dysphoric mood and autistic preoccupations (51).

The presence and severity of adverse effects of medication—as well as psychological responses to them—were measured with the Distress Scale for Adverse Symptoms (DSAS; 52). The DSAS is a clinician-administered rating scale with a checklist of the 22 most frequently observed side effects and discomfort associated with antipsychotic treatment. Responses are on a 5-point scale, with higher scores indicating higher severity and greater distress. The global DSAS index was computed as the average of adverse symptoms, mental and somatic distress scores (Cronbach's α=0.88).

The Global Assessment of Functioning scale (GAF) is one of the most widely used measures of impairment and functioning in clinical and research settings (53). Clinicians rate clients on a 1 to 100 scale in terms of their psychological, social, and occupational functioning (46). The scale includes 10 sets of anchor descriptions spaced at 10-point intervals. Anchors allow clinicians to consider both symptom severity and social/occupational functioning in their ratings.

Assessment of emotional distress and somatization was done using the Talbieh Brief Distress Inventory (TBDI; 33, 54). The TBDI is a 24-item self-report instrument that measures subjective discomfort from psychiatric symptoms. Responses are 0 to 4, with higher scores indicating greater intensity of six distress symptoms: obsessiveness, hostility, sensitivity, depression, anxiety, and paranoid ideation. The Somatization Scale is derived from the Brief Symptom Inventory-Somatization Scale (BSI-S; 55). TBDI and BSI-S demonstrated high reliability (Cronbach's α: TBDI symptoms=0.76–0.91, and BSI-S=0.85).

The Coping Inventory for Stressful Situations (CISS) is a 48-item inventory that assesses ways people react to various difficulties and stressful or upsetting situations. Re-

sponses are scored on a 5-point scale ranging from "not at all" to "very much." Three basic coping styles are evaluated (each by 16 items): task-oriented, emotion-oriented and avoidance-oriented coping (56). For the present sample, internal consistency of the CISS dimensions was high (Cronbach's α=0.87–0.92).

The General Self-Efficacy Scale is a 10-item scale for evaluating a sense of personal competence in stressful situations (GSES; 57). The Rosenberg Self-Esteem scale is a well-known 10-item self-report questionnaire for measuring self-esteem and self-regard (RSES; 58). The RSES measures global self-esteem and personal worthlessness. It includes 10 general statements that assess the degree to which respondents are satisfied with their lives and feel good about themselves. A decreased score reflects increased self-esteem. It is the most widely used scale to measure global self-esteem in research studies. For the present sample, internal consistency of the GSES and RSES was quite satisfactory (Cronbach's α=0.87 and 0.82, respectively).

The Multidimensional Scale of Perceived Social Support (MSPSS; 59) was used to measure perceived social support. The MSPSS is a psychometric instrument used to assess emotional support and the degree of satisfaction with perceived social support from family, friends, and significant others (Cronbach's α=0.84–0.90).

Statistical Analysis

The statistical analysis was performed in three steps. First, using the PAS ($\geq$18) and SAS ($\geq$12) cutoff scores, the sample was divided into "hypohedonics" (the subject had to reach PAS or SAS cutoff), "double anhedonics" (the subject had to reach both PAS and SAS cutoff at the same time), and "normal hedonics" (the subject did not reach PAS and SAS cut-off) subgroups (27, 60). These subgroups were compared on the illness- and personality-related variable scores using ANOVA with the Tukey-Kramer multiple-comparison test. Thus, ANOVA compared three subgroups of patients stratified by levels of hedonic functioning.

Second, Pearson correlation coefficients were evaluated between PAS and SAS scores with the illness- and personality-related variable scores. Correlation analysis seemed appropriate for comparisons of the obtained correlations with previously published findings.

Third, a multiple regression analysis was applied to predict PAS and SAS scores. The variable selection procedure for multivariate regression was performed in one portion of the regression analysis: it obtained a set of independent variables from a pool of candidate variables. Once the set of variables was obtained, multiple regression procedure was performed to estimate the regression coefficients, study the

residuals, and so on. Three sets of independent variables were used for the variable selection procedure: 1) illness-related variables (GCI-S, GAF, five PANSS factors, TBDI, DSAS, BSI-S scores); 2) personality-related variables (CISS coping styles, GSES, RSES, and MSPSS dimension scores); and, 3) all independent variables used for set (1) and (2) ("combined" model). Thus, the regression analysis revealed differences in the predictive power of independent variables. For all analyses, the level of statistical significance was defined as p<0.05. Statistical analysis was performed using the Number Cruncher Statistical Systems (61).
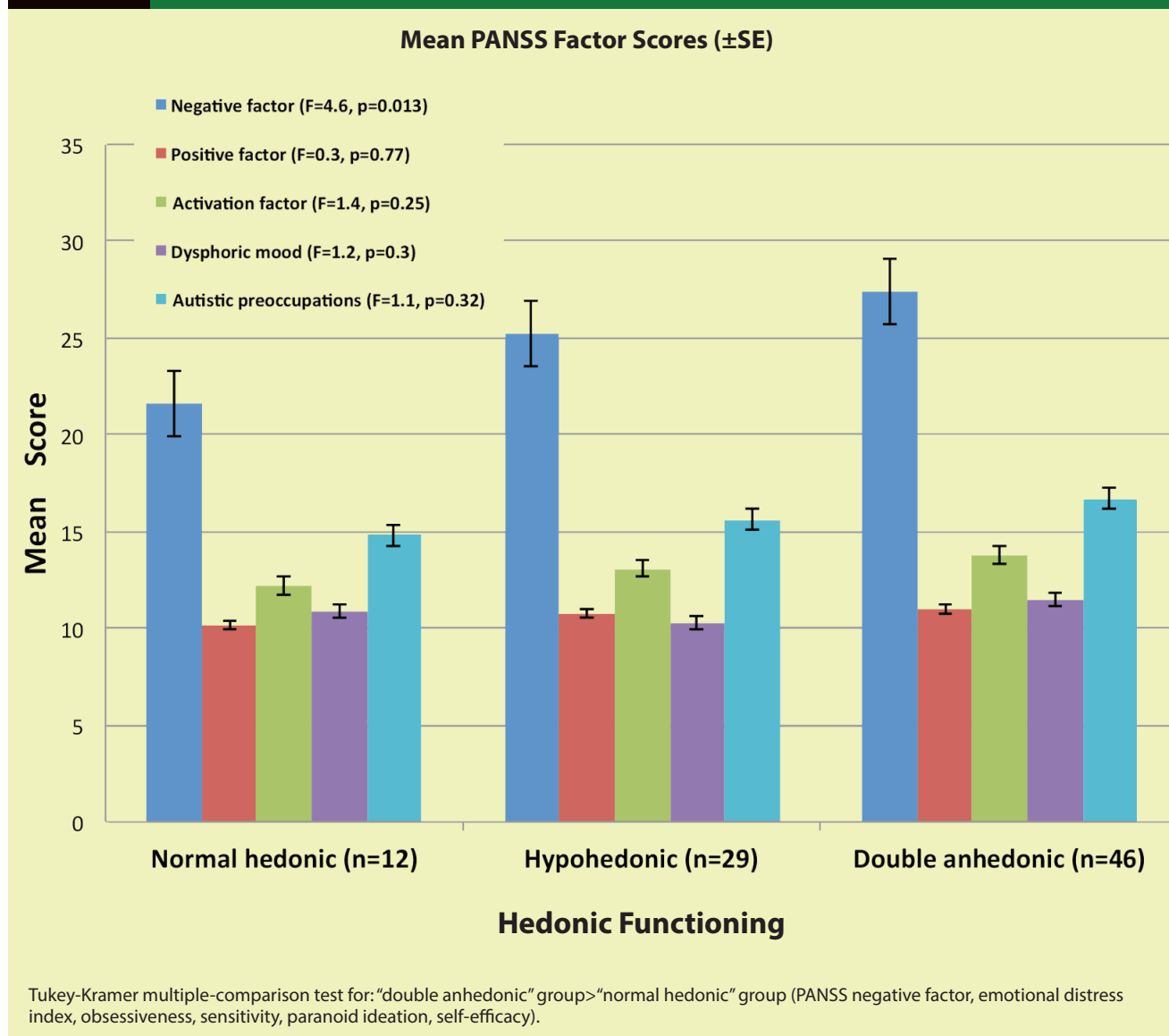
Results
Participants

Eighty-seven stable outpatients with SZ/SA took part in this study. The sample included 66 (75.9%) men, mean age 47.8±9.4 years (range: 30–69), 54 people (62.13%) were single, 22 (25.3%) were married, and 11 (12.6%) were divorced, separated or widowed. Mean extent of education was 10.7±2.6 years. Mean (±SD) age of application for psychiatric care was 23.2±7.8 years, and mean duration of disorder was 25.0±9.2 years (range: 11–49). None of the participants exhibited exacerbation of their mental condition at the time of assessment (PANSS: 76.2±17.6 scores). Among 87 patients in the sample, 48 (55.2%) presented with *DSM-IV* schizophrenia, paranoid type, 18 (20.7%) with residual type, 1 (1.1%) with disorganized type, 1 (1.1%) with undifferentiated type of SZ, and 19 (21.8%) with SA disorders. Patients were treated with first-generation antipsychotic agents (FGAs, 51 patients), with second-generation antipsychotics (SGAs, 16 patients), and with a combination of FGAs and SGAs (20 patients).

Since no significant differences between SZ and SA patients in the physical ($F_{1,87}$=2.1, p=0.15) and social anhedonia ($F_{1,87}$=0.1, p=0.95) scores were observed, all of the following analyses were conducted on the entire sample of SZ/SA patients. Patients had elevated scores on the physical anhedonia (22.0±8.6) and social anhedonia (17.0±8.4) scales compared to values in normal control samples (5). Age at examination (r=0.28, p=0.007) and illness duration (r=0.24, p=0.026) revealed a small but significant association with PAS scores, but not with SAS scores (r=0.04 to -0.04, p>0.05). PAS and SAS scores were not significantly associated with sex, marital status, *DSM-IV* SZ/SA subtypes, and types of antipsychotic agents (FGAs, SGAs, combined therapy) (all p's<0.05).

Hedonic Functioning

Three subgroups of patients stratified by level of hedonic functioning ("double anhedonics," "hypohedonics," "normal

Figure 1A | **Mean Scores of Disorder- and Personality-Related Factors by Anhedonic Functioning of 87 Patients with Schizophrenia and Schizoaffective Disorders**

Mean PANSS Factor Scores (±SE)

Legend:
- Negative factor (F=4.6, p=0.013)
- Positive factor (F=0.3, p=0.77)
- Activation factor (F=1.4, p=0.25)
- Dysphoric mood (F=1.2, p=0.3)
- Autistic preoccupations (F=1.1, p=0.32)

Y-axis: Mean Score
X-axis groups: Normal hedonic (n=12), Hypohedonic (n=29), Double anhedonic (n=46)
X-axis label: Hedonic Functioning

Tukey-Kramer multiple-comparison test for: "double anhedonic" group>"normal hedonic" group (PANSS negative factor, emotional distress index, obsessiveness, sensitivity, paranoid ideation, self-efficacy).

hedonics") were compared by illness- and personality-related variables with ANOVA (df=2,78; see Figures 1A–D). For the analyzed sample, 13 (14.9%) reached or passed the PAS cut-off, 16 (18.4%) the SAS cut-off, 46 (52.9%) the "double cut-off," and 12 (13.8%) did not reach the PAS or SAS cut-off.

The comparison revealed that "double anhedonics" had increased scores on PANSS negative symptoms (F=4.6, p=0.013), and self-report emotional distress (TBDI total score [F=3.8, p=0.027], obsessiveness [F=5.0, p=0.009], sensitivity [F=4.3, p=0.016], paranoid ideation [F=3.2, p=0.047]) scores compared to "normal hedonics." At the same time, "double anhedonics" had lower levels of task-

oriented (F=7.2, p<0.001) and avoidance-coping (F=5.5, p=0.006) styles, self-efficacy (F=4.1, p=0.021), and perceived social support (MSPSS total scores [F=9.7, p<0.001], family support [F=4.3, p=0.017], friend support [F=6.0, p=0.004], and other significant support [F=9.4, p<0.001]) compared to "normal hedonics" and/or "hypohedonics" (Tukey-Kramer multiple-comparison test, p<0.05).

No significant differences in illness severity (CGI-S; F=0.9, p=0.41), other symptoms (PANSS total score [F=3.0, p=0.055], positive factor [F=0.3, p=0.77], activation factor [F=1.4, p=0.25], dysphoric mood [F=1.2, p=0.30], autistic preoccupations [F=1.1, p=0.32]), side effects (DSAS; F=0.9, p=0.37), general functioning (GAF; F=1.0, p=0.35), self-

| **Figure 1B** | **Mean Distress Symptom Scores (±SE)** |
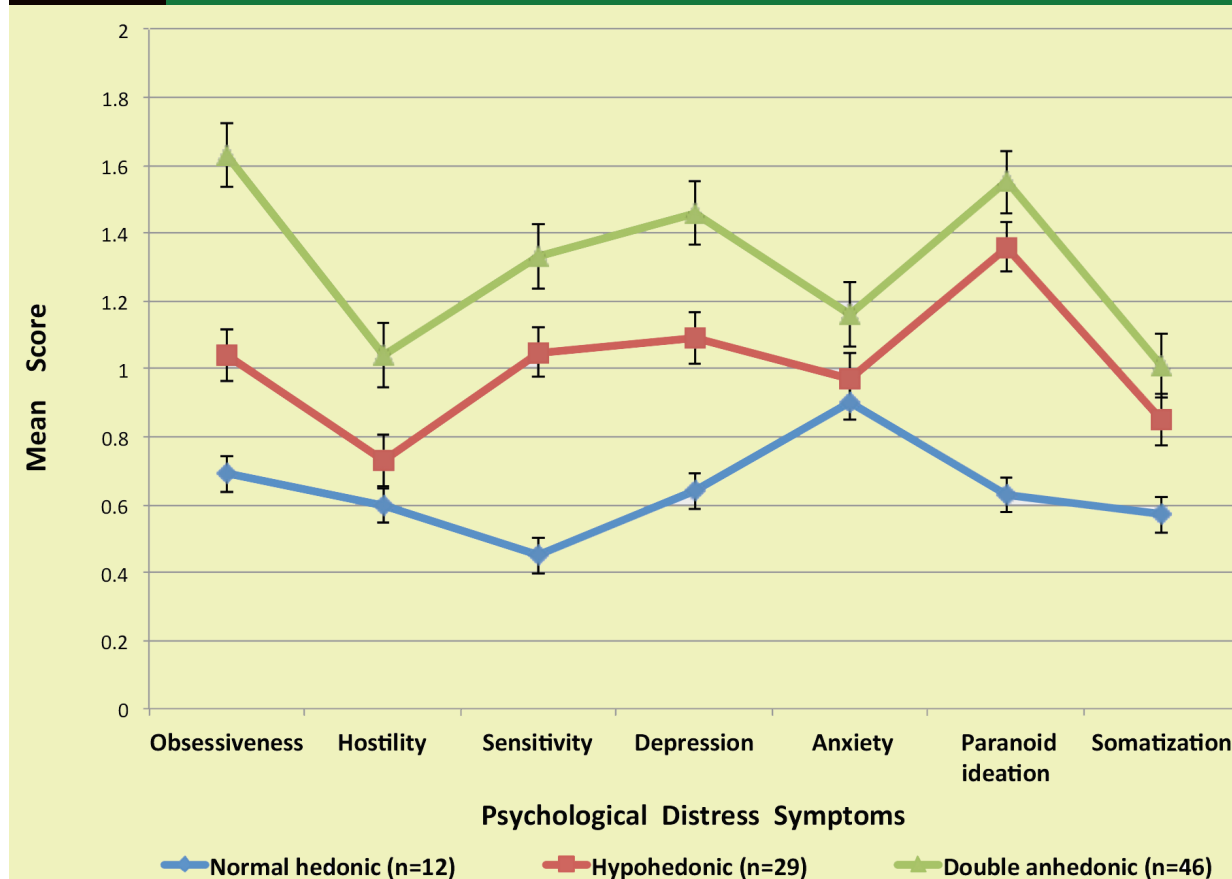
Tukey-Kramer multiple-comparison test for: "double anhedonic" group<"normal hedonic" group; "double anhedonic" group<"hypohedonic" group (task-oriented coping, perceived social support total score, family support, other significant support).

report distress symptoms (hostility [F=1.4, p=0.24], depression [F=2.8, p=0.066], anxiety [F=0.3, p=0.72], somatization [F=1.2, p=0.30]), emotion-oriented coping (F=0.9, p=0.40), and self-esteem (F=1.8, p=0.17) scores were observed. No differences were detected between subgroups in terms of gender, age, education, duration of illness, type and dosage of medication.

Correlation Analysis

For the sample, PAS/SAS total scores were significantly and positively correlated with negative symptoms (r=0.23 and 0.26, p<0.05), emotional distress index, sensitivity and depression scores (r ranged from 0.22 to 0.25; p<0.05). By contrast, there was a negative relationship with task-oriented and avoidance-coping style scores (r ranged from -0.24, p<0.05 to -0.47, p<0.001), and social support scores (r ranged from -0.24, p<0.05 to -0.44, p<0.001) (see Table 1). In addition, obsessiveness (0.29, p<0.01), self-efficacy (-0.39, p<0.001), and self-esteem (-0.27, p<0.01) are associated with

PAS scores. No correlations with CGI-S, other PANSS factors, DSAS, GAF, BSI-S scores were detected.

Three of seven PANSS negative items positively correlated with anhedonia dimensions: poor rapport (N3; r=0.27, p=0.012 for PAS; r=0.34, p<0.001 for SAS), lack of spontaneity (N6; r=0.28, p=0.008 for PAS; r=0.24, p=0.024 for SAS), and passive/apathetic social withdrawal (N4; r=0.40, p<0.001).

Regression Analysis

Table 2 presents a summary of regression models using three different sets of independent variables for predicting PAS and SAS scores. As can be seen, the first or "illness-related" model suggested that negative and/or emotional distress symptoms are significantly positively associated with variability in PAS and SAS total scores, respectively. These models explained 22% and 19% of variability in PAS and SAS scores, respectively.

The second or "personality-related" model revealed

Figure 1C Mean Coping Style Scores (±SE)
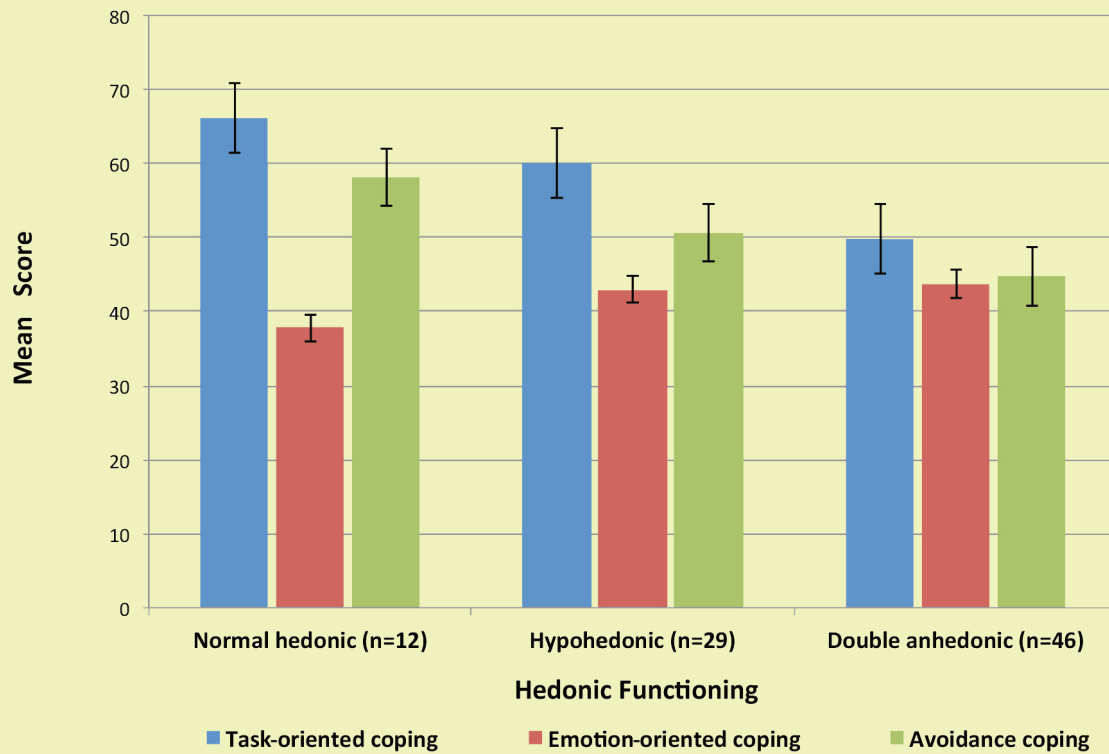
Tukey-Kramer multiple-comparison test for: "double anhedonic" group<"normal hedonic" group (avoidance-coping, friend support).
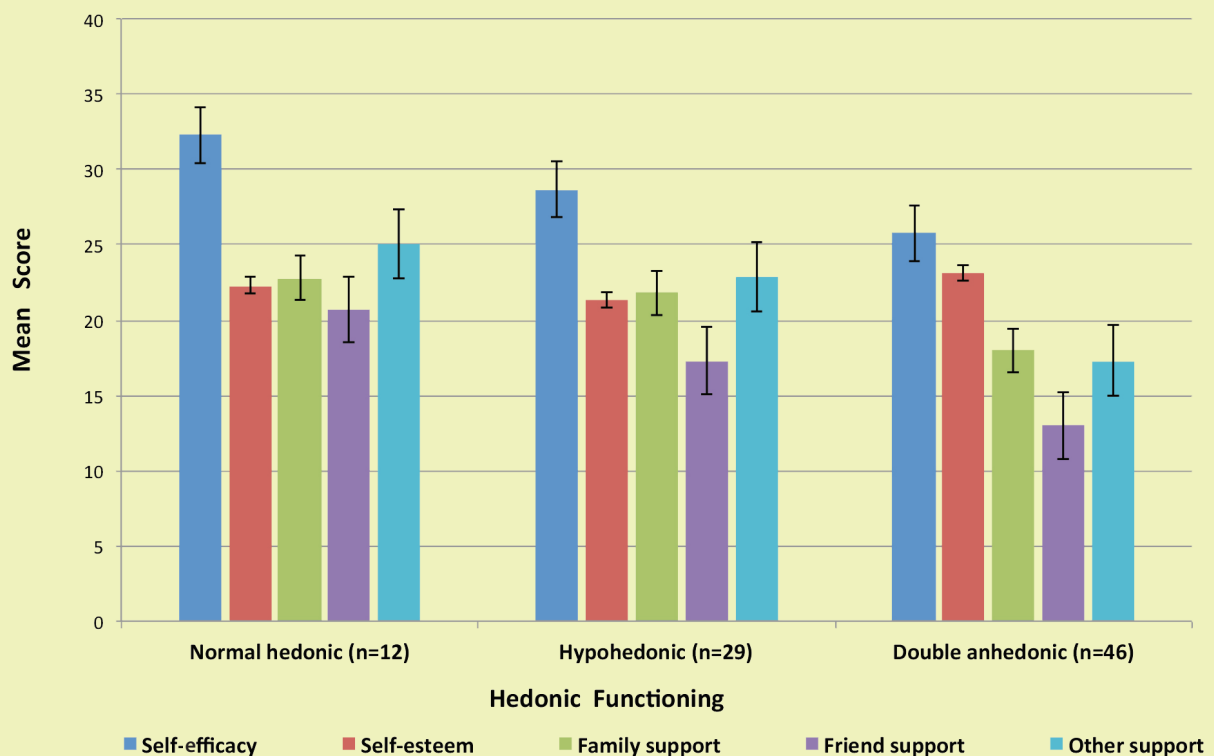
Figure 1D Mean Self-Contructs and Social Support Scores (±SE)

			Correlation Coefficients with	
Dimensions	Mean	SD	Physical Anhedonia	Social Anhedonia
Illness-Related Variables				
Illness severity (CGI-S)	4.0	1.0	0.17	0.08
PANSS, total score	76.2	17.6	0.19	**0.23***
Negative factor	25.9	6.4	**0.23***	**0.26***
Positive factor	10.8	3.6	0.09	0.07
Activation factor	13.4	3.3	0.13	0.19
Dysphoric mood	11.0	3.0	0.02	0.10
Autistic preoccupations	16.1	4.4	0.15	0.21
Side effects (DSAS)	.55	.39	-0.19	-0.07
General functioning (GAF)	60.9	11.0	-0.12	-0.09
Emotional distress index (TBDI)	1.16	.85	**0.24***	**0.27***
Obsessiveness	1.31	1.10	**0.29****	0.18
Hostility	.88	.96	0.01	0.16
Sensitivity	1.12	.93	**0.25***	**0.22***
Depression	1.23	1.10	**0.23***	**0.23***
Anxiety	1.06	1.20	0.09	0.13
Paranoid ideation	1.37	1.11	0.17	0.17
Somatization (BSI-S)	.90	.87	0.12	0.20
Personality-Related Variables				
Task-oriented coping (CISS)	55.5	16.0	**-0.47*****	**-0.29*****
Emotion-oriented coping (CISS)	42.7	13.0	0.03	0.05
Avoidance coping (CISS)	48.5	13.5	**-0.43*****	**-0.24***
Self-efficacy (GSES)	27.6	7.4	**-0.39*****	-0.17
Self-esteem (RSES)[†]	22.4	4.0	**0.27*****	0.13
Perceived social support, total score (MSPSS)	55.7	18.8	**-0.42*****	**-0.40*****
Family support	19.9	6.8	**-0.24***	**-0.24***
Friend support	15.5	8.1	**-0.36*****	**-0.34*****
Other significant support	20.2	7.5	**-0.44*****	**-0.41*****

Table 1 Pearson Correlation Coefficients of Anhedonia Scores with Disorder- and Personality-Related Variables of 87 Patients with Schizophrenia and Schizoaffective Disorders

[†]A decreased score reflects increased self-esteem; *p<0.05; **p<0.01; ***p<0.001. CGI-S=Clinical Global Impression scale; PANSS=Positive and Negative Syndrome Scale; DSAS=Distress Scale for Adverse Symptoms; GAF=Global Assessment of Functioning Scale; TBDI=Talbieh Brief Distress Inventory; BSI-S=Brief Symptom Inventory; CISS=Coping Inventory for Stressful Situations; GSES=General Self-Efficacy Scale; RSES=Rosenberg Self-Esteem Scale; MSPSS=Multidimensional Scale of Perceived Social Support

three predictors for PAS scores (R^2=46%), and three predictors for SAS scores (R^2=31%). In particular, family support, other significant support, and self-esteem scores were negatively associated with PAS scores, accounting for 4.9%, 12% and 6.5%, respectively. Friend support, other significant support, and task-oriented coping significantly contributed to variability in social anhedonia, accounting for 5.8%, 11.0% and 6.1%, respectively.

According to the third or "combined" model, the variability in PAS scores was associated with emotional distress (β=0.28), self-esteem (β=0.19), family and other significant support (β=-0.24 and β=-0.44, respectively), while the variability in SAS scores was associated with illness severity (CGI-S; β=-0.34), task-oriented coping (β=-0.31), and other significant support (β=-0.46). This model indicated that the contribution of illness-related predictors (severity

Dependent Variable Scores	Model	Independent Variable Scores	β	F	p	R² (%)	Model's Properties
Physical Anhedonia	Illness-related	PANSS negative factor	0.44	6.1	0.016	7.5	R²=0.22, adj. R²=0.11, F=2.1, p=0.035
		Emotional distress	0.57	10.6	0.001	12.4	
	Personality-related	Family support	-0.25	3.8	0.046	4.9	R²=0.46, adj. R²=0.40, F=7.6, p<0.001
		Other significant support	-0.44	9.8	0.002	12.0	
		Self-esteem*	0.20	5.0	0.028	6.5	
	Combined	Family support	-0.28	4.3	0.041	5.9	R²=0.48, adj. R²=0.40, F=5.9, p<0.001
		Other significant support	-0.44	9.9	0.002	12.5	
		Self-esteem*	0.19	4.2	0.045	5.7	
		Emotional distress	0.28	3.0	0.049	4.1	
Social Anhedonia	Illness-related	Emotional distress	0.41	5.5	0.022	6.8	R²=0.19, adj. R²=0.08, F=4.0, p<0.001
	Personality-related	Friend support	-0.26	4.4	0.038	5.8	R²=0.31, adj. R²=0.23, F=5.6, p<0.001
		Other significant support	-0.47	8.9	0.004	11.0	
		Task-oriented coping	-0.35	4.7	0.034	6.1	
	Combined	Illness severity	-0.34	3.6	0.050	5.5	R²=0.38, adj. R²=0.20, F=2.1, p=0.016
		Other significant support	-0.46	6.4	0.013	9.4	
		Task-oriented coping	-0.31	3.0	0.047	4.7	

Table 2 Summary of Multiple Regressions to Predict Physical and Social Anhedonia Scores from Different Sets of Independent Variables

*A decreased score reflects increased self-esteem. Entered independent variables: model 1: GCI-S, GAF, PANSS (five factors), TBDI, DSAS, BSI-S scores; model 2: CISS (three coping styles), GSES, RSES, and MSPSS (three subscales) scores; model 3: GCI-S, GAF, PANSS (five factors), TBDI, DSAS, BSI-S scores, CISS (three coping styles), GSES, RSES, and MSPSS (three subscales) scores. Only significant predictors are presented. Partial R² (%) was adjusted for all other independent variables.

of disorder and emotional distress) was 4.1% to the variance of the PAS and 5.5% to the SAS scores, whereas contribution of personality-related predictors (task-oriented coping, self-esteem, family and other significant support) was 24.1% for the physical and 14.1% for social anhedonia scores. The predictive value of the negative and other PANSS symptoms, side effects, and general functioning did not reach significant levels. "Combined" models explained 48% and 38% of the variability in PAS and SAS scores, respectively.

Discussion

The current study was designed to explore the relationship of both hedonic functioning with illness- and personality-related factors in SZ/SA patients. The descrip-tive findings indicated that our sample included individuals with a reasonable level of variance of key variables. Patients with SZ/SA did not differ from each other in PAS and SAS ratings, which were lower in comparison to those of normal controls as reported in the literature (5). For instance, 53% of participants reached or passed the "double cut-off," quite similar to the 45% in published data from earlier studies (27). PAS/SAS scores were not associated with sex, marital status, *DSM-IV* SZ/SA subtypes, and antipsychotic agents (FGAs, SGAs, combined therapy), while PAS scores slightly positively correlated with age and illness duration.

The principle results from the study indicated:

1) "double anhedonics" were characterized by higher severity of negative and self-report emotional distress

symptoms together with poorer levels of task-oriented and avoidance-coping styles, self-efficacy, and perceived social support compared to "normal hedonics" and/or to "hypo-hedonics."

2) PAS/SAS scores significantly correlated with negative symptoms, self-report emotional distress (index, sensitivity and depression), task-oriented and avoidance-coping style, and social support scores, while self-report obsessiveness, self-efficacy, and self-esteem scores were associated with physical anhedonia.

3) when illness- and personality-related independent variables were used together for regression analysis ("combined" model), PAS scores were attributed to elevated emotional distress, self-esteem, poorer family and other significant support, whereas SAS scores were successfully predicted by illness severity, poorer level of other significant support, and task-oriented coping. The "combined" model explained 48% and 38% of the variability in PAS and SAS scores, respectively. The predictive values of negative and other symptoms, side effects, general functioning, and somatization scores did not reach significant levels.

Three questions about the relationships between anhedonia and disorder-related variables were addressed in this study: 1) is hedonic functioning associated with illness-related variables, in particular, with negative and distress symptoms; 2) is hedonic functioning associated with personality-related factors; and, 3) is hedonic functioning of SZ/SA patients predicted by personality-related factors rather than by illness-related variables? In each case, the answer appears to be "yes."

More specifically, consistent with data of previous research (24, 62, 63), we found that the severity of anhedonia, as measured with PAS/SAS, showed a small but significant association with the severity of PANSS negative symptoms (r=0.23–0.26, p<0.05). However, these findings contradict earlier findings that did not discover significant associations (28, 29, 64). These contradictory findings may be affected by personality-related variables. To test this assumption, regression analyses with three sets of variables were applied in this study. These analyses revealed that negative symptoms, indeed, showed significant predictive value for variability of physical anhedonia scores in the framework of an "illness-related" model only, but not when illness- and personality-related measures were entered together as independent variables ("combined" model). Our findings regarding the "illness-related" model are quite consistent with results from multiple regressions from previous research that reported that negative and depressive dimensions were significant predictors of state anhedonia (23). Possible overestimation of the contribution of negative and depressive dimensions

symptoms in the Loas et al. (23) study might be explained, at least in part, by lack of personality-related measures among the independent variables. At the same time, the severity of anhedonia was found to be independent of other PANSS symptoms (positive, activation, dysphoric mood, autistic preoccupations).

Emotional distress is the reaction of an individual to external and internal stressors and is characterized by a mixture of psychological distress symptoms, such as obsessiveness, depression, hostility, hypersensitivity, anxiety, and paranoid ideation (65, 66). Anhedonia might possibly accompany stress because the loss of the pleasure of aiming for a goal and achieving it could lead to immobility (67). Elevated emotional distress experienced by schizophrenia patients was positively associated with symptom expression (33, 38, 39), side effects of antipsychotic agents (68, 69), temperament types, emotion-oriented coping, weak self-constructs (34), and positive family history (70). The present study revealed that emotional distress slightly correlated with PAS/SAS scores, significantly elevated in the "double anhedonics" group, and it was a negative indicator that accounted for about 4.1% of the variance of the PAS scores.

The present findings suggest that the contribution of two illness-related predictors (TBDI and CGI-S) to the variance of the PAS and SAS was 4.1% and 5.5%, respectively; whereas, the contribution of four personality-related predictors (task-oriented coping, self-esteem, family and other significant support) was 24.1% for the PAS and 14.1% for SAS scores. In addition, an exploratory factor analysis previously conducted on this sample indicated that PAS/SAS scores were joined to the main factor together with self-efficacy, coping styles, quality of life, and social support scores (41). In light of these results, it is plausible that anhedonia is associated with personality-related factors rather than psychopathological symptoms. The association between anhedonia and personality-related factors was not surprising. Psychotic patients had significantly lower self-esteem levels than controls (71, 72), which may be a risk factor for the development of psychosis (73). Research has indicated that schizophrenia patients were not flexible in their use of coping strategies or styles (40) and tended to use maladaptive coping styles (42, 74). Within an interactive model of schizophrenia, social support was postulated to serve as a protective factor that facilitates coping abilities (75). Consistent with our findings, individuals with social anhedonia reported less social support (26). An association of greater physical and social anhedonia with poor social functioning in the schizophrenia group was observed (76); but we did not find a significant association of the severity of anhedonia with general functioning as measured by the GAF. No significant association

was observed for PAS/SAS scores and antipsychotic drug-induced side effects.

Taken together, the present findings are consistent with the stress-vulnerability model (77). We assumed that anhedonia among SZ/SA patients appeared to be a trait-like condition rather than a state-dependent phenomenon. This assumption is in accordance with the following evidence:

1) anhedonia is closely associated with poor premorbid adjustment, in particular, the relationship between some premorbid characteristics and physical anhedonia are significant, even ten years into the course of illness (24).

2) anhedonia apparently begins early in life in relation to pathological reactions within the core family (15); first-degree relatives of highly anhedonic schizophrenic probands have a high level of anhedonia (16).

3) self-report measures of physical and social anhedonia among first-episode psychotic patients revealed higher anhedonia in comparison to control subjects (14, 20-22).

4) hedonic functioning deficit did not show strong and consistent relationships with psychotic, negative, or depressive symptoms (24); anhedonia is a construct that is distinct and separate from depression and schizophrenic symptomatology in chronic schizophrenia (29). Pelizza and Ferrari (27) considered anhedonia as a specific subjective psychopathological experience of the negative and disorganized forms of schizophrenia.

5) physical anhedonia was a stable characteristic over a 10-year period and has been proposed to be a trait-like risk factor for the development of schizophrenia (27, 28).

The present study has several limitations. First, acute psychotic patients were unable or refused to participate in the study. The second limitation is associated with the reliability of self-report methodology in research involving severely ill psychiatric patients. Third, the results of the present study might apply only to adult (30–69 years old) individuals with chronic SZ/SA (illness duration: 11–49 years) who tend to be more treatment compliant and more cooperative patients. Finally, the cross-sectional design of this study cannot establish the direction of causality among the variables assessed.

In conclusion, this study suggests that personality-related predictors of hedonic functioning are factors that can potentially be ameliorated by focusing psychotherapy on improving hedonic deficits, thereby enhancing the well-being of SZ/SA disordered patients. Future studies should test the relationship of hedonic functioning with the personality-related factors among younger (prodromal, first-episode) patients with severe mental disorders, as well as the possible role of anhedonia as a candidate endophenotype to schizophrenia.

Competing Interests

Acknowledgments

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