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The Impact of Schizophrenia on Some Aspects of Executive Function among a Sample of Saudi Males

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Abstract: The aim of this study was to investigate the nature of deficits in executive function among a Saudi sample of schizophrenic patients. It also aimed to examine the association between symptoms severity and impairments in executive function. Cross-sectional method was used in this study where cognitive performances of schizophrenia subjects were compared with normal controls (n=40 vs. n=30; M=32.13 years, SD=8.94) by using three neuropsychological tests that are usually used to measure executive functions; the Rey Complex Figure Test (RCFT), the Arabic Rey Auditory Verbal Learning Test (ARAVLT), and STROOP Color-Word Test. In addition, the Positive and Negative Symptom Scale (PANSS) was used with the schizophrenia patients to assess the symptoms severity. The schizophrenia patient groups showed significant impairments in measures of executive functions, verbal and visual immediate and delayed memory, as well as the speed of information and visual-spatial skills. Moreover, the results suggest the relationship between the schizophrenia symptoms (positive and negative) and the performances on the neuropsychological tests were almost similar. Both positive and negative symptoms were predicted by impairments in executive functions, but the relationship between the lower scores in measures of executive functions, and symptoms severity seems to be complex and needs further research.

Keywords: Cognitive functions, executive deficits, neuropsychology, schizophrenia.

Introduction

Schizophrenia is major mental illness, which was first recognized from other forms of psychiatric conditions by the German psychiatrist Emil Kraepelin at the end of the 18-century as 'dementia praecox' [1]. The definition of schizophrenia has been changed through the years. However, according to DSM-5 (i.e. the last version for the widest system for diagnosing mental disorders), schizophrenia is a condition characterized by emotional as well as the cognitive disturbance that last six months and includes at least one month of active-phase symptoms [2].

The lifetime risk to develop this illness is around 0.3-0.7 percent with variation by race/ethnicity, across countries, and by geographic origin (DSM-5), and according to World Health Organization [3] it affects one percent of the world's population. Many studies support the assumption that the combination of a genetic, biological factors and environmental impact (e.g. parental infection and trauma) may play a role in the etiology of schizophrenia [4].

Based on the neuropsychological tests and throughout the course of the schizophrenic disorder, schizophrenic patients were more likely to be impaired [5]. However, Gonzalez-Blanch *et al.* [6] reported that patients at early stages of the illness showed significantly poorer performance in eight different cognitive domains. The most marked deficits were in the speed of processing, executive functions, motor dexterity, and sustained attention. Although a longitudinal neuropsychological study showed that, the patients had a significant cognitive impairment at both baseline and the 2-year follow-up. On the other hand, the finding at baseline showed a significant correlation between executive functions and symptoms specifically with the negative symptoms, while no association was found between the negative symptoms and any cognitive domain after two years [7]. The cognitive decline in patients is present at the onset of illness and does not deteriorate significantly during the lifespan. For example, Elliott *et al.* [8] found that the cognitive deficits seem to have been present at the onset of illness and they persisted despite clinical improvement.

Based on studies reviewed, there is some evidence, though relatively inconsistent, suggest impaired executive function and working memory in schizophrenia patients. These results could be regarded as suggesting and encouraging further investigation the nature of neuropsychological deficits and examining various domains of the cognitive impairments especially the executive functions (EF) as one of the candidate core function, and its relationship to the schizophrenic symptoms.

Problem Statement:

Schizophrenia is one of the most widespread psychiatric disorders. One of several theories that appeared as an attempting to understand the nature of this disorder is the neuropsychological perspective. Only a few studies carried out in the Arab world examined the cognitive functions in several disorders; however, none of them was in schizophrenia disorder. It would be helpful to examine this disorder in an Arabic speaking culture.

Study Objectives:

The current study aimed to achieve the following:

1- Examine the nature and severity of executive function and memory deficits in schizophrenic patients, compared to a matched group of non-psychiatric persons.
2- Explore whether the degree of the executive function deficits is associated with the duration and severity of the schizophrenia by examining the relationships between performance in neuropsychological tests and scores in PANSS.
3- Evaluate the range of factors, which might affect the performance in standard tests of executive functioning by comparing the performance of the two groups.
4- Enrich the existing assessment protocol of schizophrenia at the local level.

Empirical research, data, methodology, and results

Participants included 40 persons with schizophrenia disorder and 30 non-psychiatric/healthy persons. The participants in the experimental group were selected from three in-patient male psychiatric wards (consists of 100 beds) in Al-Amal Complex for Mental Health (ACMH); a specialized hospital that authorized to provide professional help for mental disorders, which is located in Dammam – Kingdom of Saudi Arabia (KSA). All patients were diagnosed by consultant psychiatrists and inclusion criteria with patients: i) DSM-IV-TR diagnosis of schizophrenia disorder determined with the Structured Clinical Interview for the DSM-IV-TR, ii) being an adult and admitted as inpatient during the study period, (iii) have signed consent form for participation, iv) levels of education was not less than six grades. Exclusion criteria were no co-morbidity with intellectual disability, substance abuse or dependence, and neurological disorders that may have an effect on cognitive performance.

All 70 subjects in the clinical group were Saudi nationals, with the mean age of M. = 32.13 years, SD = 8.94. The healthy control group was matched (as closely as possible) to the patient group in relation to the demographic characteristics (i.e. age, and sex), and education level.

Instruments and Material:

The Positive and Negative Symptoms Scale (PANSS). The PANSS is a relatively brief interview, requiring 30 to 40 minutes to complete, consists of 30 items comprising three scales (1) positive scale includes seven positive symptoms; (P1-P7), (2) negative scale includes seven negative symptoms (N1-N7), and (3) general psychopathology scale includes sixteen symptoms related to schizophrenia (G1-G16). Each dimension has a global rating of symptoms severity and each of the 30 items has seven rating points (from 1 = absent to 7 = extreme) according to the standardized instruction [9].

Meanwhile, in order to measure the executive functions, three following NP test was used, which are widely used in the research and clinical settings. The sensitivity and accuracy of these tests in measuring these functions have been approved.

The Rey Complex Figure Test (RCFT): was used to assess the visual memory, planning and organizing skills. The RCFT is a "pen–paper" test, which is consisted of laminated stimulus card (figure) and three blank sheets of paper. Three tasks administrated: (1) a Copy trail, the stimulus card presented in front of the patient while he is drawing the figure. Stimulus card was viewed only in the first one (Copy trail), while the patient is asked to remember the figure in the other tasks and draw it in a blank sheet; (2) the Immediate recall trail was administrated three minutes after the Copy trail is completed and (3) Delayed recall trails is administrated 30 minutes after the Copy trail is completed [10].

The Arabic Rey Auditory Verbal Learning Test (ARAVLT): ARAVLT consists of a set of 15 common words, which were read to the participants at the rate of one word per second, in five consecutive trials (Trials 1 through 5). Each reading was followed by a free recall task, followed by B list (i.e. interference trail) which also consisted of 15 words. In trial-6, the participant is asked to recall the words (from the first list) as much as possible, after 20 minutes the participant is once more asked to recall the first list again, i.e. trail-7, followed by the recognition trail which involves a set of 50 words (15 words from first list, 15 from second list, and 20 new common nouns). The participants are asked to identify the 15 first-list words [11].

STROOP Color-Word Test (SCWT): Many studies showed that the performance on the STROOP test is very sensitive to lesions of the frontal lobes and is commonly used in the clinical setting, and there are no differences between the English and Arabic versions [12]. The STROOP consists of four cards, 21.5 cm x 14 cm; each card has six rows and four columns, that were presented to the participants with this order: Card A (Word printed in black ink), Card C (Colored circles), Card B (color-words) and Card D; response inhibition trail (color-words are printed with incongruent color). The colors used in this test were of the red, yellow, blue, and green. The participants were instructed to read the words, name the colors, and name the ink color of the printed words as quickly and as accurately as possible. The time and errors were calculated in the four subtasks.

Procedure:

The investigator saw each patient individually to complete the interviewing and testing protocol in a separate assessment room in the male psychiatric ward. All patients completed all tests starting by introducing and explaining the nature and objectives of the study to each participant. When the consent and agreement of volunteering were obtained, the testing processes started with the following order: First, presenting the copy part of RCFT; then tried to collect some items from the PANSS for three minutes. Second, presenting the immediate part of RCFT. Third, the free recall on the five consecutive trials (trials 1 to 5) of the ARAVLT, followed by interference list (B), then the free recall of the trail (6). Fourth, all trails of STROOP test (all steps has been followed from the test manual) as it was noted above. Fifth, the participant was asked to recall the figure from RCFT (Delayed recall trail). Sixth, (trial-7) of the ARAVLT followed by asking the participant to identify the 15 words from the first list, out of 50 words presented verbally (Recognition trial). Finally, the participant was asked about the remaining items from the PANSS and about the demographic data, which were missing in the patient chart.

Analysis:

Statistical Package for the Social Sciences (SPSS, 2012) version 21.0 was used for all data entry and statistical analysis. Comparisons of the two groups on demographic, clinical and neuropsychological tests were carried out using analysis of variance (ANOVA).

For the comparison of the neuropsychological indices as dependent variables among study groups, multivariate analysis of covariance (MANCOVA) was used. Multiple regression analysis was used to test if there is a relationship between the change in performance of schizophrenia patients in some neuropsychological tasks and the positive and negative symptoms.

Results:

To examine the nature of EFD in schizophrenia disorder, compared the performance on the neuropsychological test between schizophrenia patients and a group of non-psychiatric persons. As noted in chapter three, the present analysis includes the data of 70 males (M. = 32.13 years, SD = 8.94), which were divided into two groups: (a) schizophrenia patients (N = 40), and (b) healthy control group (N = 30). However, the main demographic characteristics for both groups are summarized in Table (1).

Table (1) The Main Demographic Characteristics of Schizophrenia Patients vs. Control Groups.

Demographic characteristics		SZ N=40 (57.1%)	Controls N=30 (42.9%)	Total N=70 (100%)	P value
Age range (years)	18 to 32	18 (56.3%)	14 (43.8%)	32 (45.7%)	0.890
	33 to 53	22 (57.9%)	16 (42.1%)	38 (54.3%)	
Marital status	Single	32 (82.1%)	7 (17.9%)	39 (55.7%)	0.001
	Married	8 (25.8%)	23 (74.2%)	31 (44.3%)	
Occupational status	Unemployed	26 (96.3%)	1 (3.7%)	27 (38.6%)	0.001
	Employed	14 (32.6%)	29 (67.4%)	43 (61.4%)	
Education	6 to 9 grade	8 (53.3%)	7 (46.7%)	15 (21.4%)	0.009
	10 to 12 grade	23 (76.7%)	7 (23.3%)	30 (42.9%)	
	≥ 13 grade	9 (36.0%)	16 (64.0%)	25 (35.7%)	
Family History	Negative	14 (53.0%)	27 (90.0%)	41 (58.6%)	0.001
	Positive	26 (65.0%)	3 (10.0%)	29 (41.4%)	

Note. Key to abbreviation: N = number of subjects; SZ = schizophrenia. P value sig in Bold.

According to the above table, there was a significant difference between the two groups in education level, marital status, occupational status, and family history. In addition, 22 patients (57.9%) and 16 healthy

persons (42.1%) were over 33 years old. Slightly over eighty-two present (82.1) of the schizophrenia patients were single while the majority of the healthy individuals were married. Although, most of the people in the control group (n = 29) were employed while 26 of the patients were unemployed. Moreover, higher education was completed by 64.0% of the healthy individuals.

The descriptive statistics of the symptomatology and neuropsychological tests indices for all participants reporting means and standard deviations are presented in Table (2), and the results of analysis of variance are shown in Table (3).

Table (2) The Mean and Standard Deviation of All Tests Indices for the Two Groups

Tests Indices	SZ		Controls		Total	
	M	SD	M	SD	M	SD
PANSS						
Positive scale (sum)	15.08	4.60	n/a	n/a	n/a	n/a
Negative scale (sum)	12.65	5.00	n/a	n/a	n/a	n/a
General psychopathology scale (sum)	24.68	5.48	n/a	n/a	n/a	n/a
STROOP						
Card A Time	18.24	6.61	13.14	11.14	16.10	9.09
Card A error	.13	.46	.01	.001	.07	.36
Card B Time	15.54	6.14	10.83	1.70	13.56	5.32
Card B error	.13	.52	.01	.001	.07	.40
Card C Time	19.38	7.50	12.45	2.19	16.46	6.79
Card C error	.30	.79	.01	.001	.17	.62
Card D Time	48.62	30.99	23.08	4.89	37.88	26.87
Card D error	2.15	3.21	.72	.92	1.55	2.60
ARAVLT						
Trial 1	5.10	2.38	7.00	1.54	5.90	2.26
Trials 1-5	35.65	10.20	53.24	6.48	43.04	12.39
Interference score; trail6	6.30	2.85	10.76	2.20	8.17	3.40
Delayed recall; trail 7	5.98	2.77	10.86	2.30	8.03	3.53
Recognition	12.05	2.55	13.76	1.33	12.77	2.28
Perseveration score	4.50	2.80	1.83	1.75	3.38	4.72
Interference Errors (5-6)	2.78	2.41	1.93	1.41	2.42	2.08
Perseveration score for Confabulation	2.08	2.66	1.07	2.36	1.65	2.57

Tests Indices	SZ		Controls		Total	
	M	SD	M	SD	M	SD
Confabulation Score	2.80	3.39	1.28	1.62	2.16	2.87
RCFT						
Copy trail	22.39	7.69	30.38	3.06	25.75	7.32
Time of COPY trail	336.5	174.5	312.9	150.6	326.5	164.2
Immediate recall trail	6.21	4.37	19.19	7.38	11.67	8.66
Delayed recall trail	6.24	3.69	19.76	6.92	11.92	8.53

Note: n/a = not applicable

Table (3) The MANCOVA Results for All Tests Indices Different Groups.

Tests Indices	df	Mean Square	F	Sig.
STROOP				
Card A error	1,64	.26	2.02	.160
Card A Time	1,64	134.71	5.51	.022
Card B error	1,64	.09	.54	.464
Card B Time	1,64	336.94	15.05	.001
Card C error	1,64	.42	1.15	.288
Card C Time	1,64	683.21	19.46	.001
Card D error	1,64	15.84	4.12	.052
Card D Time	1,64	436.44	10.04	.002
ARAVLT				
Trial 1	1,64	18.29	4.31	.042
Trials 1-5	1,64	350.15	12.15	.001
Interference score; trail6	1,64	214.57	10.78	.001
Delayed recall; trail 7	1,64	324.04	18.75	.001
Recognition	1,64	32.39	6.88	.011
Interference Errors (5-6)	1,64	9.84	2.23	.140
Confabulation Score	1,64	48.96	6.31	.015
Perseveration score	1,64	44.23	5.88	.021
Perseveration score for Confabulation	1,64	9.09	1.38	.244
RCFT				

Tests Indices	df	Mean Square	F	Sig.
Copy trail	1,64	689.12	12.52	.001
Time of COPY trail	1,64	499.05	.13	.722
Immediate recall trail	1,64	706.91	18.49	.001
Delayed recall trail	1,64	559.12	14.76	.001

Note: The sig. in Bold

MANCOVA was used to test the main hypothesis, which is related to the existence of significant differences between the two groups in their performance on neuropsychological tests. The age, level of education and occupation were used as covariates because they showed significant effects in the initial analysis of chi-square. As can be seen in Table 3, there are significant differences between the two groups on 14 of the neuropsychological indices. Patients with schizophrenia performed significantly worse on RCFT (all trail), ARAVLT (trails 1 to 7, recognition trail, confabulation, and perseveration responses), and STROOP Color-Word Test (Time of A, B, C, and D). This cognitive pattern indicates significant deficits in attention, psychomotor performance, cognitive flexibility, planning and organizing skills and in particular in executive functions, verbal learning memory, visual memory, the speed of information processing in schizophrenia patient, compared to control subjects.

The internal reliability of the PANSS test was examined using Cronbach's alpha coefficient of the three subscales (positive, negative, and general psychopathology). As described in Table (4), the results indicate that the PANSS test is highly reliable.

Table (4): Cronbach's Alpha Coefficient of the PANSS Test.

PANSS subscales	N of Items	Cronbach's alpha
Positive scale	7	.900
Negative scale	7	.940
General psychopathology scale	16	.956

Positive scale on PANSS is significantly correlated with the score of ARAVLT in trial 1 to 5 ($t = -2.81$, $p = 0.03$), perseveration responses ($t = -2.06$, $p = 0.05$), also, with the raw score of RCFT-delayed recall ($t = -2.16$, $p = 0.03$), in addition, with the STROOP- card D time reaction ($t = 4.15$, $p = 0.001$), and card D error ($t = -3.04$, $p = 0.004$). On the Other hand, Negative scale on PANSS was significantly correlated with the score of ARAVLT in trial 1 to 5 ($t = -3.36$, $p = 0.002$), confabulation ($t = -2.06$, $p = 0.05$), RCFT-delayed recall ($t = -1.98$, $p = 0.05$), STROOP- card-D time reaction ($t = 2.77$, $p = 0.008$), and STROOP- card-D error ($t = 2.40$, $p = 0.02$). Thus, the positive and negative symptoms could predict the change in performance of schizophrenia patients

on some neuropsychological tasks such as EF, delayed visual memory, immediate and delayed verbal memory, and speed of processing information. See Table (5), and Table (6).

Moreover, the model summary presented in Table 7 generally indicates that there is association between the neuropsychological score and positive score (F = 8.47, p = .001) and negative score (F =10.11, p = .001).

Table (5): Regression Analysis for the PANSS-Positive Scale as Predict of Performance in Some Neuropsychological Tasks.

Tests Indices	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
STROOP					
Card A Time	-.03	.092	-.04	-.37	.71
Card A error	-1.38	2.00	-.06	-.69	.50
Card B Time	.33	.23	.21	1.43	.16
Card B error	2.71	1.87	.13	1.45	.16
Card C Time	-.33	.24	-.27	-1.38	.17
Card C error	1.60	1.68	.12	.95	.35
Card D Time	.18	.04	.58	4.15	.001
Card D error	-1.26	.42	-.40	-3.04	.004
ARAVLT					
Trial 1	1.65	.46	.45	3.57	.001
Trials 1-5	-.37	.17	-.55	-2.18	.03
Interference score; trail6	-.73	.68	-.30	-1.07	.29
Delayed recall; trail 7	.57	.56	.24	1.01	.32
Recognition	.06	.37	.02	.16	.88
Perseveration score	-.61	.25	-.40	-2.06	.05
Interference Errors (5-6)	-.38	.48	-.08	-.79	.43
Perseveration score for Confabulation	-.25	.35	-.08	-.70	.49
Confabulation Score	-.10	.30	-.04	-.34	.74
RCFT					
Copy trail	.09	.13	.08	.70	.49
Time of COPY trail	.005	.004	.11	1.28	.21

Tests Indices	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Immediate recall trail	.12	.27	.13	.46	.65
Delayed recall trail	-.59	.27	-.60	-2.16	.04

Table (6): Regression Analysis for the PANSS-Negative Scale as Predict of Performance in Some Neuropsychological Tasks.

Tests Indices	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
STROOP					
Card A Time	-.09	.08	-.11	-1.12	.27
Card A error	-1.59	1.65	-.08	-.96	.34
Card B Time	.24	.19	.17	1.25	.22
Card B error	-.98	1.55	-.05	-.63	.53
Card C Time	-.21	.20	-.20	-1.08	.29
Card C error	-1.57	1.39	-.13	-1.13	.26
Card D Time	.10	.04	.36	2.77	.008
Card D error	1.11	.46	.36	2.40	.02
ARAVLT					
Trial 1	.36	.38	.11	.93	.36
Trials 1-5	-.47	.14	-.79	-3.36	.002
Interference score; trail6	.32	.56	.15	.56	.58
Delayed recall; trail 7	-.15	.46	-.07	-.33	.74
Recognition	.04	.31	.01	.13	.89
Perseveration score	.06	.13	.04	.46	.65
Interference Errors (5-6)	-.18	.39	-.04	-.46	.65
Perseveration score for Confabulation	-.29	.29	-.10	-1.01	.32
Confabulation Score	-.51	.25	-.20	-2.06	.05
RCFT					
Copy trail	.16	.11	.16	1.49	.14

Tests Indices	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Time of COPY trail	.002	.003	.05	.69	.49
Immediate recall trail	.06	.22	.08	.29	.77
Delayed recall trail	-.45	.23	-.52	-1.98	.05

Table (7): Model Summary - ANOVA Results.

PANSS	R	R Square	F	Sig.
Positive scale	.89	.79	8.47	.001
Negative scale	.90	.82	10.11	.001

Table (5), Table (6), and Table (7) shows that the same indices that measure executive functions significantly correlate and predict symptoms severity, as measured by the positive and negative PANSS.

Discussion and Conclusions

The main finding of this study suggests that there are significant differences between participants (patients vs. controls) in the executive functions (EF) as measured by the tests used in the present study. Moreover, the results suggest the relationship between the schizophrenia symptoms (positive and negative) and the performances on the neuropsychological tests are almost similar.

However, the participants with schizophrenia performed significantly well below what was found in the controls persons on almost all the neuropsychological tests except for limited indices of the tests. Thus, for the STROOP test, all indices show a significant difference, except for the error rates of cards A, B, and C. This is very interesting findings since these are not generally related to executive function. The significant differences found in favor of the control group are in the times of reading these cards, and in the error rates and time for the card (D), which is directly related to interference and response inhibition. Thus, the clear significant difference is shown in the indices that are usually attributed to mental flexibility and response inhibition. In other words, findings might suggest that schizophrenic patients suffer from the cognitive processes that are related to executive functions, as measured by the STROOP tasks.

Another possible explanation for the poor performance of schizophrenic patients in the STROOP test is that the time which was taken to complete the cards was longer for schizophrenia group than that the of the control group (see Table 2). Thus, impaired speed of information processing might also explain this deficiency in the patient with schizophrenia. However, as expected, impaired performances on the STROOP confirm the first part of hypothesis in that patient group show impaired executive function.

For the verbal learning memory, visual memory, and speed of information processing, similar findings are revealed as shown in Tables (2) and (3). Participants in the control group did significantly better than those in the schizophrenic groups on all indices of ARAVLT, (except for interference and perseverated confabulation) and in all two indices of immediate and delayed visual-spatial memory. Additionally, the patient group showed significantly poor performance than the control on the visual-spatial skills as measured by the copy trial of RCFT. Hence, the first hypothesis has been confirmed in that the patient groups showed significant impairments in measures of executive functions, verbal and visual immediate and delayed memory, as well as the speed of information and visual-spatial skills.

The findings are consistent with the recent and earlier findings of EFD in schizophrenia [12]. However, some authors claim that the scores on RAVLT reflect the participant's socioeconomic and culture [13].

Furthermore, the score in measures of executive functions, attention, cognitive flexibility, the speed of information processing, immediate verbal learning memory, and delayed visual memory are significantly associated with scores on the positive scale of PANSS and with scores on the negative scale of PANSS. In other words, some of the neuropsychological indexes score show correlations with both the PANSS-Positive scores and the PANSS-Negative scores. This is clearly shown in Table (5) and Table (6), that show the results of multiple regressions. More specifically, higher positive symptoms are predicted by significantly lower score on STROOP (card D time, and error rate), ARAVLT (trail 1, trails 1 to 5, and perseveration), and RCFT (delayed recall).

Higher negative symptoms were also predicted by significantly lower score on STROOP (card D time, and error rate), ARAVLT (trails 1 to 5, and confabulation), and RCFT (delayed recall). Therefore, the neuropsychological test that would predict the positive and negative scores was mainly represented on indices of executive functions (flexibility and response inhibition), verbal learning and recall, of the ARAVLT (including perseveration), and the delayed recall of RCFT. However, although this finding seems to be expected and is an addition to the existing literature, it needs further verification. Thus, the hypotheses concerning the correlations between the positive and negative scores as a predictor for performance on some neuropsychological tasks were only partially confirmed.

However, findings in this line is consistent with many studies that showed that the higher negative symptoms scores correlated to the lower score in measures of executive functions, attention, cognitive flexibility, speed of information processing, immediate verbal learning memory, and delayed visual memory [14], while other studies correlate the deficits in the speed of information processing, immediate verbal learning memory, and delayed visual memory to the higher positive symptoms scores [15]. In contrast, other authors found that there is no relationship or the relationship within the normal range between the PANSS scores

(positive and negative) and neuropsychological score. Indeed, the relationship between the performance on EF tests and PANSS score (severity of schizophrenia symptoms) is very complex [16].

However, many factors could affect the relationship between the performance on EF tests and symptomatology, such as 1) The side effects, or/and the long-term, or/and the doses of antipsychotic drugs, as shown in Bozikas et al. (2004) study that the psychopathology and cognitive deficits in schizophrenia are caused, at least partially, by distinct pathophysiological processes. 2) Duration of the disorder. 3) The variation on the measures, which were used in the studies and its sensitivity. In addition, the higher scores on symptom rating scales (PANSS) might be explained by the effect of the preserved cognitive performance of the patients on shown the symptoms, and thus reducing the detection of the real relationship between cognitive impairment in EF and schizophrenia symptoms [17]. More research is necessary to confirm the effects of these factors in the differences between the two groups in an Arabic country.

It is worth noting that in the present study, nearly 57.9% of the schizophrenia patients were older than 33 years old. Also, 31 of them had lower education levels (less than 13 grades). In addition, the majority of them were single and unemployed than the healthy control persons. Previous studies indicated that these characteristics had a large influence on many tests, thus it might be related to poor performance of EF tests and poorer clinical outcomes in schizophrenia patients [18].

Limitations, and Strengths of the Study

In this study, a comprehensive test was used had a good reliability, validity, and were sensitive to the impairment and symptomatology. Moreover, our inclusion and exclusion criteria were similar to previous studies and, therefore, contributed to the comparability of data with the international data. The findings cannot be overgeneralized to the general population of schizophrenia patients because the sample was from one area and only male patients were included. In addition, excluding the schizophrenia patients with multiple comorbidities (e.g. intellectual disability, substance abuse or dependence, and neurological disorders), thus, the participants needed to fulfill several inclusion criteria.

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أثر مرض الفصام على بعض الوظائف التنفيذية: عينة من الذكور السعوديين

الملخص: هدفت الدراسة إلى التحقق من طبيعة الضعف أو العجز في الوظائف التنفيذية لدى عينة من مرضى الفصام بالمملكة العربية السعودية، وفحص العلاقة بين ضعف الأداء على مقاييس الوظائف التنفيذية وشدة الأعراض (الإيجابية والسلبية) لدى مرضى الفصام. استخدمت في هذه الدراسة المنهجية الوصفية (المستعرضة، المقطعية) حيث تمت مقارنة أداء مرضى الفصام بعينة أفراد عاديين (مطابقة في العمر، الجنس والمستوى التعليمي) على ثلاثة اختبارات نفسية عصبية: اختبار الذاكرة "ريي" للتعلم اللفظي والسمعي، اختبار المرونة العقلية "ستروب"، واختبار شكل "ريي". وإضافة لهذه الاختبارات، تم استخدام مقياس الأعراض الإيجابية والسلبية مع مرضى الفصام لتقييم شدة الأعراض. أوضحت النتائج وجود فروق في القدرات المعرفية بين مجموعات البحث، حيث كان أداء مجموعة مرضى الفصام أضعف بكثير من أداء مجموعة الأفراد العاديين في اختبارات الوظائف التنفيذية، والذاكرة اللفظية والبصرية (قصيرة وبعيدة المدى)، سرعة معالجة المعلومات، والتآزر البصري الحركي. كما أوضحت النتائج أن ضعف الأداء في الوظائف التنفيذية يتنبأ بشدة الأعراض ولكن العلاقة بين ضعف الأداء والأعراض السلبية والإيجابية تبدو تقريباً متشابهة.

الكلمات المفتاحية: الوظائف المعرفية، عيوب الوظائف التنفيذية، علم النفس العصبي، الأعراض الإيجابية والسلبية، الفصام.