ejpmr, 2023,10(1), 06-10

SJIF Impact Factor 6.222

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Review Article

ISSN 2394-3211

EJPMR

ASSESSMENT OF THE SHORT-TERM MEMORY OF POLY-DRUG USERS IN COTE D'IVOIRE

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Article Received on 05/11/2022 **Article Revised on 25/11/2022** **Article Accepted on 15/12/2022**

ABSTRACT

For the past decade, Côte d'Ivoire has become the hub of illicit drugs in Africa, to the point that young users of these psychoactive substances no longer hide themselves. However, few studies have been done on that tricky problem of drug addiction in sub-Saharan Africa and on complications linked to its use. The aim of this study is to assess the effects of this behaviour (drug addiction) on the memory abilities of users, particularly on short-term memory. For this purpose, the Wechsler Adult Intelligence Scale 3rd Edition (WAIS III) digit memory test was used to evaluate the immediate and working memory of patients admitted to rehabilitation centers in Côte d'Ivoire. The results showed that the repeated use of these drugs led to a very significant decrease in immediate memory and more in working memory.

KEYWORDS: Narcotics – Addict – Youth - Immediate memory - Working memory.

1. INTRODUCTION

A narcotic drug is a toxic substance which action on the nervous system is manifested through a numbing of mind and body, and used in a low dose for the treatment of severe pain.

According to **Manuila et al (2015)**, it is a prohibited or regulated psychotropic drug, often because of its potential for problematic use, or a chemical that acts on the central nervous system to induce changes in perception, sensation, mood or consciousness.

The use of psychoactive substances exposes people to health problems and social life issues (**Baasher, 1981**). In 2010, it was estimated that, their use caused between 99,000 to 253,000 deaths worldwide. These deaths accounted for 0.5-1.3% of all-cause of mortality among people aged between 15 to 64 years old (**UNODC, 2012**). Drug use in Africa is currently a major concern for political and health authorities. While globally cannabis abuse seems to be stabilized (prevalence: 3.4%), it continues to increase in Africa where the current prevalence among 15-64 year olds is high (**Tigori-Sangaré et al 2009**).

In West Africa, there is a wide variety of addictive substances, which are used in great proportion by young people. This practice could lead to physical, psychological and other social issues (**Éric, 2007**).

In Côte d'Ivoire, studies were performed on the problem of psychoactive substances. For each of them, different causes and indicators as well as several factors were revealed on the use of these substances (**Ndri, 2018**). For the past decade, Côte d'Ivoire has become the hub of illicit drugs in Africa, to the point that young users of these psychoactive substances no longer hide themselves. However, few studies was carried out on complications linked to the use of these illicit drugs in Côte d'Ivoire.
In this context, our aim was to evaluate the effects of these illicit drugs on users' memory abilities, such as on short-term memory.

2. MATERIALS AND METHODS

2.1. Materials

2.1.1. Patients

The study involved one hundred and forty-one (141) patients, including hundred and twenty one (121) drug users (poly-drug users) and twenty (20) controls (non

users of drugs). Only patients consuming illicit drugs were concerned by this study. Patients' age ranged in from 17 to 50 years old (mean age, 21 years old).

All patients were admitted to the Blue Cross reception center and to the Regional Drug Training Center (CRFLD). For this study, only male patients were considered. Hormonal changes caused by the menstrual cycle do not allow to draw effective conclusions in the case of intergroup comparisons (in Yao, 2011).

Therefore, it was necessary to put patients under the same psychological conditions during the test. All participants signed their informed consent.

2.1.2. Technical material

The Wechsler Adult Intelligence Scale 3rd Edition (WAIS III) digit memory test was used to assess short-term memory. This test consists of two subtests, the first one assesses the immediate memory while the second one evaluate the working memory.

2.2. Methods

The Wechsler Adult Intelligence Scale, Part 1 - 3rd Edition (WAIS III) digit memory test is a subtest consisting of two sets of exercises. The first (direct order) has 16 items consisting of numbers to be repeated in the same order as the investigator: it assesses immediate memory. The second (reverse order) consists of 14 sets of numbers to be repeated in the reverse order as the investigator (see appendix). The latter evaluate the working memory.

The patient was comfortably seated in a chair and was asked to repeat a series of numbers in direct order (in the same order as the investigator). The number of digits presented for recall increases with each successful trial. The series stops after two unsuccessful attempts in the same item. This test assesses patients' immediate memory (**Diboh, 2014**).

The second part of this test evaluates the working memory. This is carried out under the same conditions. The numbers are recalled in reverse order to that of the investigator. Here, however, the two trials of each item are administered, even though the first trial was successful. The series stops after two unsuccessful attempts in the same item. Control patients are given the same test. The scoring rule is the same in both tests:

- 0 point for a failure;
- 1 point for a correct answer.

The tests were conducted in the mornings (9 a.m.) in order to minimise the effect of fatigue (physical and intellectual).

2.3. Data processing

The data collected in this study were processed using STATISTICA® 10.0 software. The analysis of the memory performance of each group was compared with the other groups. Thus, it is necessary to check the significance of differences observed between the performance of drug users and those of controls on the memory test of the Wechsler scales, 3rd edition (WAIS III).

In other words, it is a question of knowing whether the difference of these performances between groups is significant or not. For this purpose an analysis of variance (ANOVA) was used for comparisons.

The probability (p) of 0.05 was considered as the limit value for significance. So, if "p" is less than or equal to 0.05, then the difference between compared values is significant. On the other hand, if "p" is greater than 0.05, then the difference between compared values is not significant.

2.4. Assessment of immediate memory in drug users (direct order of the WAIS III test)

Figure 1 shows the performance of poly-drug users in the immediate memory test. The memory performance of drug-users is lower than that of controls. The difference is significant as $F(1,39)=45.04$ for $P=0.0001$.

However, this lower memory performance of patients compared to controls is still within the norm, as the memory span of a normal (healthy) person is 7±2 items (figures 1).

2.5. Assessment of the working memory in drug-using patients (reverse order of WAIS III test)

Figure 2 shows the performance of the different groups of patients in the working memory test. In this respect, the performance of drug users is much lower than that of controls. The difference is highly significant as $F(1,38)=36$ and $p=0.0001$.

The working memory of these poly-drug users is affected because their memory performance is below the norm of 5±2 items (figures 2).

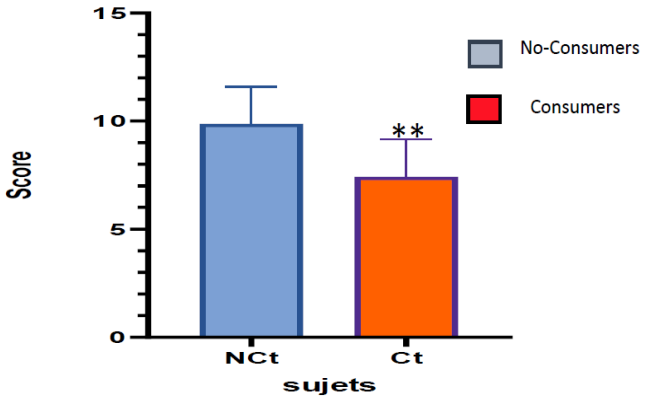

Figure 1: Assessment of immediate memory in drug users according to the WAIS III test (direct order)
User: drug user
Non-user: control
** significant

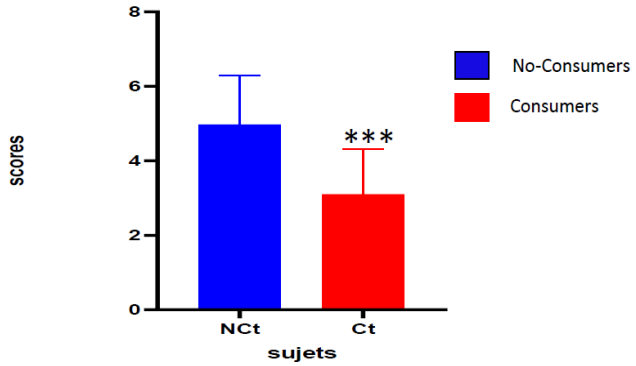

Figure 2: Assessment of the working memory of drug-users according to the WAIS III test (reverse order).
*** : very significant
The memory performance (immediate memory and especially working memory) of drug addicts is significantly lower than that of controls (non-users).

3. DISCUSSION

In this study, the quality of some cognitive functions were evaluated, on short-term memory, linked to regular drug use in patients admitted for treatment at the regional drug training center (CRFLD) and the Blue Cross reception center. To this end, this work revealed that the memory performance of drug users was significantly lower than that of controls (non-users of narcotics). These same observations were made by Diboh (2014) on regular consumers of Koutoukou (a home-made brandy, obtained from the fermentation of the sap of palm oil "Elaeis guineensis Jacq"). Numerous studies have shown that an abuse use of psychoactive substances can negatively influence several cognitive functions such as the executive functions (Kalechstein et al., 2007), verbal fluency (Zhu et al., 2022 ; Reiman et al., 2022) and impulsiveness (Mousavi et al., 2014). This memory corresponds to the capacity to grasp information (visual and/or auditory) and to restore it immediately, without treatment. This memory, of short duration (second), has a limited capacity to retain and restore a number of 7±2 items (elements), which corresponds to the memory span of a normal person. It can be measured by the place span: this consists of restoring in order a series of items (numbers, letters, words) that have just been uttered. It serves as a support for working memory (Orsini et al., 1987). The latter could be defined as a set of cognitive processes enabling information to be maintained available for any task involving mental processing. This memory is mainly evaluated by means of a reverse memory span test which consists of restoring a series of words in reverse order (Schouten, 2002). It allows complex cognitive processing of temporarily stored elements (following a conversation, mental calculation, dialling a telephone number immediately, simultaneous translation by an interpreter, etc.). As a result, it is constantly in demand (Gisquet, 2006). Working memory is sensitive to distraction and interference (in which case the information is irretrievably lost). This memory is responsible for the maintenance and temporary processing of information.

Regular cannabis use induces cognitive disorders, in particular attention, memory and executive function disorders. These disorders are related to the dose, frequency, duration of exposure and age of first use (increased risk if use began before the age of 15) (Inserm, 2013). A 25-year exposure to cannabis

decreases the intelligence quotient (IQ) by 8 points in an irreversible way (Costentin 2017). The impact of cannabis use on the brain has been assessed in more than 40 brain imaging studies. The effects of cannabis are reflected in a dose-dependent decrease in grey matter density in the hippocampus, parahippocampal regions and amygdala in regular users (daily use over several years) (Inserm, 2013). Short-term memory involves the hippocampus and neurons mediated by acetylcholine. Their destruction determines the disorders of Alzheimer's disease. Furthermore, according to **Costentin (2017**), narcotics reduce the blood supply and thus the oxygen supply to the hippocampus, while the stimulation of CB1 receptors in the mitochondria (which form ATP, the fuel of the cells) disrupts the energetics of the hippocampus, with amnesic effects. The lasting impairment of memory functions leads to a regression in intellectual performance.

Morphological imaging studies, particularly MRI, show that regular and prolonged cocaine use can induce a reduction in the volume of the prefrontal and temporal cortices, which can persist for several weeks after withdrawal Volkow et al (2004). Clinically, this abnormality may correspond to attention and executive function disorders, with loss of inhibitory control, impaired judgement and difficulties in decision-making. Bolla et al (1999) claimed that acute use of large amounts of cocaine (above 2 grams) might have an impact on verbal fluency tasks, executive functions and verbal memory, compared to moderate doses.

Amphetamines and new drugs, such as cathinones (mephedrone), could have effects comparable to those of cocaine. Neurological complications of opiates are more rare. They are linked to overdoses, particularly with heroin. These complications may also be linked to the use of tobacco, alcohol, cannabis or cocaine, which is very common among heroin addicts and methadone patients. Prolonged heroin use can also induce volume reduction in the prefrontal and temporal cortices, which is reversible after withdrawal (**Wang et al., 2012**). Almost all cannabis and cocaine addicts are smokers. Tobacco use, which is generally underestimated by patients, is a major contributor to stroke risk (**Wang et al., 2012**). According to some clinical studies, almost two thirds of cocaine addicts, between one third and a half of heroin addicts and 10% of cannabis addicts had an alcohol dependence problem in their lifetime (**Dervaux et al., 2012**). Alcohol consumption (especially strong alcohols) aggravates the cardiovascular toxicity of cocaine, increasing the blood concentration of cocaine by 30% and leading to the formation of coca ethylene, a metabolite that is more toxic for the central nervous system and the cardiovascular system than cocaine alone, with a long time period elimination (**Dervaux et al., 2009**). Sedatives also cause memory impairment, especially when used with alcohol (**Matilla et al., 1998; Kamboj et al., 2006**).

4. CONCLUSION

This study shows that regular drug use has a significant impact on immediate memory, but also on working memory in young people, whose cerebral development is only completed around the age of 24 to 25. We therefore recommend the evaluation of cognitive performance in withdrawal protocols for a better management of patients.

This work needs to be widely disseminated in order to raise the awareness of the dangers awaiting users of narcotic substances, as it is very difficult to act on the production and distribution of these drugs. However, we can still act on the target population, such as young people.

In a near future, it could be appropriate to undertake a comparative study to determine the toxic effects of each of these substances, using an animal model.

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