*IOSR Journal Of Pharmacy And Biological Sciences (IOSR-JPBS)*
*e-ISSN:2278-3008, p-ISSN:2319-7676. Volume 18, Issue 5 Ser. 1 (Sept. – October. 2023), PP 39-43*
*www.Iosrjournals.Org*

# Cognitive Inhibition And Impulsive Behavior In Subjects With Schizophrenia.

Yassine Benhaddouch[1], Karima Hajji[1], Nour El Houda Fares[1], Amina Ouaati[1], Soumaya Benmaamar[2], Amine Bout[1], Chadia Aarab[1], Samira El Fakir[2], Rachid Aalouane[1]

[1] *Psychiatry-Addictology Department CHU Hassan II of Fez (Morocco)*
[2] *Epidemiology Department of the Faculty of Medicine and Pharmacy of Fez (Morocco)*

***Abstract:***
***Introduction:*** *Impaired cognitive function has beeń identified in schizophrenia. However, to date Several studies have shown a correlation between cognitive inhibition and impulsive behaviors, whereas some others have not reported such an association. The objective of our study was to evaluate mental flexibility, cognitive inhibition capacity and impulsivity in schizophrenic patients, as well as to look for the existence of correlations between them.*
***Patients and method:*** *Our sample includeď 52 patients with schizophrenia, whose PANSS score was below 40. These patients validateď the inclusion criteria for a research protocol. This assessment waś done using the BIS-11 impulsivity scale. For the assessment of executive functions, we useď the Stroop Test, the Trail Making Test (TMT). We then compared performance between the two impulsive and non-impulsive groups.*
***Results:*** *The performance of impulsive schizophrenic subjects was impaired compared to non-impulsive subjects on all tests (Stroop, TMT). These differences were mostly significant on the TMT-b and the Stroop dimensions.*
***Conclusion:*** *Our results suggest that executive functions could serve as specific markers for subjects at high risk for impulsivity. Nevertheless, experimental tests seem necessary to interpret the predictive value of our results.*
***Résumé :***
***Introduction :*** *L'altération des fonctions cognitives a ét́e identifiée dans la schizophrénie. Cependant, à ce jour Plusieurs travaux ont montré une corrélation entre inhibition cognitive et comportements impulsifs, alors que certains autres n'ont pas rapporté une telle association. L'objectif de notre étude était d'évaluer la flexibilité mentale, la capacité d'inhibition cognitive et l'impulsivité chez les patients schizophrènes. Puis, chercher l'existence de corrélations entre eux.*
***Patients et méthode :*** *Notre échantillon a comporté 52 patients souffrant de schizophrénie, dont le score PANSS était inférieur à 40. Ces patients ont validé les critères d'inclusion d'un protocole de recherche. Cette evaluation a ét́e faite en utilisant l'échelle d'impulsivité BIS-11. Pour l'évaluation des fonctions exécutives, nous avons utilisé le Test de Stroop, le Trail Making Test (TMT). Nous avons ensuite comparé les performances entre les deux groupes impulsifs et non impulsifs.*
***Résultats :*** *Les performances des sujets schizophrènes impulsifs étaient altérées en comparaison à celles des non impulsifs au niveau de tous les tests (Stroop, TMT). Ces différences ont atteint un seuil de significativité au niveau du TMT-b et les dimensions du Stroop.*
***Conclusion :*** *Nos résultats suggèrent que les fonctions exécutives pourraient servir de marqueurs spécifiques pour les sujets à haut risque d'impulsivité. Néanmoins, des tests expérimentaux semblent nécessaires afin d'interpréter la valeur prédictive de nos résultats.*
***Conflict of interest:*** *the authors declare that they have no conflict of interest.*

---

Date of Submission: 19-09-2023 Date of Acceptance: 29-09-2023

---

## I. INTRODUCTION:

Schizophrenia is a common disease. It affects one percent of the general population (1). Heteroaggressive acts are frequent reasons for hospitalization and compromise the socio-professional integration of patients (1). The media coverage of these acts reinforces the popular belief that schizophrenic patients are violent individuals. A better knowledge of heteroaggressive acts and an adapted management could improve the treatment of schizophrenia.

Executive functions are involved in complex cognitive processes such as inhibition, strategy initiation, cognitive flexibility, planning, execution and control of motor and cognitive activities directed towards a specific goal requiring a high level of integration (2). Thus, they are solicited each time the subject is faced with a new

situation requiring an adapted behavior (3). The impairment of these functions is among the most classically and frequently documented abnormalities in schizophrenia (4, 5).

Cognitive inhibition, i.e. the ability to avoid irrelevant information entering working memory and to reduce the activation of stimuli that are irrelevant to the task in hand. It is the most sensitive executive function in schizophrenia, is central to the processes of control of cognitive activity (6) and plays a crucial role in executive functioning and may be related to impulsivity (7). It has been little explored in schizophrenia, even though it is involved in resistance to antipsychotic drugs.

Several studies have shown a correlation between cognitive inhibition and impulsive behavior, whereas some others have not reported such an association. The diversity of results appears to be related to differences in the populations examined and the clinical tools used.

The aim of our current study is to assess mental flexibility, cognitive inhibition and impulsivity in schizophrenic patients. Then, to look for the existence of correlations between cognitive inhibition, mental flexibility with impulsive behavior in subjects with schizophrenia.

## II. MATERIALS AND METHODS:

We conducted a cross-sectional study spread over six months, from January 1 to June 1, 2019, with a primary focus on patients with schizophrenia according to DSM-V criteria and hospitalized in the psychiatry department of the Hassan II University Hospital of Fez.

Each patient was interviewed under similar conditions according to an operating form considering sociodemographic data, anamnestic data of the disease, and on the management including the course of care, as well as the notion of clinical stabilization. All the patients interviewed were stabilized at the time of testing on antipsychotic medication.

In this study we included patients diagnosed with schizophrenia according to the DSM-5, who were consenting and cooperating, hospitalized during the study period, and who had clinical stabilization confirmed by PANSS scores. Excluded patients were those who were illiterate, or who refused to participate in the study, and also patients with hearing or visual impairments, as well as patients who were perpetrators of homicide or self-harm

All patients were assessed by the Positive and Negative Symptoms Scale (PANSS), to measure the severity of symptoms in schizophrenic subjects. Impulsivity was assessed by the Barratt Impulsivity Scale (BIS 11), which is a self-administered questionnaire that assesses three sub-dimensions: motor impulsivity (acting without thinking), cognitive impulsivity (rapid cognitive decision making) and planning difficulty (present orientation and lack of future orientation).

Suppression function is assessed by the Trail Making Test (TMT), which measures mental flexibility, and is conducted in two stages.

Braking function is assessed by the Stroop Test, which measures inhibition ability using 3 indices: temporal (Stroop inter-time), self-corrected errors (Stroop inter-EAC), and uncorrected errors (Stroop Inter-ENC).

Frequencies were measured for categorical variables. Means and standard deviations were used for quantitative variables. Student's t test in bivariate analysis was used to test the associations between impulsivity, suppressive function, and braking function. Correlation was used to test associations between the impulsivity scale and tests of braking and suppressive function.

In all analyses, the significance level was maintained at $<0.05$. Statistical analyses were performed using EPIINFO.

## III. RESULTS:

A total of 52 patients were recruited for the study, whose PANSS score was below 40.

It was found that there were as many women (50%) as men (50%), with a mean age of 34.60 years + 8.8, single people were the most represented with 78.80%, a low socio-economic level in 80.80% of the patients, and the majority of these patients were without profession (78.90%).

The study of the suppressive function using the Trail Making Test (TMT), found that the mean of the first and second part of the test were higher in impulsive subjects compared to non-impulsive subjects, with significant correlations for the second part of the test (Table 1).

Analysis of the braking function using the Stroop test, found that the inter-timing indices, self-corrected errors and uncorrected errors were higher in impulsive subjects than in non-impulsive subjects with statistically significant correlations (Table 1).

The univariate study of the three parameters of impulsivity according to the Barratt Impulsivity Scale, finds a positive correlation with the tests of braking and suppressive function for the different dimensions of impulsivity, but it is significant for the dimension of motor impulsivity with the interference of time, self-corrected errors and uncorrected errors of the Stroop test (Table 2).

**Table 1: Association between cognitive inhibition and tests assessing suppressive and braking function.**

| PARAMETERS | **IMPULSIVE PATIENTS** | **NON-IMPULSIVE PATIENTS** | **P VALUE** |
|---|---|---|---|
| **TMT a (Secondes)** | 85,5 +/- 22,20 | 77,33 +/- 34,75 | 0,31 |
| **TMT b (Secondes)** | 233,88 +/- 66,44 | 213,13 +/- 76,75 | **0,03** |
| **Stroop inter-temps** | 108,75 +/- 67,86 | 102,60 +/- 40,46 | **0,04** |
| **Stroop inter-EAC** | 6,65 +\- 3,22 | 2,78 +/- 1,56 | **0,01** |
| **Stroop inter-ENC** | 7,78 +/- 4,56 | 4,33 +/- 3,24 | **0,01** |

**Table 2: Correlation between impulsivity according to the Barratt Impulsivity Scale and tests assessing suppressive and braking function: results of univariate analysis.**

| PARAMETERS | **BIS motrice** | **BIS cognitif** | **DIFFICULTY IN PLANNING** |
|---|---|---|---|
| **Stroop inter-temps** | 0,40 [**p = 0,01**] | 0,13 [p = 0,3] | 0,04 [p = 0,16] |
| **Stroop inter-EAC** | 0,36 [**p = 0,02**] | 0,24 [p = 0,07] | 0,21 [p = 0,23] |
| **Stroop inter-ENC** | 0,31 [**p = 0,02**] | 0,23 [p = 0,08] | 0,13 [p = 0,33] |
| **TMT a** | 0,16 [p = 0,23] | 0,05 [p = 0,69] | 0,13 [p = 0,35] |
| **TMT b** | 0,10 [p = 0,39] | 0,14 [p = 0,30] | 0,04 [p = 0,75] |

## IV. DISCUSSION:

In schizophrenic subjects, impulsivity can result in aggression, suicide attempts, substance abuse, risk-taking behaviors. It therefore has a significant impact on the evolution of the schizophrenic disorder.

Several studies have evaluated the prevalence of violent behavior in the population of schizophrenic patients, with often contradictory results. We note that among the studies reviewed, all the subjects included are both male and female. Only Lindqvist and Allebeck (8) studied men and women separately.

Swanson et al (1990) showed that, in the general population, the risk of violent behavior is multiplied by six for an individual with a diagnosis of schizophrenia, by ten for an individual with a diagnosis of schizophrenia and a comorbidity, and by 17 for an individual with a diagnosis of schizophrenia and a psychoactive substance use (9).

Lovell et al (2008) showed that the number of assaults and violent behaviors experienced by individuals with schizophrenia is significantly higher than in the general population (10).

Douglas et al in a systematic review estimates that suicide in schizophrenic subjects is 13 times more frequent than in the general population (11). Similarly, a study shows that high impulsivity in schizophrenic patients is responsible for a high risk of suicidal acts (12).

In our study, we evaluated the executive functions in a sample of schizophrenic individuals. Firstly, we evaluated the impulsivity threshold of these individuals according to the score obtained after taking the BIS 11, a score higher than 72 means a high degree of impulsivity and a score between 52 and 71 translates into a normal degree of impulsivity (13). Next, mental flexibility and cognitive inhibition ability were compared between impulsive and non-impulsive subjects. Thus, our results could suggest that executive functions are more impaired in impulsive schizophrenics. This finding is consistent with the majority of previous studies agreeing on the existence of impaired executive functions in patients with progressive schizophrenia as well as during the prodromal phase (14,15,16).

Impulsive schizophrenics not only appear to be proportionally slower at Stroop performance than less impulsive schizophrenics, but also produce more persistent errors on the TMT and read more distracting words on the reading with distractors task in which inhibitory control processes are required. Thus, these results show that impulsive patients with schizophrenia, even during a stabilizing phase of their illness, exhibit a trait of cognitive inhibition deficits (17), with intraindividual variability (18).

In contrast to studies that have reported alterations over time and perseverations of suppression function in patients with schizophrenia (19), only an alteration in the number of TMTb perseverations was significant in our study. An alteration in the braking function of cognitive inhibition was found during the performance of the Stroop task in our study, which agrees with the literature (20).

Recently, functional and structural neuroimaging studies have shown brain changes during early childhood and adolescence. One of these studies showed an accelerated loss of grey matter from the parietal to

the frontal lobe in schizophrenic patients during childhood and adolescence (21). This would probably be an exaggeration of the normal developmental process (22) and could explain the cognitive dysfunctions highlighted in individuals at risk of psychotic transition (23).

Our results highlighted the fact that cognitive inhibition is not a single cognitive process in schizophrenia, but a composite cognitive process with attentional and semantic components. Furthermore, intra-individual differences in cognitive inhibition processes reflect short-term fluctuations in cognitive performance (24), but are not due to aging of cognitive processes (25). The Stroop task provides greater sensitivity to the pathology of selective attention in schizophrenia (26). This finding confirmed several predictions and the results were consistent with the hypothesis that abnormal Stroop performance in schizophrenia reflects a failure to attend adequately to the stimulus dimension appropriate to the task (color). This inattention affects both congruent and incongruent conditions and multiple points in the information processing pathway (27).

This study is limited by:

- A sample size that is relatively small and an unknown ability of patients to accurately report impulsivity.
- The possible influence of neuroleptic drugs on impulsivity and cognitive inhibition should not be overlooked. Clozapine in particular may reduce impulsivity (28) (29) and affect neurocognitive processes (30) (31).
- A history of substance use may be associated with a high threshold for impulsivity. For example, high impulsivity scores are often associated with substance use or abuse (32).
- Extrapyramidal symptoms, which have not been evaluated, could affect patients' performance on tests.

It is clear that a deficit in cognitive inhibition is present in schizophrenia; however, its exact nature must be determined parametrically in the context of the various subtypes of disorder, the nature and duration of psychotropic drug use, and the history of substance use.

## V. CONCLUSIONS:

This work allowed us to explore, on one hand, the impact of cognitive inhibition and mental flexibility on impulsivity in schizophrenic subjects and, on the other hand, the links and associations that possibly exist between the dimensions of cognitive inhibition, mental flexibility and the three dimensions of impulsivity according to the Barratt scale.

We revealed an alteration of the executive functions in impulsive patients suffering from schizophrenia. Given the small size of our sample, we plan to continue the work in order to enlarge the study's population.

## Reference:


[1]. Simonnot AL, Gluck-Vanlaer N, Abe K, Caillat AS, Auby P. Actualités Des Données Sur Les Modalités Évolutives De La Schi-Zophrénie. EMC-Psychiatrie 2007;3:1—9 [37-282-A-10].

[2]. Philipps LH. Do 'Frontal Tests' Measure Executive Function? Issues Of Assessment And Evidence From Fluency Tests. In: Rabbit P, Editor. Meth- Odology Of Frontal And Executive Function. Hove: Psychology Press; 1997. P. 191–213.

[3]. Rabbit P. Introduction: Methodologies And Models In The Study Of Execu- Tive Function. In: Rabbit P, Editor. Methodology Of Frontal And Executive Function. Hove: Psychology Press; 1997. P. 1–38.

[4]. Chan RCK, Chen EYH, Cheung EFC, Cheung HK. Executive Dysfunctions In Schizophrenia: Relationships To Clinical Manifestation. Eur Arch Psychiatry Clin Neurosci 2004;254:256–62.

[5]. Nieuwenstein MR, Aleman A, De Haan EHF. Relationship Between Symptom Dimensions And Neurocognitive Functioning In Schizophrenia: A Meta-Analysis Of WCST And CPT Studies. J Psychiatr Res 2001;35:119–25.

[6]. Kebir O, Dellagi L, Azouz O, Rabeh Y, Sidhom O, Tabbane K. Déficits Des Fonctions Exécutives Dans La Schizophrénie Selon Les Dimensions Positive, Négative Et De Désorganisation. Annales Medico-Psychologiques - ANN MEDICO-PSYCHOL. 2008;166:627-632. Doi:10.1016/J.Amp.2006.04.010

[7]. Twamley, E.W., Palmer, B.W., Jeste, D.V., Taylor, M.J., Heaton, R.K., 2006. Transient And Executive Function Working Memory In Schizophrenia. Schizophrenia Research 87, 185–190.

[8]. Lindqvist P, Allebeck P. Schizophrenia And Crime. A Longitudinal Follow-Up Of 644 Schizophrenics In Stockholm. Br J Psychiatry 1990;157:345—50.

[9]. Swanson JW, Holzer 3rd CE, Ganju VK, Jono RT. Violence And Psychiatric Disorder In The Community: Evidence From The Epidemiologic Catchment Area Surveys. Hosp Community Psy- Chiatry 1990;41:761—70.

[10]. Lovell AM, Cook J, Velpry L. Violence Towards People With Severe Mental Disorders: A Review Of The Literature And Of Related Concepts. Rev Epidemiol Sante Publique 2008;56:197—207.

[11]. Douglas, K. S., Guy, L. S., & Hart, S. D. (2009). Psychosis As A Risk Factor For Violence To Others: A Meta-Analysis. Psychological Bulletin, 135, 679–706.

[12]. Joyal, C., Dubreucq, J. -L., Grendon, C., & Millaud, F. (2007). Major Mental Disorders And Violence: A Critical Update. Current Psychiatry Reviews, 3, 33–50.

[13]. Henry M., Jacob L., Joyal C. C. Evaluation Clinique De L'impulsivité. Revue Québécoise De Psychologie, 36(2), 7-30 (2015)

[14]. Jelili S, Abbes Z, Hajri M, Et Al. Fonctions Exécutives Chez Les Adolescents Tunisiens A Ultra-Haut Risque De Psychose : Etude Comparative. Neuropsychiatrie De l'Enfance Et De l'Adolescence. 2020;68(4):210-214. Doi:10.1016/J.Neurenf.2019.11.006

[15]. Brewerjw,Franceysm,Woodsj,Jacksonhj,Pantelisc,Phillipslj,Etal.Memory Impairments Identified In People At Ultra-High Risk For Psychosis Who Later Develop First-Episode Psychosis. Am J Psychiatry 2005;162(1):271–8.

[16]. Cornblatt BA, Keilp JG. Impaired Attention, Genetics, And The Pathophysiology Of Schizophrenia. Schizophr Bull 1994;20(1):31–46

[17]. Gigaux, J., Le Gall, D., Jollant, F., Lhuillier, J.P., Richard-Devantoy, S., 2013. Cognitive Inhibition And Quality Of Life In Schizophrenia: A Pilot Study. Schizophrenia Research 143, 297–300.

[18]. Raffard, S., Bayard, S., 2012. Understanding The Executive Functioning Heterogeneity In Schizophrenia. Brain Cognition 79, 60–69.

[19]. Sanchez-Morla, E.M., Barabash, A., Martinez-Vizcaino, V., Tabares-Seisdedos, R., Balanza-Martinez, V., Cabranes-Diaz, J.A., Baca-Baldomero, E., Gomez, J.L., 2009. Comparative Study Of Neurocognitive Function In Euthymic Bipolar Patients And Stabilized Schizophrenic Patients. Psychiatry Research 169, 220–228.

[20]. Westerhausen, R., Kompus, K., Hugdahl, K., 2011. Impaired Cognitive Inhibition In Schizophrenia: A Meta-Analysis Of The Stroop Interference Effect. Schizophrenia Research 133, 172–181.

[21]. Thompson PM, Vidal C, Giedd JN, Gochman P, Blumenthal J, Nicolson R, Et Al. Mapping Adolescent Brain Change Reveals Dynamic Wave Of Accelerated Gray Matter Loss In Very Early-Onset Schizophrenia. Proc Natl Acad Sci U S A 2001;98(20):11650–5

[22]. Gogtay N, Giedd JN, Lusk L, Hayashi KM, Greenstein D, Vaituzis AC, Et Al. Dyna- Mic Mapping Of Human Cortical Development During Childhood Through Early Adulthood. Proc Natl Acad Sci U S A 2004;101(21):8174–9.

[23]. Bang M, Kim KR, Song YY, Baek S, Lee E, An SK. Neurocognitive Impairments In Individuals At Ultra-High Risk For Psychosis: Who Will Really Convert? Aust N Z J Psychiatry 2015;49(5):462–70.

[24]. Kaiser, S., Roth, A., Rentrop, M., Friederich, H.C., Bender, S., Weisbrod, M., 2008. Intra-Individual Reaction Time Variability In Schizophrenia, Depression And Borderline Personality Disorder. Brain Cognition 66, 73–82.

[25]. Silver, H., Bilker, W.B., 2013. Pathways To Similar Executive Impairment: Comparison Of Schizophrenia Patients And Healthy Aging Individuals. Psychiatry Research 210, 694–701.

[26]. Perlstein, W.M., Carter, C.S., Barch, D.M., Baird, J.W., 1998. The Stroop Task And Attention Deficits In Schizophrenia: A Critical Evaluation Of Card And Single-Trial Stroop Methodologies. Neuropsychology 12, 414–425.

[27]. Barch, D.M., Carter, C.S., Hachten, P.C., Usher, M., Cohen, J.D., 1999. The "Benefits" Of Distractibility: Mechanisms Underlying Increased Stroop Effects In Schizophre- Nia. Schizophrenia Bulletin 25, 749–762.

[28]. Dursum, S.M., Szemis, A., Andrews, H., Whitaker, P., Reveley, M.A., 2000. Effects Of Clozapine And Typical Antipsychotic Drugs On Plasma 5-HT Turnover And Impulsivity In Patients With Schizophrenia: A Cross-Sectional Study. Journal Of Psychiatry & Neuroscience 25, 347–352.

[29]. Strous, R.D., Kupchik, M., Roitman, S., Schwartz, S., Gonen, N., Mester, R., Weizman, A., Spivak, B., 2006. Comparison Between Risperidone, Olanzapine, And Clozapine In The Management Of Chronic Schizophrenia: A Naturalistic Prospective 12-Week Observational Study. Human Psychopharmacology: Clinical And Experimental 21, 235–243.

[30]. Kumari, V., Sharma, T., 2002. Effects Of Typical And Atypical Antipsychotics On Prepulse Inhibition In Schizophrenia: A Critical Evaluation Of Current Evidence And Directions For Future Research. Psychopharmacology 162, 97–101.

[31]. Weickert, T.W., Goldberg, T.E., 2005. First- And Second-Generation Antipsychotic Medication And Cognitive Processing In Schizophrenia. Current Psychiatry Reports 7, 304–310.

[32]. Dervaux, A., Bayle, F.J., Laqueille, X., Bourdel, M., Le Borgne, M., Olie, J., Krebs, M., 2001. Is Substance Abuse In Schizophrenia Related To Impulsivity, Sensation Seeking, Or Anhedonia? American Journal Of Psychiatry 158, 492–494.