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ABSTRACT • Objective : To compare the intellectual efficiency of people with schizophrenia to healthy subjects, and within schizophrenics compare patients with predominant negative symptoms and those with positive symptoms. **Methods :** A case-control study was conducted between September 2013 and September 2014 and enrolled 56 participants (28 schizophrenic patients and 28 controls). The Cattell Culture Fair II Intelligence test (Cattell 2) was used to measure intellectual functioning whereas PANSS (Positive and Negative Syndrome Scale) scale was used to assess symptom severity. **Results :** The control group was significantly associated with higher level of IQ test. A negative correlation was found in schizophrenic patients between the negative symptoms and IQ test ($r = -0.710$, $p < 0.001$). However, no association was found between the positive symptoms and the IQ test ($r = 0.229$, $p = 0.241$). **Conclusion :** This study is the first to evaluate the effect of schizophrenia on cognition and attainment. The psychopathological approach and the new therapeutic and psychosocial strategies led clinicians to reevaluate their therapeutic objectives based essentially on the evaluation of cognitive abilities in order to improve the prognosis of schizophrenia. Clinicians will improve their therapeutic management of schizophrenic subjects by applying new scientific advances in the cognitive domain in their clinical practice.

Keywords : schizophrenia; schizoaffective; intellectual efficiency; psychotic symptoms; cognitive psychology; clinical psychology

INTRODUCTION

Schizophrenia is characterized by the presence of psychotic symptoms as well as by relational, affective and professional difficulties [1]. It is recognized nowadays that cognitive disturbances are also part of this picture [2]. Cognitive abnormalities associated with schizophrenia have long been considered negligible compared to positive and negative symptoms, the latter being considered to be the direct cause of cognitive dysfunction [2].

The cognitive domain concerns cognitive psychological processes on which are based our perceptions, our thoughts, and our behaviors. These processes are essential in virtually all daily actions and more specifically during perception, targeted action and intellectual activities such as learning and problem solving [3]. In addition, social cognitions, described as difficulties in identifying emotions, feeling connected to others, inferring people's thoughts and reacting emotionally to others, are also considered to be part of the cognitive domain [4]. The cognitive state of the schizophrenic patient is therefore important for predicting individual capacities and social reintegration.

Intellectual efficiency is one component of cognitive functioning and may be an indicator of vulnerability to developing psychotic symptoms [5]. Moreover, a slight alteration of intellectual functioning exists before the onset of the disease [6], which gives an additional argument to the neuro-developmental model of schizophrenia [6].

Numerous researches assigned a primary role to cognitive impairment of schizophrenia and presymptom development. These disorders are often present before the onset of the disease in approximately more than 80% of the patients [7-8]. A retrospective study [9] showed that children who later developed schizophrenia had a deteriorated performance in verbal and nonverbal intelligence tests at age 8. A meta-analysis conducted by Woodberry *et al.* [10] showed that the premorbid IQ of schizophrenic patients was 94.7 for an average IQ of control subjects of 100. In addition, Hughes and colleagues [11] showed that there was a correlation between negative symptomatology and general deficient intellectual performance in chronic schizophrenic patients.

The primary objective of our study was to compare the intellectual efficiency of people with schizophrenia to healthy subjects. The secondary objectives were: 1) to compare the intellectual efficiency of schizophrenic subjects with predominantly negative symptoms and those with predominantly positive symptoms; 2) to compare intel-

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lectual capacities of patients with schizoaffective disorders and those with paranoid schizophrenia.

More than 85% of people with schizophrenia have cognitive impairment [7]. Our study is focused only on intellectual efficiency, in particular on fluid intelligence which refers to the processes involved in inductive reasoning tests using nonfigurative material (series laws, matrices, classical analogies) and concerns both the relationship-building and concept-forming capacities; it relies on the ability to acquire new knowledge and on the inferential reasoning needed to solve new problems.

MATERIAL AND METHODS

Study design and participants

A case-control study was conducted at the Psychiatric Hospital of the Cross – Lebanon, between September 2013 and September 2014. We recruited 56 participants, 28 patients with schizophrenia and 28 healthy control subjects with no major psychopathology, matched for age, sex, and educational level. The Psychiatric Hospital of the Cross, Ethics and Research Committee, in compliance with the hospital's regulatory research protocol, waived the need for an approval based on the facts that it was an observational study that respected participants' autonomy and confidentiality and induced minimal harm to them.

Patients with a diagnosis of schizophrenia, aged between 30-60 years old, from mental illness for at least one year, admitted to the Psychiatric Hospital of the Cross for psychotic relapse for at least two weeks and treated for two months, were included in the study.

The diagnosis of schizophrenia was made according to the criteria of the Diagnostic and Statistical Manual of Mental Disorders – The American Psychiatric Association (DSM V-TR) by the psychiatrists dealing with the Psychiatric Hospital of the Cross.

Individuals were excluded if they had: • any other mental illness • a diagnosis of alcohol or substance dependence • a history of cranial trauma • an inability to understand instructions for intelligence tests and • sensory disorders, particularly visual.

Clinical and psychiatric evaluations

Clinical observations and interviewing of the patients were done in four phases: the first, nondirective, aimed at establishing contact, observe spontaneous behavior and identify major problems; the second, semi-structured, systematically sought the presence of symptoms by appreciating their severity; the third, structured, to assess mood, anxiety, spatial and temporal orientation and abstract reasoning; the fourth, directive, to specify the information and to evaluate the patient at the psychological level.

Information concerning treatment, symptoms, history of psychiatric illness, family history of psychiatric illness, the age of onset of the disorder, the number of hospitalizations, the diagnosis made at each hospitalization, the presence of comorbidities, were collected from medical files.

Assessment of general intelligence factor

The Cattell Culture Fair II Intelligence test (Cattell 2) developed by Horn & Cattell (1982) [12] was used to assess intellectual functioning. It is designed to test non-verbal intelligence while minimizing cultural or educational biases and involves only the ability to perceive relationships between shapes and figures. It consists of four subtests with different perspectives, in order to obtain a composite measure of intelligence that is not based on a single type of problem solving [14].

Subtest 1, series (12 items): Progressive and incomplete series are presented to the subject who must select among the 5 answers proposed, that which completes the series.

Subtest 2, classifications (14 items): Five figures are proposed. The subject must identify the one figure that differs from the others.

Subtest 3, matrices (12 items): The patients must correctly complete a drawing by choosing the missing part of the five answers.

Subtest 4, topology (8 items): The task consists in choosing from among five responses the figure which fulfills the same conditions as those involved in the model figure [13-14].

For each subtest, the subject exercises with some examples before starting the test itself.

The correction of the test is made using the correction grid. For each subtest, one point is given per correct answer, with a maximal score of 46 points.

According to the test manual, the average score for adults is 29 (for men: $M = 29.43 \pm 7.21$ and for women: $M = 28.2 \pm 5.80$).

The Intelligence Quotient (IQ) is calculated using the following formula: $IQ = 100 \pm (xi - x)$ standard deviation [14-15].

Evaluation of positive and negative symptoms

The PANSS scale, previously validated in its Arabic version in Lebanon [16], is a 30-item questionnaire, originally organized into separate scales for positive symptoms (seven items), negative symptoms (seven items) and general psychopathology (16 items) as designed by Kay *et al.* to assess the severity of psychopathology in adult patients with schizophrenia and other psychotic disorders [17]. All individual items are scored with values from 1 to 7, with 1 reflecting the absence of symp-

toms and 7 reflecting extremely severe symptoms. The scores for these scales are calculated by summation of ratings across component items. Therefore, the potential ranges are 7 to 49 for the Positive and Negative Scales and 16 to 112 for the General Psychopathology Scale [17]. The PANSS questions were administered to both patients and controls.

Data analysis

Data entry and analysis were performed on SPSS software version 23. Student's t-test was used to compare IQ test continuous variables between the case-control group and schizophrenic patients, the type of schizophrenia and having a positive or negative subtype. Pearson correlation was used for linear correlation between continuous variables, IQ test and positive, negative symptoms. Significance was defined as a *p*-value less than 0.05.

RESULTS

Characteristics of the sample population

Overall 56 participants were enrolled in the study. The mean age of schizophrenic patients was 44.79 ± 6.56 years versus 43.18 ± 6.22 years for the controls. Average years of education for patients was 10.86 ± 3.78 compared to 11.32 ± 3.83 for the control group.

The mean on the IQ test for schizophrenic patients was 75.71 ± 12.98 while the mean Cattell score was 18.93 ± 5.37 . On the other hand, the mean IQ test for the control group was 100.61 ± 9.46 while the mean Cattell score was 29.61 ± 3.97 .

The mean positive PANSS scale for schizophrenic

TABLE I
CHARACTERISTICS OF THE SAMPLE POPULATION

	Patients Frequency (%)	Controls Frequency (%)
Gender		
Male	14 (50.0%)	14 (50.0%)
Female	14 (50.0%)	14 (50.0%)
Diagnosis		
Paranoid schizophrenia	14 (50.0%)	–
Schizoaffective	14 (50.0%)	–
	Mean ± SD	Mean ± SD
Age	44.79 ± 6.56	43.18 ± 6.22
Years of education	10.86 ± 3.78	11.32 ± 3.83
Cattell score	18.93 ± 5.37	29.61 ± 3.97
IQ	75.71 ± 12.98	100.61 ± 9.46
P-PANSS	20.00 ± 5.70	–
N-PANSS	20.68 ± 5.54	–
Composite score	-0.68 ± 7.69	–

IQ: intelligence quotient
PANSS: positive (P) & negative (N) syndrome scale

patients was 20.00 ± 5.70 , the negative PANSS scale was 20.68 ± 5.54 while the composite score was -0.68 ± 7.69 . Half of the patients had a paranoid schizophrenia and half of them had a schizoaffective disorder.

Details regarding the characteristics of the participants are shown in table I.

Association between IQ test & case-control, diagnosis of schizophrenia & positive, negative subtypes

Table II displays the associations between the IQ test and case-control group, diagnosis of schizophrenia and P-PANSS, N-PANSS. The control group was significantly associated with higher level of IQ test ($p < 0.001$). Schizo-affective patients were significantly associated with an increased level of IQ ($p = 0.015$). Patients with positive symptom predominance were significantly associated with higher level of IQ ($p < 0.001$).

Correlation between IQ test and positive (P) & negative (N) PANSS subscales

Figure 1 showed a negative correlation between negative symptoms and IQ test ($r = -0.710$, $p < 0.001$). However, no association was found between positive symptoms and the IQ test as shown in figure 2 ($r = 0.229$, $p = 0.241$).

DISCUSSION

This is the first study in Lebanon that evaluates IQ and schizophrenia symptomatology in a sample of schizophrenic patients. The results obtained with the Cattell 2 test showed a significant difference between the cases and controls groups. This difference allows us to confirm that schizophrenia affects intellectual capacity. It is recognized today that cognitive deficits are a central aspect of schizophrenia and can explain deficit in the daily functioning more than the influence of positive and negative symptoms in this area [18]. In fact, patients have a difficult time forming a conceptual framework to under-

TABLE II
ASSOCIATION BETWEEN THE IQ TEST AND CASE-CONTROL, DIAGNOSIS OF SCHIZOPHRENIA & PANSS SCALE

	IQ	<i>p</i> -value
Case-Control		
Patient	75.71 ± 12.98	< 0.001
Control	100.60 ± 9.45	
Schizophrenic patients		
Paranoid schizophrenia	69.92 ± 11.02	0.015
Schizoaffective	81.50 ± 12.50	
Composite score		
Positive subtypes	84.13 ± 9.93	< 0.001
Negative subtypes	66.00 ± 8.56	

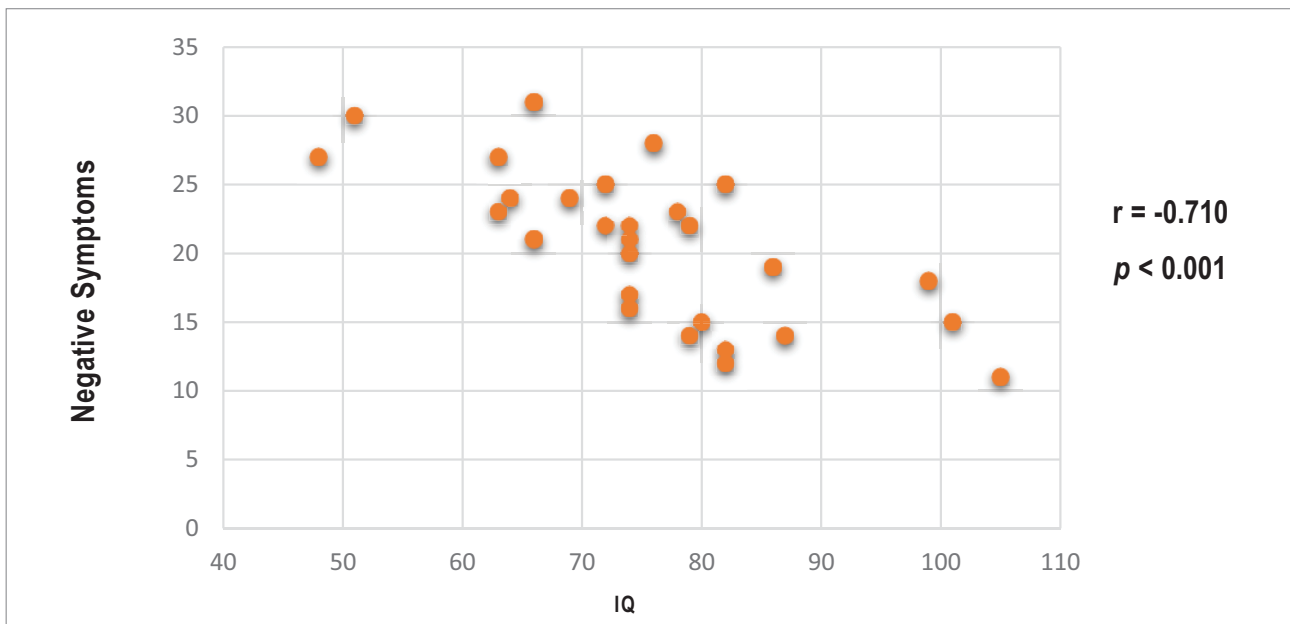


Figure 1. Correlation between the IQ test and N-PANSS

stand ambiguous stimuli [19]. Schizophrenia patients have also trouble adapting to changes in the environment that require different behavioral responses [20-21]. Self-care, social, interpersonal, community, and occupational functions are all associated with executive functioning in schizophrenia [22-25]. Thus, altered intellectual functioning would be essential in schizophrenia [26]. A study developed by Frith [27] considers cognitive disorders to be fundamental disorders of the disease. It suggests that

the disorganization of thought and also delusions and hallucinations originate from cognitive impairment, not the reverse [27]. A retrospective study showed that children who later developed schizophrenia had a deteriorated performance in verbal and nonverbal intelligence tests at the age of 8 years and in arithmetic skills at the age of 11 years [9]. A study done by Kendler and colleagues [28] showed that a low IQ assessed in late adolescence is a robust risk factor for subsequent onset of

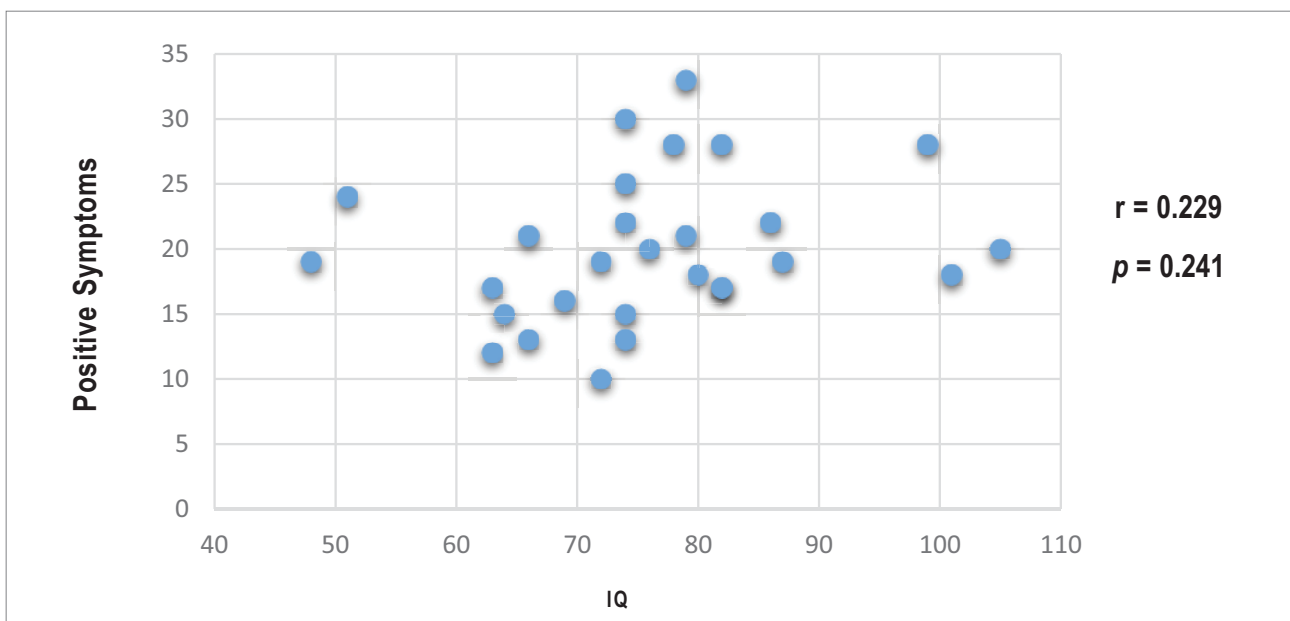


Figure 2. Correlation between the IQ test and P-PANSS

schizophrenia. In other words, the risk of developing schizophrenia increases when the individual has a lower IQ [28].

Our study showed also a significant association between the intellectual capacity and paranoid or affective subtypes. A study of clinically stabilized hospitalized patients showed a higher level of performance in bipolar patients compared to schizophrenics [29]. Schizoaffective subjects have higher general intellectual abilities compared to paranoid schizophrenic subjects. Several studies point the existence of epidemiological, clinical, cognitive and genetic characteristics shared by schizoaffective and other disorders with psychotic characteristics such as bipolar with psychotic features [30-31]. However, there is a difference in levels or severities of these characteristics according to the clinical picture of schizophrenia [32]. In general, schizoaffective disorder would have a less adverse clinical course than schizophrenia and its prognosis would be somewhat better than the prognosis of schizophrenia [33].

We found that the intellectual capacities measured by the intellectual quotient of schizophrenic subjects belonging to the “positive subtype” are significantly higher than those of the subjects belonging to the “negative subtype”.

The negative symptoms are strongly correlated with social disintegration and cognitive deterioration [27]. Hemsley suggests that the negative signs of schizophrenia reflect a strategy adopted by the patient to overcome the cognitive abnormalities underlying positive symptomatology [34]. If the positive symptom is due to an excess of stimulation, withdrawal of all activity would be a defense mechanism to reduce these stimulations [34]. Thus, for Hemsley, the schizophrenic subject would suffer from an overload of the information processing system and attempts to adapt to the disorder would lead the patient to a cognitive slowdown [34]. However, Frith considers negative symptoms as a defective coping strategy because he feels that this strategy would not allow the patient to function better and would lead to a greater disability than to show only positive symptoms [27].

When we controlled the influence of negative and positive symptoms on intellectual efficiency, only the correlation with the negative symptoms was significant, whereas there was no correlation with the positive symptoms. The link between cognitive disorders and schizophrenic symptoms remains unclear. A study conducted by Ventura *et al.* suggested that negative symptoms are correlated with performance at many neuropsychological tests [35]. Negative symptoms such as cognitive disorders are highly predictive of impaired psychosocial function in patients with schizophrenia [36].

The literature does not, however, provide robust argu-

ments in favor of a link between cognitive disorders and positive symptoms. Frith considers hallucinations are due to a cognitive deficit in the perceptions of his own intentions in voluntary actions [37].

It is now recognized that cognitive deficits rather than positive and negative symptoms are more likely to explain daily functioning [26].

On the other hand, treatments that act effectively on positive symptoms remain relatively ineffective on cognitive deficits. Thus, the results obtained in our study reveal that there is no relationship between intellectual efficiency and positive symptoms.

Limitations

The sample size was insufficient to constitute a representative sample of the studied population. It would, therefore, be necessary to increase the sample size. We took only patients having schizophrenia; it would be interesting to study other mental illnesses as well.

Moreover, defining a pathology such as schizophrenia must take into account the intraindividual variability as well as the different evolutionary moments of the individual. Moreover, the intensity of the psychotic symptoms and the absence of insight in the patient may make it difficult to evaluate certain indicators or symptoms.

CONCLUSION

Intellectual efficiency is not affected in the same way in all schizophrenic subjects but according to the symptomatology and subtypes of schizophrenia or even according to the severity of the symptoms of the disease. Thus, the management of schizophrenia must not be limited to symptoms, but must also take into consideration cognitive deficits, which are the causes of an essential part of the crucial disorders of social cognition and quality of patients' lives.

The psychopathological approach and the new therapeutic and psychosocial strategies lead clinicians to reevaluate their therapeutic objectives based essentially on the evaluation of cognitive abilities in order to improve the prognosis of schizophrenia, a still severe and long-lasting duration mental disorder. This study presents the interest of opening a new field of research on schizophrenia that is a source of cognitive and clinical psychology. Similarly, clinicians will improve their therapeutic management of schizophrenic subjects by taking into account, in their practice, scientific advances in the cognitive domain.

Conflicts of interest and funding

The authors have nothing to disclose.

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