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Research Article

To Evaluate and Find Relationship Among Executive Functioning, Coping Strategies and Clinical Correlates in Patients with Migraine

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Introduction

Migraine is the leading cause of neurological disability in the world. Around 15-20% of the general population develops migraine during their lifetime. It is the most common headache diagnosis for which patients seeks treatment. It is not just a physical experience but it has a range of consequences to other areas of life. Due to which patients presented with some or total limitations of normal daily activities. Stress is accepted as a primary precipitant of muscle contraction headache. Recently it got acknowledged as a major precipitator of migraine headaches. Patient‘s usually presented with cognitive complaints and difficulty to cope with problems. Therefore, it is important for us to assess their executive functioning and coping strategies employed by them. So that we can reinforce the fact that management of migraine is more than only control groupling the pain. Migraine is a common, chronic, intermittently disabling, and usually inherited neurovascular disorder. Patients with this condition typically suffer from severe headache accompanied by autonomic symptoms. It is the second most common cause of headache, afflicts approximately 15% of women and 6% of men over a 1-year period. It is usually an episodic headache associated with certain features such as sensitivity to light, sound, or movement; nausea and vomiting often accompany the headache. (Hauser, S.L.,2006) **[**1**]**.

According to ICHD-3**[**2**]** migraine is a common disabling primary headache disorder. A lot of epidemiological studies has been documented showing its high prevalence and has impact on personal as well as socio-economic. In the Global Burden of Disease Study (2010) **[**3**]**, it was ranked as the third most prevalent disorder in the world. In 2015, GBD, migraine was ranked as a third–highest cause of disability all around the world in both the gender under the age of 50 years.

Migraine is a recurring syndrome of headache associated with other symptoms of neurologic dysfunction in varying admixtures. Migraine can often be recognized by its activators, referred to as triggers. The brain of the migraineur**[**4**]** is particularly sensitive to environmental and sensory stimuli; migraine-prone patients do not habituate easily to sensory stimuli. This sensitivity is amplified in females during the menstrual cycle. Headache can be initiated or amplified by various triggers**[**5,6,7**]**, including glare, bright lights, sounds, or other afferent stimulation; hunger**[**8**]**; let-down from stress; physical exertion; stormy weather or barometric pressure changes; hormonal fluctuations during menses; lack of or excess sleep; and alcohol or other chemical stimulation, such as with nitrates. Knowledge of a patient‘s susceptibility to specific triggers can be useful in management strategies involving lifestyle adjustments.

Few researches shows that migraineur shows reduced frontal lobe GM density and diffusion abnormalities in migraineurs. Such evidence shows abnormalities of frontal lobe in migraine and neuro-functionally, frontal lobe abnormalities are associated with EF deficits. **[**9**]**

Executive functions is a complex, higher order processes which is moderated primarily by the frontal lobe, specifically the prefrontal cortex. There is a complexity of executive function which has made a universally accepted definition very elusive, but attention (focusing on relevant information and ignoring distractors), working memory (maintaining and manipulating information until execution), and motor planning (goal-directed motor planning and programming) are generally considered as a main key of executive functions.**[**10**]**

Executive functions (EFs; also called executive control group or cognitive control group) refer to a family of top-down mental processes needed when you have to concentrate and pay attention, when going on automatic or relying on instinct or intuition would be ill-advised, insufficient, or impossible **[**11-13**]**

There are subdomains of EF which act coherently to successfully implement cognitive flexibility. A constant changing environment, individuals must first identify how surroundings have changed by directing attention to those elements that are in flux. After discovering that a previous strategy is not suitable in the new environment, individuals must interdict previous responses and reorgainse a new strategy. Individuals take in information and manipulate it in real time to flexibly switch responses from one scenario to another. Cognitive flexibility is not merely the sum of implementing various EFs, but also requires shifting, or the reconfiguration of one‘s response set to the new goal. Cognitive flexibility is the ability to appropriately adjust one‘s behavior according to a changing environment.**[**14,15**]** CF enables an individual to work efficiently to disengage from a previous task, reconfigure a new response set, and implement this new response set to the task at hand. Greater cognitive flexibility is associated with favorable outcomes throughout the lifespan higher resilience to negative life events and stress in adulthood**[**16**]**

Inhibition or inhibitory control group is the ability to inhibit or control group impulsive (or automatic) responses, and create responses by using attention and reasoning. This cognitive ability is one of our executive functions and contributes to anticipation, planning, and goal setting. Inhibition or inhibitory control group blocks behaviors and stops inappropriate automatic reactions, changing one response for a better, more thought-out response adapted to the situation.**[**17**]**

Working memory is the system by which information is maintained in an active mental state during the course of processing so that it can be used for other purposes. It is this system that allows us, for instance, to understand a lengthy sentence or to retain a phone number long enough to run to the telephone and dial it. The working memory system is intimately related to various aspects of executive function: information must remain in an active state so that it is accessible for use in higher-order behaviors, such as planning and organizing, decision making, and problem solving.

It is one of the brain‘s executive functions that provides with an ability to hold on to new information so we can turn around and use it in some way. WM allows us to hold information without losing track of what we‘re doing. Cognitive measures of WM capacity reflect an individual‘s capacity to maintain information, including task goals, in a highly active state despite interference. They suggest that keeping relevant information highly active and easily accessible reflects an individual‘s ability to control group attention, because ―coherent and goal-oriented behaviour in interference-rich conditions requires both the active maintenance of relevant information and the blocking or inhibiting of irrelevant information‖**[**18**]**

In the digit span task, the patient repeats progressively longer number sequences in the forward or the reverse direction. Although digit span is affected by both age and education, typical adult performance is about seven digits forward with a reverse span that does not differ by more than two digits.**[**19**]**

Planning is often needed to help optimize the execution of complex tasks. Patients with impaired planning may exhibit difficulty developing a flexible plan appropriate to the circumstances, initiating the plan, carrying out a series of steps in the correct order, maximizing efficiency and time management, adjusting the plan in real time, and completing the series of actions.**[**20**]**

Coping is defined as the process of executing a response to a stressor, where stress is viewed as the experience of encountering relevant difficulties in one‘s goal-related efforts **[**21**]** and exists when an individual perceives the achievement of a desired goal as impossible or detects possible future punishments.**[**22**]** Thus, coping has been described as an individual‘s attempt to use cognitive and behavioural strategies to manage and regulate pressures, demands, and emotions in response to stress.**[**23**]**

Coping has been defined as a special category of adaptation elicited in normal individuals by unusually taxing circumstances.**[**24**]** The most influential model of psychological stress response is the one proposed by Lazarus and Folkman**[**25**]**

The process of coping was defined as constantly changing cognitive and behavioural efforts which are undertaken by an individual in order to deal with demands which are especially challenging and are probably exceeding individual capacities and/or resources**[**25**]**. The process of coping involves three main elements: the source of the stress (the event or stressor); cognitive appraisal (which includes evaluation of the event as being irrelevant, threatening or positive, and simultaneous assessment of available coping resources within the individuals and their environment); and coping mechanisms. Several scales have been designed in order to measure coping strategies. Carver (1997) presented an abbreviated Version of COPE, the Brief-COPE, which has been widely used in health contexts.**[**27**]**

Relationship Between Executive Functioning and Coping Strategies:

Coping may recruit multiple executive function components, particularly working memory, planning, sequencing, cognitive flexibility and inhibitory control group.**[**28**]**For example, coping effectively with a stressor may involve holding prior encounters with similar stressors in mind (i.e., working memory) while evaluating coping alternatives and adjusting cognitive and behavioral responses (i.e., cognitive flexibility).**[**29**]**Hence, an individual‘s capacity to select and implement coping strategies that forestall the onset of depression may be affected by the executive function components that subserve these strategies.

Relative strengths or weaknesses in particular executive functions may either enhance or interfere with the selection and effective implementation of coping strategies, and thereby impact psychological adjustment.**[**30**]** That is, these executive function components could

facilitate adaptive coping, exacerbate maladaptive coping, or mitigate against the harmful effects of maladaptive coping.

Clinical Correlates:

The scope and impact of depression and anxiety disorders worldwide are overwhelming. The watershed Global Burden of Disease (GBD) study found that major depression ranked fourth among all medical illnesses in terms of its disabling impact on the world population.**[**31,32**]**

Depression and anxiety disorders are among the most common illnesses in the community and in primary care. Patients with depression often have features of anxiety disorders, and those with anxiety disorders commonly also have depression. Both disorders may occur together, meeting criteria for both. It can be

difficult to discriminate between them but it is important to identify and treat both illnesses, as they are associated with significant morbidity and mortality. General practitioners are well placed to identify and take a primary role in treatment of these illnesses, to facilitate better mental health outcomes.[33]

Patients who have depression and anxiety comorbidity have higher severity of illness, higher chronicity, and significantly greater impairment in work functioning, psychosocial functioning, and quality of life than patients not suffering from comorbidity.[34,35,36,37]

Comorbid depression and anxiety can increase impairment and health care use, compared with either disorder alone. Their co-occurrence is often associated with a poor prognosis and significant detrimental impact on functioning in the workplace. The number and severity of anxiety symptoms, rather than the specific anxiety diagnosis, correlate strongly with the persistence of subsequent depressive symptoms, and this relationship is stable over decades.[38]

Relationship Between Migraine and Executive Functioning:

Migraineur shows reduced frontal lobe GM density and diffusion abnormalities in migraineurs. There is, however, increasing evidence of frontal lobe abnormalities in migraine[39,40,41], and neuro-functionally, frontal lobe abnormalities are associated with EF deficits [42].

The inferior parietal lobe monitors selective attention, and the superior parietal region is responsible for task-switching, set-shifting and integration of information[39] Neuroanatomically, a network of fronto-striatal-parietal brain regions is responsible for monitoring executive functioning. Executive functioning's are a subset of cognitive functions, which enable us to demonstrate goal-directed behavior, usually in novel contexts with competing response alternatives.[43] However, the neurobiological and pathological processes underlying the disorder are unclear, and little is know about the relationship between brain structure and cognitive impairments in migraineurs.

Several investigations have addressed the possibility that subtle cognitive deficits might be associated with migraine. However despite the substantial burden that migraine places upon the society, the number neuropsychological investigations addressing in migraine is relatively less.

Relation Between Migraine and Coping Strategies:

In the last years, a relationship between recurrence of migraine episodes and maladaptive coping styles has been suggested, but this issue has been poorly investigated. Migraine sufferers were characterized by pronounced psychological abnormalities during the headache phase, demonstrating a larger use of maladaptive coping behaviour in migraineurs than in patients with TTH **[**44**]**. Other observations suggested that migraine patients are prone to use internally focused coping strategies such as nonverbal complaints, suppressive thoughts, and decreased search for social support suggesting a contracted attitude toward affective support coming from other people **[**44,45**]**

Relation between Migraine and Clinical Correlates: Depression and Anxiety

Both migraine and psychiatric disorders are prevalent and burdensome conditions challenging the health care systems worldwide **[**46-50**]**. These conditions show a large overlap**[**51,52**]** and epidemiological studies suggest that patients with migraine – especially those with chronic migraine (CM) and migraine with aura – are at increased risk for major depression, anxiety.

Similar to other pain conditions, it is reasonable to assume that a diagnosis of migraine might lead to increased worrying and vulnerability to pain, anxiety, dysphoria and a higher risk of depression. Understanding the nature of relation between migraine and depression or anxiety could improve our understanding of the etiology of these conditions and influence the choice of treatment. Psychiatric comorbidity in migraine was found to exacerbate the impact of the illness and substantially increase the associated medical expenses. Migraine itself is a polygenetic disorder; however, it has an influence of environmental factors that may determine the frequency, duration, and chronification of pain. The predisposition to psychiatric comorbidities may play a role. There are many studies that have found a relationship between migraine and anxiety/depression.**[**53-55**]**

However, there is a dearth of research studying the impact of executive functions on coping strategies, especially in migraine, and how effective those strategies are in decreasing negative psychological outcomes.

Aims & Objectives

To study the executive functioning, coping and clinical correlates among patients with migraine and without migraine (control group group)

To study the different coping strategies utilized by patients with migraine and without migraine

To evaluate executive functioning in patients with migraine and without migraine.

To assess clinical correlates in patients with migraine and without migraine.

To assess a relation between executive function and coping strategies in patients with migraine and without migraine.

To compare executive functioning, coping strategies and clinical correlates in patients with migraine and without migraine.

Materials and Methods

Research design

The hospital based, cross-sectional study design was conducted in DMC&H, Ludhiana. In which the investigator measured the outcome and the exposures in the study participants at the same time.

Source of Data

Study was conducted on patients with migraine presenting to Neurology OPD, DMC&H, Ludhiana.

Method of Collection of Data

Sample Collection- The study included 50 patients with Migrainein age group 20-40 years from the department of Neurology in DMC& Hospital, Ludhiana and 50 control group from those residing in Ludhiana with matched age group.

Inclusion Criteria:

Patients diagnosed with migraine with aura, without aura according to the International Classification of Headache Disorders. The current version, the ICHD-3 Beta.

Age group between 20-40 years.

Subjects with a formal education of at least 12+ years

Exclusion Criteria:

Patient with any neurosensory deficits, communication problems, developmental disabilities such as Intellectual disability.

Behavioral disorders such as addiction to drugs and alcohol

Inclusion Criteria (Control group)

Individuals not diagnosed with Migraine

Age group between 20-40 years

Subjects with a formal education of at least 12+ years

Subjects with no history of diagnosed psychiatric illness.

Exclusion Criteria (Control group)

Individuals with any other chronic illness

Subjects with no history of diagnosed psychiatric illness.

Methodology

The study was conducted on 50 patients with Migraine and 50 without Migraine (control group). Informed consent was taken from the patients. Socio-demographic Proforma was filled containing the basic information about the patient. Both the groups were evaluated on the Executive Functioning test by using Digit span test, Stroop color-word test, Trail-making test A & B and Clock Drawing Test. For evaluation of coping strategies, Brief-Cope questionnaire was administered. Hospital anxiety and depression scale (HAD-S) was administered to determine the levels of anxiety and depression that a person is experiencing.

Tools:

Socio-Demographic Proforma

Executive Functioning Test

Brief Cope Inventory

Hospital Anxiety and Depression Scale

Statistical Analysis

Statistical analysis of the results of study was described in terms of range, mean standard deviation, frequencies (number of cases) and relative frequencies (% age) as appropriate. Chi square test was performed for analyzing categorical data. Pearson‘s correlation was done for analyzing correlation between

variables. A probability value (p value) less than 0.05 was considered statistically significant. All statistical calculations were done using SPSS version 21.0 statistical programme for Microsoft windows.

Results

The current study was conducted in the department of neurology Dayanand Medical College & Hospital, Ludhiana on subjects diagnosed with Migraine (N=50) and healthy control groups (N=50) with the same socio-demographic data. The subjects were drawn from the OPD of Neurology department. Both the groups were assessed on Executive functioning tests- TMT-A & B, Stroop test, Clock drawing test, Digit span test. They were assessed on Brief-Cope Scale and Hospital Anxiety-Depression Scale. The data thus collected was tabulated and after analyzing the following results were obtained.

We have studied the comparative distribution of TMT-A Performance in patients and control groups. In our study 74% patients showed deficit in TMT-A performance of the same size (N=50) and in We have compared the mean value of TMT-A & TMT-B in both patients and control groups. As observed the mean on TMT-A of patients and control groups is 78.42 & 42.98 respectively. For TMT-B is 158.48 & 63.62 respectively. The variance is significant with p-value < 0.05.

The mean of stroop test on naming word, color and color-word of patients and control groups which shows a significant difference with a p value < 0.000.

The interference score of stroop test. Larger the interference scores poorer the performance. The observed mean of patients is 31.62 and control group is 9.44. The variance is significant with p value <0.05.

The mean value of CDT of patients and control groups which is 5.50 & 8.92 respectively which is significant with p-value 0.000.

We tabulated the mean of attention(working memory) of patients and cases is 12.66 & 18.28 respectively. On forward & backward for patients and control groups it is 7.30 & 9.34, 5.36 & 8.94 respectively. The variance is significant with p- value 0.05.

We have compared the mean on Brief-Cope domains Avoidant and Adaptive of patients and control groups showing significant difference at p-value < 0.05. The mean value of Avoidant coping in patients and control groups is 33.66 & 21.00 respectively. For adaptive strategy it is 21.64 & 38.10 for patients and control groups respectively.

Intergroup observation of HAD Scale between patients and control groups. The mean value of depression is 9.20 & 5.92 respectively. On anxiety the mean for patients is 10.96 &control groups (7.96). The variance is significant with p- value 0.05.

The correlation between TMT-A and domain of coping-self blame with Pearson‘s correlation negative value of-.281 shows more the attention, lesser will be self blame.

The relationship between TMT-A and clinical correlates – Depression with Pearson‘s correlation negative value of - .281 shows more the attention, lesser will be the level of depression.

The correlation between TMT-B and domain of coping- substance use with pearson‘s correlation negative value of -.343 shows more the cognitive flexibility lesser will be the use of substance use.

The relationship between TMT -B and depression with pearson‘s correlation negative value -.361 which shows more cognitive flexibility, lesser will be the level of depression.

Correlation between Stroop interference and domains of coping- self blame with correlation value .279 shows more the cognitive inhibition, more of self blame whereas negative pearson‘s correlation value on acceptance -.424 indicating more the cognitive inhibition, lesser the acceptance in patients with migraine.

The relationship between Attention and domain of coping- venting shows pearson‘s correlation negative value of -.303 shows more the use of attention, lesser will be the venting.

Correlation between the venting and clinical correlate- depression with negative correlation value -.342 indicating more the use of venting, lesser will be the level of depression.

The relationship between stroop interference & Coping strategy- Self blame and acceptance. The correlation value .279 indicating higher the cognitive inhibition, higher will be the use of self blame. The negative correlation value -.424 reflects lower the cognitive inhibition, higher the use of acceptance.

	Cases		Control group		t	p- value
	Mean	SD	Mean	SD		
TMT-A	78.42	18.11	42.92	19.06	9.549	0.000
TMT-B	158.48	44.32	63.62	33.22	12.111	0.000
INTERFERENCE SCORE= Larger score poorer performance. (W- CW= INTERFERENCE SCORE)	31.62	11.21	9.44	5.61	12.506	0.000
CDT	5.50	2.64	8.92	1.12	-8.441	0.000
ATTENTION	12.66	4.06	18.28	4.57	-6.504	0.000
FORWARD	7.30	2.22	9.34	2.45	-4.363	0.000
BACKWARD	5.36	2.43	8.94	3.16	-6.343	0.000

Table 1 shows the difference of mean value on Executive functioning test in both patients and control group

	Cases		Control group		t	p- value
	Mean	SD	Mean	SD		
AVOIDANT	33.66	2.56	21.00	4.41	17.548	0.000
ADAPTIVE	21.64	3.28	38.10	4.23	- 21.728	0.000
HADS-D	9.20	2.42	5.92	2.16	7.149	0.000
HADS-A	10.96	2.70	7.96	3.60	4.720	0.000

Table 2 shows the mean difference on Brief-Cope domains Avoidant and Adaptive and clinical correlates of patients and control group.

SELF BLAME		
TMT-A	Pearson Correlation	-.281*
	p-value	0.048
	N	50

Table 3, shows correlation between TMT- A and Coping strategy self blame

HADS-DEPRESSION		
TMT-A	Pearson Correlation	-.281*
	p-value	0.048
	N	50

Table 4, shows correlation between TMT-A and clinical correlates – Depression.

SUBSTANCE USE		
TMT-B	Pearson Correlation	-.343*
	p-value	0.015
	N	50

Table 5, we have shown the correlation between TMT-B and domain of coping- substance use

DEPRESSION		
TMT-B	Pearson Correlation	-.361**
	p-value	0.010
	N	50

Table 6 shows correlation between TMT -B and depression.

		SELF BLAME	ACCEPTANCE
INTERFERENCE SCORE	Pearson Correlation	.279*	-.424**
	p-value	0.050	0.002
	N	50	50

Table 7: shows correlation between Stroop interference and domains of coping- self blame and acceptance

VENTING		
ATTENTION	Pearson Correlation	-.303*
	p-value	0.032
	N	50

Table 8 correlates the relationship between Attention and domain of coping- venting

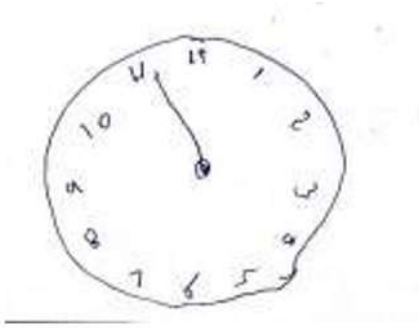
DEPRESSION		
VENTING	Pearson Correlation	-.342*
	p-value	0.015
	N	50

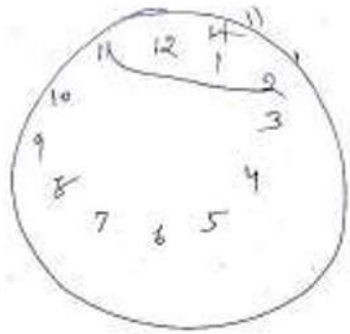
Table 9 correlation between the venting and clinical correlate- depression.

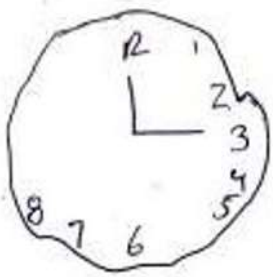
		SELF BLAME	ACCEPTANCE
INTERFERENCE SCORE	Pearson Correlation	.279*	-.424**
	p-value	0.050	0.002
	N	50	50

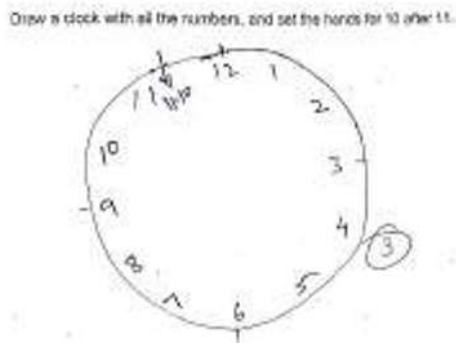
Table 10 Shows correlation between Stroop interference and domain of coping- self blame and acceptance.

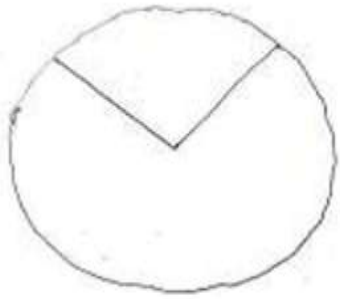
Samples: Performance on CDT in Migraine Patients.

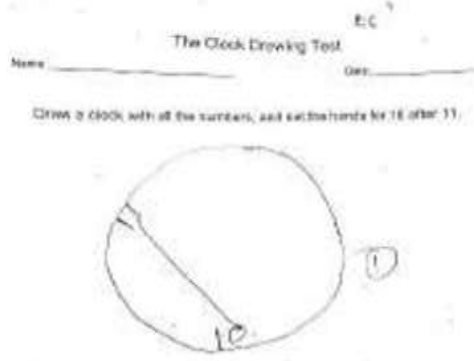




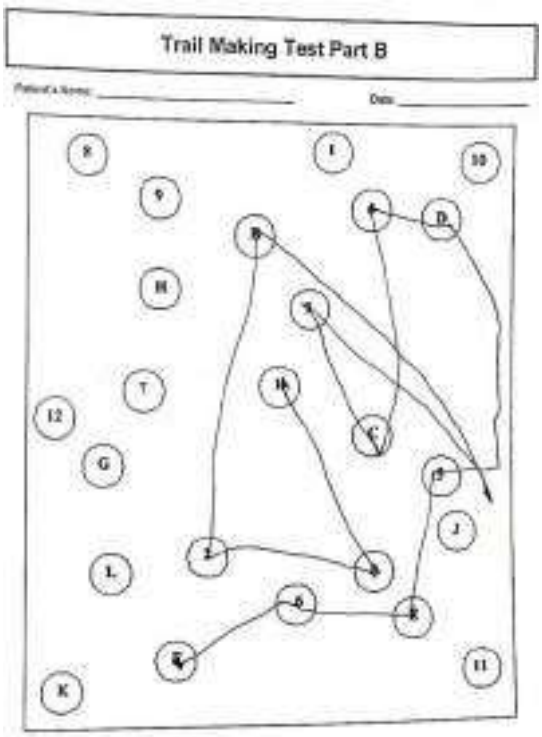


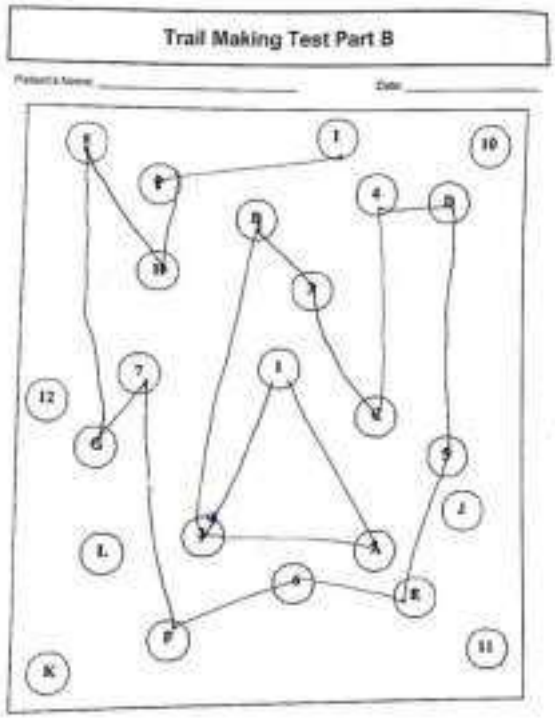


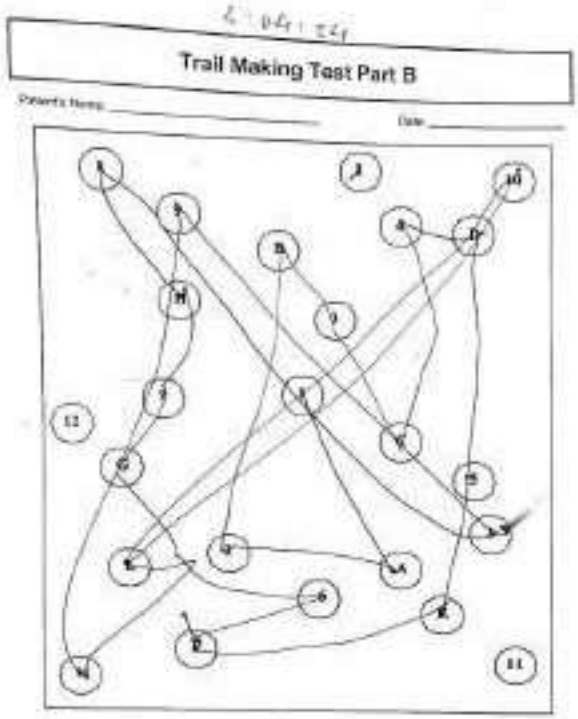




Performance on Trail Making Test -B







Discussion

The present study was conducted with the aim to find out whether the patients who are suffering from migraine have any cognitive impairment especially in their executive functioning and coping strategies as compared to the healthy control groups. The secondary aim was to find out its relationship to clinical correlate. Considering all the factors, the study included patients with higher levels of education in order to provide a more definite and generalized findings. A total number of 100 patients(50 in each group) fulfilling the laid down inclusion and exclusion criteria were recruited and assessed with the help Executive functioning test- TMT-A & B, Stroop test, CDT,DST, Brief-Cope Scale and HAD-S. Diagnosis of the study population was made according to the diagnostic criteria of ICHD-3. The data was then analyzed and following conclusions were reached.

Executive Functioning

In our study we compared executive functioning of patients with migraine and control groups, we found a significant difference. The maximum difference of means of all domains is found in patients and control groups. This was in concordance with a cross sectional clinical based study by Costa-Silva et al.,[107] 2016 where patients with migraine performed mild- moderate and healthy control groups performed good on executive functioning. Another study done by Huang et al[108].,(2017) showed similar results exhibiting migraine patients performed worst on executive functioning.

Domains of Executive Functioning

TMT-A: which evaluates selective attention and visuomotor tracking

TMT-B: which assesses divided attention and set-shifting.

A significant difference was observed between the performance of patient and control groups on Trail making test in both A & B form. On TMT-A and TMT- B, 74% and 56% respectively patients shows deficit in performance compared to control groups. The current study results are also in corroboration with the earlier-mentioned studies which found significant differences between groups for execution time on the TMT where migraineurs took longer to complete the test. [Costa-Silva et al.,[107]2016].Another study held by Villa et al[109].,2009 and Calandre et al (2002)[110] assesses patients on TMT which measures

executive functioning and is associated with selective and divided attention, speed of processing information, and visuomotor tracking reported the deficits in visuomotor tracking and selective attention are consistent with the available data on adults with migraine. A cross-sectional study by Pellegrino Baena et al**[**111**]**., 2018 showed poorer performance in Trail Making Test-B in migraine patients suggesting an impairment in executive functions which is in concordance to our study. Another study held by Camarda et al.,**[**112**]** 2007 found that the trail making test- B is possibly the test most consistently found to be disturbed in individuals with migraine compared with control groups

Stroop Test: which assess cognitive inhibition and processing speed with language process.

In our study we found a significant difference in mean of Stroop interferences between patients and control groups which is 31.62 and

9.44 respectively, which indicates larger interference score poorer performance between the sample which is in corroboration with another study held by Ferreira et al.,2016 **[**113**]** reporting that the patients with migraine had a poorer performance in Stroop test **[**Patients and control groups mean= 24.5 &18.8, respectively**]**.

CDT: Clock Drawing Test: which assess planning and visuo- constructive abilities.

We found a significant difference in performance on CDT in both patients and control groups. 48% shows mild difficulty followed by 26% showing severe difficulty indicating poor planning. The mean of cases is 5.50 which is lower than the control groups 8.92 in our study which is in concordance with study by Ferreira etal.,**[**113**]** 2016 **[**Mean = 2.2 & 2.7 in patients and control groups respectively.**]**

Attention & Concentration: Digit Span test- which assess the verbal working memory.

In our study we observed the mean attention scores found in patients and control groups were 12.66 and 18.28 respectively. However, the control groups had higher mean value of attention depicting the better verbal memory and attention. This is in concordance with the study by Ferreira et al**[**113**]**.,2016 **[** mean=13.0 & 15.8 respectively**]**in migraine patients and healthy group. Another study by Le Pira et al.,**[**114**]** 2000 reported Impaired attention in migraine patients.

Brief-Cope: Avoidant and Approach

Our study compiled the scores of various domains of coping strategies in two categories which is adaptive and avoidant. Emotion focused and problem focused are defined as adaptive strategies. The problem-focused strategies of planning, instrumental support and active coping, together with the emotion focused strategies of self-distraction, emotional support and acceptance, were used the most. In our study we have observed the patients had higher mean value of 33.6 in use of avoidant strategies and lower level of adaptive strategies with mean value 21.6 which is in concordance with a study by Siniatchkin et al**[**115**]**.,1999 the observations suggested that migraine patients are prone to use internally focused coping strategies such as nonverbal complaints, suppressive thoughts, and decreased search for social support suggesting a contracted attitude toward affective support coming from other people. Another study by Martin et al**[**116**]**., 1993support these findings where the adults with chronic headaches score significantly lower on social support, compared to non-headache subjects, Ebrahim et al.,**[**117**]** 2014 have similar results showing avoidant strategy used by migraine and tension type headache than non-clinical participants whereas in another study by a study conducted by Russo et al**[**104**]**., 2019 observed that MwoA patients shows no abnormalities neither in the different dimensions of basic coping strategies which is in contrast to our result.

In our study we observed higher mean value (6.60) of behavioural disengagement domain in patient as compared to control groups (4.56)

.The finding are in concordance with another study by Tomasso et al**[**118**]**.,2014 which reported higher behavioral disengagement in Migraine patients, compared to control groups.

On domain of venting higher mean value of 4.86 inpatient as compared to control groups (3.92). The finding is in contrast with earlier study held by Lanzi**[**119**]** et al., 2001found that headache sufferers internalized their feelings.

Mean values on instrumental (4.38) and social support (4.00) are also decreased for the migraine group as compared to the control groups which is 6.18 & 6.38 respectively. The results are supported by the study conducted by Tomasso et al**[**118**]**.,2014 where the scores on both these domains were reduced in the migraine patients. Another study by Gunel et al**[**120**]**., 2008 migraineur patients used the coping way of seeking social support less compared to the control group individuals.

On the domain of religion our study observed a higher mean value 4.48 in migraine patients which is higher than the mean value for control groups which is 3.78 which is in concordance with a study done by Osman

et al.,[121] 2014 which showed that migraine patients scored higher on religious coping strategy (mean= 14.68 & 13.38) respectively. Few more studies done by Sica et al[122],2008 and Russo et al[104], 2019 which stated that there's a significantly reduced use of the ―turning to religion‖ approach. Our study showed use of religious coping strategies because for most Indians, faith is important. In a 2015 pew Research center survey, eight-in-ten Indians said religion is very important in their lives. Few researches, has found that the majority of patients with chronic pain use religious and/or spiritual forms such as prayer and spiritual support for coping with their pain (Dunn et al.,2004) [123]

The mean value of active coping in patients and control groups are 3.20 & 6.28 respectively. Our findings are consistent with the study by Osman et al[121]., 2014 show significant lower scores on active coping when they were compared to migraine and control group groups(mean value= 10.93 & 11.30) respectively. Active coping such as active problem solving, planning, reconceptualize, and self-reliance strategies, are better ways to deal with stressful events.

Gender Differences in Coping:

Edward et al[124]., 2015 in his study suggested that women in pain are more likely to use coping strategies considered to be maladaptive, resulting in poorer functioning, while men tend to engage in coping strategies considered to be adaptive, leading to better functional outcomes. On the contrary our study found a significant gender difference in mean of avoidant coping strategy. The mean value in males was 35.63 which is higher as compared to the females which was 33.29. Significant gender difference was also found in use of substance use as coping mechanism (maladaptive way) higher in males. In the Indian social context, as the elements of the avoidance scale (alcohol consumption) are more permissible for the male gender, they probably employ this strategy more often.

Whereas the females scored higher mean value in use of religion as coping strategy in contrast to males. The investigator was unable to find a similar relation in studies done earlier on the same population.

Clinical Correlates: Depression and Anxiety

Our study observed the patient's mean value of depression are 9.20 which is higher than the mean value of control groups 5.92. The results are in corroboration with earlies study done by Chung et al.,2014[125]demonstrated that patients with migraine have high levels of depression.(Mean=17.75&

12.76) respectively. This finding is consistent with earlier study that highlight the burden of depression in migraine patients by Wieser et al[126].,2012 .

On HADS- Anxiety the mean value of patients are 10.96 &control groups are 7.96 which is lower than the migraine patients. The findings are in corroboration with a study held by Chung et al., 2014[125] highlights on the high level of anxiety on migraine patients &control groups. (Mean=23.56& 13.16) respectively. Another study held by Mario et al[127]., 2017 showed similar results indicating high level of anxiety in migraine compared to non-headache control groups.

Correlation Between Age and Duration of Illness, Frequency of Attack, CDT

In our study, the relationship between age and duration of illness had shown correlation indicating more the age, more the duration of illness which reflects that onset of migraine tends to take place in early years. Therefore, duration of illness is longer. Early intervention, thereby, can help patients with migraine to prevent severity. The investigator was unable to find a similar relation in studies done earlier. The relation between age and CDT showed negative correlation. More the age, more the worsening performance on CDT. This was in consistency with the study conducted by Taim[128] et al., 2020 found age and education influence the performance on the CDT.

Correlation Between Duration of Illness and Domains of Coping Strategies.

Our study shows a negative correlation between duration of illness and domain of adaptive coping strategy i.e. acceptance which reflects that with the increase in the duration of illness there would be decrease in the acceptance adaptive coping. The findings differed from previous study conducted by Büssing[129]et al., 2010 which revealed that duration of illness had no significant impact on the adaptive coping strategies. On the domain of venting our study reflected longer the duration illness, lesser the use of venting which is corroboration with other study by Lanzin et al[119]., 2001 found that chronic headache sufferers internalized their feelings.

Correlation Between Duration of Illness and Domains of Clinical Correlate-Anxiety.

Our study depicted the relation between duration of illness and anxiety indicating longer the duration of illness, higher the anxiety. The findings are supported by another study by Rammohan [130] et

al.,2019where the duration and frequency of migraine headaches were found to correlate with the presence of Higher level of anxiety. A study by Breslau et al[131]., 1998 also reported that migraneurs are 2-5 times more like to have anxiety. Similarly, many studies have confirmed the comorbidity of migraine and anxiety disorders.[132]

Correlation Between Domains of Executive Functioning and Coping Strategies.

Our study depicted a negative correlation between domain of executive functioning which are attention, processing speed, cognitive flexibility, inhibition and maladaptive coping strategies i.e self- blame, substance use, venting and unable to accept which is in corroboration with earlier studies done by Shields et al.,[133] 2016 found that stress deteriorates working memory, coginitve flexibility and inhibition. Another study done by Houben[134]et al.,2011 showed better the cognitive inhibition, flexibility and working memory may help at-risk drinker to reduce their impulsive attack. Many other studies by Campbell [135]et al., 2009 & Robinson [136] et al., 2015 found individuals with impaired executive functioning may also demonstrate impairment in the ability to use adaptive approaches to cope with stress. Increase in brain activation in pre-frontal regions in response to working memory task were associated with greater use of secondary control group coping strategies and better psychosocial functioning.

Correlation Between Executive Functioning and Clinical Correlates- Anxiety & Depression

Our study shows a negative correlation between cognitive flexibility and depression which indicates lower the attention, the level of depression would be high which is in concordance with a study held by Youngjuan[137] et al., 2018 found greater scores depression were associated with lower scores of cognitive flexibility and higher levels of impulsivity. Depression and cognitive flexibility could predict attention impulsivity and non-planning impulsivity. Another study held by Gabrys[138] et al., 2018 suggested that greater cognitive control group/flexibility was associated with more favourable stressor appraisals and effective coping, which in turn, would be predictive of lower levels of depressive symptoms.

Correlation Between Coping Strategies and Clinical Correlates

A study done by Materazzo[139] et al., 2000 found migraine patients use less effective coping strategies that can lead to higher level of depression which is in corroboration to our findings reflecting correlation

between depression and venting (Avoidant strategy). Other study had indicated coping by ―venting‖ produced greater levels of anxiety and depression by McPherson [140]et al., 2013 but our study did not show such correlation. Migraine patients internalise their feelings that can produce depression therefore thought ventilation is an adaptive way to cope with stress.

Conclusion

To conclude the present study suggested that patients with migraine showed deficit in executive functioning with maladaptive coping strategies and symptoms of depression & anxiety compared to healthy control group.

Executive functioning, coping strategies and clinical correlates are an important area of study in migraine. The goal of assessing these domains is that the individuals could receive appropriate cognitive training and have the best opportunity to recover. The findings of the present study indicate that there is a significant correlation among executive functioning, coping strategies and clinical correlates. These domains could be potential targets for cognitive training and for therapeutic intervention. The improvements in these domains may lead to a better daily functioning in patients suffering from migraine.

Future Directions

The existing data suggest that migraine patients have deficit in executive performance and employ maladaptive coping strategies with presence of depressive and anxiety symptoms. Future studies should consider population based longitudinal studies that can address the question of whether all migraine disorders can lead to cognitive impairment. Lower educational level could be studied as well to analyse whether migraine has a significant effect on executive performance and consequently its association with the employed coping strategies. The assessment of executive function was limited therefore further domain of executive function could be studied. Future research can evaluate executive functioning, coping strategies and psychological distress by applying proper cognitive training with therapeutic intervention to see the pre and post phase of executive performance, adaptive coping and level of distress which would help us to go beyond the treatment of just pain itself.

References

1. Hauser SL, Kasper DL,Braunwald E, Fauci AS, Longo DL. Neurology in Clinical Medicine. McGraw-Hill Professional.2006.

2. Headache Classification Committee of the International Headache Society (IHS). The International Classification of Headache Disorders, 3rd edition (beta version). Cephalalgia: an international journal of headache. 2013;33:629–808

3. Spencer S. Global Burden of Disease 2010 Study: A personal reflection. Global cardiology science & practice. 2013;2:115–26.

4. Penman J. Trigeminal neuralgia. In: Vinken PJ, Bruyn GW, editors. Handbook of clinical neurology. Amsterdam: North Holland, 1968: 296-322.

5. Van den BerghV, Amery WK, Waelkens J; Trigger factors in migraine: a Study conducted by the Belgian Migraine Society. Headache. 1987;27:191-6.

6. Robbins L. Precipitating factors in migraine; A Retrospective Review of 494 patients. Headache. 1994;34:214-6

7. Scharff L, Turk DC, Marcus DA. Trigger of headache episodes and coping responses of headache diagnosticgroups. Headache. 1995;35:397-403

8. Fuenmegor LD, Garcia S. The effects of fasting on 5- hydroxyltryptamine metabolism in brain regions of thealbino rat. Br. J. Pharmocol. 1984;83:357-62

9. Schmitz N, Arkink EB, Mulder M, Rubia K, Admiraal-Behloul F, Schoonman GG, et al. Frontal lobe structure and executive function in migraine patients. Neuroscience letters. 2008;440:92–6.

10. Sereno AB, Babin SL, Hood AJ, Jeter CB. Executive functions: eye movements and neuropsychiatric disorders.2009.

11. Burgess PW, Simons JS. 18 Theories of frontal lobe executive function: clinical applications. The effectiveness of rehabilitation for cognitive deficits. 2005;211.

12. Espy KA. Using developmental, cognitive, and neuroscience approaches to understand executive control group in young children. Dev Neuropsychol. 2004;26:379-84.

13. Miller EK, Cohen JD. An integrative theory of prefrontal cortex function. Annu Rev Neurosci. 2001;24:167-202.

14. Armbruster DJ, Ueltzhöffer K, Basten U, Fiebach CJ. Prefrontal cortical mechanisms underlying individual differences in cognitive flexibility and stability. Journal of cognitive neuroscience. 2012;24:2385–99.

15. Scott WA. Cognitive complexity and cognitive flexibility. Sociometry. 1962:405–414.

16. Genet JJ, Siemer M. Flexible control group in processing affective and non-affective material predicts individual differences in trait resilience. Cognition and emotion. 2011;25(2):380-8.

17. Anderson MC. Rethinking interference theory: Executive control group and the mechanism of forgetting. J Mem Lang. 2003; 49: 415–455.

18. Kane MJ, Engle RW. Working-memory capacity and the control group of attention: the contributions of goal neglect, response competition, and task set to Stroop interference. Journal of experimental psychology: General. 2003;132(1):47.

19. Weintraub S. Neuropsychological assessment. Principles of behavioral and cognitive neurology. 2000;124–9.

20. Miller BL, Grafman J, Cummings JL. Planning and the brain. The Human Frontal Lobes, Second Edition: Functions and Disorders (The Science and Practice of Neuropsychology) Second Edition. 2007;249–61.

21. R. S. Lazarus, Psychological Stress and the Coping Process, McGraw-Hill, New York, NY, 1966.

22. Carver CS, Connor-Smith J. Personality and coping. Annual Review of Psychology. 2010;61:679–704.

23. Folkman S, Lazarus RS, Dunkel-Schetter C, DeLongis A, Gruen RJ, Dynamics of a stressful encounter: cognitive appraisal, coping, and encounter outcomes. Journal of Personality and Social Psychology. 1986;50:992–1003.

24. Costa Jr PT, Somerfield MR, McCrae RR. Personality and coping: A reconceptualization.1996.

25. Folkman S, Lazarus RS. Stress, appraisal, and coping. New York: Springer Publishing Company; 1984.

26. Endler NS, Parker JD. Multidimensional assessment of coping: A critical evaluation. Journal of personality and social psychology. 1990;58(5):844.

27. Carver CS. You want to measure coping but your protocol'too long: Consider the brief cope. International journal of behavioral medicine. 1997;4(1):92-100.

28. Compas BE. Psychobiological processes of stress and coping: Implications for resilience in childhood and adolescence. Annals of the New York Academy of Sciences. 2006;1094:226–234.

29. Skinner EA, Zimmer-Gembeck MJ. Coping and the Development of Regulation: New Directions for Child and Adolescent Development, Number 124. Jossey-Bass; 2009;87–99.

30. Compas BE, Jaser SS, Dunn MJ, Rodriguez EM. Coping with chronic illness in childhood and adolescence. Annual Review of Clinical Psychology. 2012;8:455–480

31. Murray CJ, Lopez AD, World Health Organization. The global burden of disease: a comprehensive assessment of mortality and disability from diseases, injuries, and risk factors in 1990 and projected to 2020: summary. World Health Organization; 1996.

32. Murray CJ, Lopez AD. A compendium of incidence, prevalence and mortality estimates for over 200 conditions. The Global Burden of Disease and Injury Series. The Global Burden of Disease. 1996;2.

33. Contribution of primary care to health systems and health.Starfield B, Shi L, MacinkoJMilbank Q. 2005; 83(3):457-502.

34. Olfson M, Fireman B, Weissman MM, Leon AC, Sheehan DV, Kathol RG, Hoven C, Farber L. Mental disorders and disability among patients in a primary care group practice. American Journal of Psychiatry. 1997;154(12):1734-40.

35. Brown C, Schulberg HC, Madonia MJ, Shear MK, Houck PR. Treatment outcomes for primary care patients with major depression and lifetime anxiety disorders. The American journal of psychiatry. 1996.

36. Lifetime panic-depression comorbidity in the National Comorbidity Survey.Kessler RC, Stang PE, Wittchen HU, Ustun TB, Roy-Burne PP, Walters EEArch Gen Psychiatry. 1998; 55(9):801-8.

37. Comorbid anxiety disorder and the functioning and well-being of chronically ill patients of general medical providers.Sherbourne CD, Wells KB, Meredith LS, Jackson CA, Camp PArch Gen Psychiatry. 1996; 53(10):889-95.

38. Roy-Byrne PP, Stang P, Wittchen HU, Ustun B, Walters EE, Kessler RC. Lifetime panic–depression comorbidity in the National Comorbidity Survey: Association with symptoms, impairment, course and help-seeking. The British Journal of Psychiatry. 2000;176(3):229-35.

39. Rocca MA, Ceccarelli A, Falini A, Tortorella P, Colombo B, Pagani E, et al. Diffusion tensor magnetic resonance imaging at 3.0 tesla shows subtle cerebral grey matter abnormalities in patients with migraine. Journal of Neurology, Neurosurgery & Psychiatry. 2006;77(5):686-9.

40. De Benedittis G, Lorenzetti A, Sina C, Bernasconi V. Magnetic resonance imaging in migraine and tension-type headache. Headache: The Journal of Head and Face Pain. 1995;35(5):264-8.

41. Bender S, Oelkers-Ax R, Resch F, Weisbrod M. Frontal lobe involvement in the processing of meaningful auditory stimuli develops during childhood and adolescence. Neuroimage. 2006;33(2):759-73.

42. Shallice TI, Burgess PW. Deficits in strategy application following frontal lobe damage in man. Brain. 1991;114(2):727-41.

43. Robbins TW. Shifting and stopping: fronto-striatal substrates, neurochemical modulation and clinical implications. Philosophical Transactions of the Royal Society B: Biological Sciences. 2007;362(1481):917-32.

44. Siniatchkin M, Riabus M, Hasenbring M. Coping styles of headache sufferers. Cephalalgia. 1999;19(3):165-73.

45. Ellison CW. Spiritual well-being: Conceptualization and measurement. Journal of psychology and theology. 1983;11(4):330- 8.

46. Feigin VL, Abajobir AA, Abate KH, Abd-Allah F, Abdulle AM, Abera SF, et al. Global, regional, and national burden of neurological disorders during 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. The Lancet Neurology. 2017;16(11):877-97.

47. Steiner TJ, Stovner LJ, Vos T, Jensen R, Katsarava Z. Migraine is first cause of disability in under 50s: will health politicians now take notice?.2018:19(1):17

48. Steel Z, Marnane C, Iranpour C, Chey T, Jackson JW, Patel V, et al. The global prevalence of common mental disorders: a systematic review and meta-analysis 1980–2013. International journal of epidemiology. 2014;43(2):476-93.

49. Patel V, Chisholm D, Parikh R, Charlson FJ, Degenhardt L, Dua T, et al. Addressing the burden of mental, neurological, and substance use disorders: key messages from Disease Control group Priorities. The Lancet. 2016;387(10028):1672-85.

50. Walker ER, McGee RE, Druss BG. Mortality in mental disorders and global disease burden implications: a systematic review and meta-analysis. JAMA psychiatry. 2015;72(4):334-41.

51. Seng EK, Seng CD. Understanding migraine and psychiatric comorbidity. Current opinion in neurology. 2016;29(3):309-13.

52. Zarcone D, Corbetta S. Shared mechanisms of epilepsy, migraine and affective disorders. Neurological Sciences. 2017;38(1):73-6.

53. Baskin SM, Lipchik GL, Smitherman TA. Mood and anxiety disorders in chronic headache. Headache: The Journal of Head and Face Pain. 2006;46:S76-87.

54. Antonaci F, Nappi G, Galli F, Manzoni GC, Calabresi P, Costa A, et al. Migraine and psychiatric comorbidity: A review of clinical findings. J Headache Pain. 2011;12:115–25.

55. Breslau N. Psychiatric comorbidity in migraine. Cephalalgia. 1998;18(Suppl 22):56-8.

56. Hooker WD, Raskin NH. Neuropsychologic alterations in classic and common migraine. Archives of neurology. 1986;43(7):709-12.

57. Burker E, Hannay HJ, Halsey JH. Neuropsychological functioning and personality characteristics of migrainous and nonmigrainous female college students. Neuropsychology. 1989;3(2):61–73

58. Siniatchkin M, Riabus M, Hasenbring M. Coping styles of headache sufferers. Cephalalgia. 1999;19(3):165-73.

59. Waldie KE, Hausmann M, Milne BJ, Poulton R. Migraine and cognitive function: a life-course study. Neurology. 2002;59(6):904-8.

60. Mongini F, Keller R, Deregibus A, Barbalonga E, Mongini T. Frontal lobe dysfunction in patients with chronic migraine: a clinical– neuropsychological study. Psychiatry research. 2005;133(1):101-6.

61. Gaist D, Pedersen L, Madsen C, Tsiropoulos I, Bak S, Sindrup S, et al. Long-term effects of migraine on cognitive function: a population- based study of Danish twins. Neurology. 2005;64(4):600-7.

62. Camarda C, Monastero R, Pipia C, Recca D, Camarda R. Interictal executive dysfunction in migraineurs without aura: relationship with duration and intensity of attacks. Cephalalgia. 2007 Oct;27(10):1094-100.

63. Kalaydjian A, Zandi PP, Swartz KL, Eaton WW, Lyketsos C. How migraines impact cognitive function: findings from the Baltimore ECA. Neurology. 2007;68(17):1417-24.

64. Schmitz N, Arkink EB, Mulder M, Rubia K, Admiraal-Behloul F, Schoonmann GG, et al. Frontal lobe structure and executive function in migraine patients. Neuroscience letters. 2008;440(2):92- 6.

65. Gunel MK, Akkaya FY. Are migraineur women really more vulnerable to stress and less able to cope?. BMC health services research. 2008;8(1):1-6.

66. Rist PM, Dufouil C, Glymour MM, Tzourio C, Kurth T. Migraine and cognitive decline in the population-based EVA study. Cephalalgia. 2011;31(12):1291-300.

67. Araújo CM, Barbosa IG, Lemos SM, Domingues RB, Teixeira AL. Cognitive impairment in migraine: a systematic review. Dementia &neuropsychologia. 2012;6(2):74-9.

68. Suhr JA, Seng EK. Neuropsychological functioning in migraine: clinical and research implications. Cephalalgia. 2012;32(1):39-54.

69. Martins IP, Gil-Gouveia R, Silva C, Maruta C, Oliveira AG. Migraine, headaches, and cognition. Headache: The Journal of Head and Face Pain. 2012;52(10):1471-82.

70. Rist PM, Schürks M, Buring JE, Kurth T. Migraine, headache, and the risk of depression: Prospective cohort study. Cephalalgia. 2013;33(12):1017-25.

71. de Tommaso M, Federici A, Loiacono A, Delussi M, Todarello O. Personality profiles and coping styles in migraine patients with fibromyalgia comorbidity. Comprehensive Psychiatry. 2014;55(1):80-6.

72. Biagianti B, Grazzi L, Usai S, Gambini O. Dependency-like behaviors and pain coping styles in subjects with chronic migraine and medication overuse: results from a 1-year follow-up study. Bmc Neurology. 2014;14(1):1-7.

73. Morris MC, Evans LD, Rao U, Garber J. Executive function moderates the relation between coping and depressive symptoms. Anxiety, Stress, & Coping. 2015;28(1):31-49.

74. Shaik MM, Hassan NB, Tan HL, Gan SH. Quality of life and migraine disability among female migraine patients in a tertiary hospital in Malaysia. BioMed research international. 2015;2015.

75. Gil-Gouveia R, Oliveira AG, Martins IP. Cognitive dysfunction during migraine attacks: a study on migraine without aura. Cephalalgia. 2015;35(8):662-74.

76. Padilla MF, Pitta P, Lombana-Angel L, Ingram G, Gómez C, Restrepo JA. Differences in Executive Functions applied to memory processes in people with Migraine: a Cross-Sectional Study. Universitas Psychologica. 2016;15(5).

77. Costa-Silva MA, Prado AC, Souza LC, Gomez RS, Teixeira AL. Cognitive functioning in adolescents with migraine. Dementia &neuropsychologia. 2016;10(1):47-51.

78. Huang L, juan Dong H, Wang X, Wang Y, Xiao Z. Duration and frequency of migraines affect cognitive function: evidence from neuropsychological tests and event-related potentials. The journal of headache and pain. 2017;18(1):1-7.

79. Borges L, Speciali J, Junior FR. Depressive and Anxiety Disorders in Migraine and Chronic Migraine (P1. 319).

80. Lee SH, Kang Y, Cho SJ. Subjective cognitive decline in patients with migraine and its relationship with depression, anxiety, and sleep quality. The journal of headache and pain. 2017;18(1):1-8.

81. Ferreira KS, Teixeira CT, Cáfaro C, Oliver GZ, Carvalho GL, Carvalho LA, et al. Chronic migraine patients show cognitive impairment in an extended neuropsychological assessment. Arquivos de neuro-psiquiatria. 2018;76(9):582-7.

82. Sreedhar A, Kumar SM, Shobha AN. Executive function and its clinical correlates among migraineurs. Indian Journal of Pain. 2018;32(3):167.

83. Gil-Gouveia R, Martins IP. Cognition and cognitive impairment in migraine. Current pain and headache reports. 2019;23(11):1-0.

84. Sajobi TT, Amoozegar F, Wang M, Wiebe N, Fiest KM, Patten SB, et al. Global assessment of migraine severity measure: preliminary evidence of construct validity. BMC neurology. 2019;19(1):53.

85. Baschi R, Monastero R, Cosentino G, Costa V, Giglia G, Fierro B, et al. Visuospatial learning is fostered in migraine: evidence by a neuropsychological study. Neurological Sciences. 2019;40(11):2343-8.

86. Russo A, Santangelo G, Tessitore A, Silvestro M, Trojsi F, De Mase A, et al. Coping strategies in migraine without aura: a cross- sectional study. Behavioural neurology. 2019;2019.

87. Nieto M, Romero D, Ros L, Zabala C, Martínez M, Ricarte JJ, et al. Differences in coping strategies between young and older adults:The role of executive functions. The International Journal of Aging and Human Development. 2020;90(1):28-49.

88. O'Rourke EJ, Halpern LF, Vaysman R. Examining the relations among emerging adult coping, executive function, and anxiety. Emerging Adulthood. 2020;8(3):209-25.

89. DesRosiers G, Kavanagh D. Cognitive assessment in closed head injury: Stability, validity and parallel forms for two neuropsychological measures of recovery. International Journal of Clinical Neuropsychology. 1987.

90. Golden CJ. Clinical interpretation of objective psychological tests. New York: Grune& Stratton; 1979.

91. Perret E. The left frontal lobe of man and the suppression of habitual responses in verbal categorical behaviour. Neuropsychologia. 1974;12(3):323-30.

92. McNally RJ, English GE, Lipke HJ. Assessment of intrusive cognition in PTSD: Use of the modified Stroop paradigm. Journal of Traumatic stress. 1993;6(1):33-41.

93. Franzen MD, Tishelman AC, Sharp BH, Friedman AG. An investigation of the test-retest reliability of the stroop colorword test across two intervals. Archives of Clinical Neuropsychology. 1987;2(3):265-72.

94. Sunderland T, Hill JL, Mellow AM, Lawlor BA, Gundersheimer J, Newhouse PA, et al. Clock drawing in Alzheimer's disease: a novel measure of dementia severity. Journal of the American Geriatrics society. 1989;37(8):725-9.

95. Van Hout H, Berkhout S. Inter-rater reliability of the clock-drawing test. Age and ageing. 1999;28(3):327-8..

96. Ryan JJ, Lopez SJ, Paolo AM. Digit span performance of persons 75–96 years of age: Base rates and associations with selected demographic variables. Psychological assessment. 1996;8(3):324- 7.

97. Lezak MD, Howieson DB, Loring DW, Fischer JS. Neuropsychological assessment. Oxford University Press, USA; 2004.

98. Ostrosky-Solís F, Lozano A. Digit span: Effect of education and culture. International Journal of Psychology. 2006;41(5):333-41.

99. Sung JE. The reliability and validity of short-term and working memory pointing tasks developed for clinical populations with speech and language disorders. Communication Sciences & Disorders. 2011;16(2):185-201.

100. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. Acta psychiatricascandinavica. 1983;67(6):361-70.

101. Djukanovic I, Carlsson J, Årestedt K. Is the Hospital Anxiety and Depression Scale (HADS) a valid measure in a general population 65–80 years old? A psychometric evaluation study. Health and quality of life outcomes. 2017;15(1):1-0.

102. Padilla MF, Pitta P, Lombana-Angel L, Ingram G, Gómez C, Restrepo JA. Differences in Executive Functions applied to memory processes in people with Migraine: a Cross-Sectional Study. Universitas Psychologica. 2016;15(5).

103. Stewart WF, Lipton RB, Kolodner K, Liberman J, Sawyer J. Reliability of the migraine disability assessment score in a population-based sample of headache sufferers. Cephalalgia. 1999;19(2):107-14.

104. Russo A, Santangelo G, Tessitore A, Silvestro M, Trojsi F, De Mase A, et al. Coping strategies in migraine without aura: a cross- sectional study. Behavioural neurology. 2019;2019.

105. Sreedhar A, Kumar SM, Shobha AN. Executive function and its clinical correlates among migraineurs. Indian Journal of Pain. 2018;32(3):167.

106. Shaik MM, Hassan NB, Tan HL, Gan SH. Quality of life and migraine disability among female migraine patients in a tertiary hospital in Malaysia. BioMed research international. 2015;2015.

107. Costa-Silva MA, Prado AC, Souza LC, Gomez RS, Teixeira AL. Cognitive functioning in adolescents with migraine. Dementia &neuropsychologia. 2016;10(1):47-51.

108. Huang L, juan Dong H, Wang X, Wang Y, Xiao Z. Duration and frequency of migraines affect cognitive function: evidence from neuropsychological tests and event-related potentials. The journal of headache and pain. 2017;18(1):1-7.

109. Villa TR, Moutran AC, Diaz LS, Pinto MP, Carvalho FA, Gabbai AA, et al. Visual attention in children with migraine: a control groupled comparative study. Cephalalgia. 2009;29(6):631-4.

110. Calandre EP, Bembibre J, Arnedo ML, Becerra D. Cognitive disturbances and regional cerebral blood flow abnormalities in migraine patients: their relationship with the clinical manifestations of the illness. Cephalalgia. 2002;22(4):291-302.

111. Pellegrino Baena C, Goulart AC, Santos ID, Suemoto CK, Lotufo PA, et al. Migraine and cognitive function: baseline findings from the Brazilian longitudinal study of adult health: ELSA-Brasil. Cephalalgia.

2018;38(9):1525-34.

112. Camarda C, Monastero R, Pipia C, Recca D, Camarda R. Interictal executive dysfunction in migraineurs without aura: relationship with duration and intensity of attacks. Cephalalgia. 2007;27(10):1094- 100.

113. Ferreira KS, Oliver GZ, Thomaz DC, Teixeira CT, Foss MP. Cognitive deficits in chronic pain patients, in a brief screening test, are independent of comorbidities and medication use. Arquivos de neuro-psiquiatria. 2016;74(5):361-6.

114. Le Pira F, Lanaia F, Zappalà G, Morana R, Panetta MR, Reggio E, et al. Relationship between clinical variables and cognitive performances in migraineurs with and without aura. Functional neurology. 2004;19(2):101-5.

115. Siniatchkin M, Riabus M, Hasenbring M. Coping styles of headache sufferers. Cephalalgia. 1999;19:165–73.

116. Martin PR, Theunissen C. The role of life event stress, coping and social support in chronic headaches. Headache J Head Face Pain. 1993;33(6):301–6.

117. Rezaei Dogaheh E, Yoosefi A, Kami M. Comparison of maladaptive coping styles in patients with migraine and tension headaches with normal group.2014.

118. de Tommaso M, Federici A, Loiacono A, Delussi M, Todarello O. Personality profiles and coping styles in migraine patients with fibromyalgia comorbidity. Comprehensive Psychiatry. 2014;55(1):80-6.

119. Lanzi G, Zambrino CA, Ferrari-Ginevra O, Termine C, D'arrigo S, Vercelli P, et al. Personality traits in childhood and adolescent headache. Cephalalgia. 2001;21(1):53-60.

120. Gunel MK, Akkaya FY. Are migraineur women really more vulnerable to stress and less able to cope?. BMC health services research. 2008;8(1):1-6.

121. Ozdemir O, Aykan F, Ozdemir PG. Coping Strategies and personality traits in women patients with migraine and tension type headache. Psychiatry and Behavioral Sciences. 2014;4(2):59.-65.

122. Sica C, Magni C, Ghisi M. Coping orientation to problems experienced (COPE): Italian translation and adaptation. PsicoterapiaCognitiva e Comportamentale. 2008;14(1):27-53.

123. Dunn KS, Horgas AL. Religious and nonreligious coping in older adults experiencing chronic pain. Pain Management Nursing. 2004;5(1):19-28.

124. Edwards R, Augustson EM, Fillingim R. Sex-specific effects of pain- related anxiety on adjustment to chronic pain. The Clinical Journal of Pain. 2000;16(1):46-53.

125. Oh K, Cho SJ, Chung YK, Kim JM, Chu MK. Combination of anxiety and depression is associated with an increased headache frequency in migraineurs: a population-based study. BMC neurology. 2014;14(1):1-9.

126. Wieser T, Walliser U, Womastek I, Kress HG. Dysfunctional coping in headache: avoidance and endurance is not associated with chronic forms of headache. European Journal of Pain. 2012;16(2):268-77.

127. Peres MF, Mercante JP, Tobo PR, Kamei H, Bigal ME. Anxiety and depression symptoms and migraine: a symptom-based approach research. The journal of headache and pain. 2017;18(1):1-8.

128. Muayqil TA, Tarakji AR, Khattab AM, Balbaid NT, Al-Dawalibi AM, Alqarni SA, et al. Comparison of Performance on the Clock Drawing Test Using Three Different Scales in Dialysis Patients. Behavioural Neurology. 2020;2020.

129. Büssing A, Ostermann T, Neugebauer EA, Heusser P. Adaptive coping strategies in patients with chronic pain conditions and their interpretation of disease. BMC public health. 2010;10(1):1-0.

130. Rammohan K, Mundayadan SM, Das S, Shaji CV. Migraine and mood disorders: prevalence, clinical correlations and disability. Journal of neurosciences in rural practice. 2019;10(1):28–33.

131. Breslau N. Psychiatric comorbidity in migraine. Cephalalgia. 1998;18(Suppl 22):56-8.

132. Oedegaard KJ, Neckelmann D, Mykletun A, Dahl AA, Zwart JA, Hagen K, et al. Migraine with and without aura: association with depression and anxiety disorder in a population-based study. The HUNT Study. Cephalalgia. 2006;26(1):1-6.

133. Shields GS, Sazma MA, Yonelinas AP. The effects of acute stress on core executive functions: A meta-analysis and comparison with cortisol. Neuroscience &Biobehavioral Reviews. 2016;68:651-68.

134. Houben K, Wiers RW, Jansen A. Getting a grip on drinking behavior: training working memory to reduce alcohol abuse. Psychological science. 2011;22(7):968-75.

135. Campbell LK, Scaduto M, Van Slyke D, Niarhos F, Whitlock JA, Compas BE. Executive function, coping, and behavior in survivors of childhood acute lymphocytic leukemia. Journal of pediatric psychology. 2009;34(3):317-27.

136. Robinson KE, Pearson MM, Cannistraci CJ, Anderson AW, Kuttesch Jr JF, Wymer K, et al. Functional neuroimaging of working memory in survivors of childhood brain tumors and healthy children: Associations with coping and psychosocial outcomes. Child Neuropsychology. 2015;21(6):779-802.

137. Yu Y, Yu Y, Lin Y. Anxiety and depression aggravate impulsiveness: the mediating and moderating role of cognitive flexibility. Psychology, health & medicine. 2020;25(1):25-36.

138. Gabrys RL, Tabri N, Anisman H, Matheson K. Cognitive control group and flexibility in the context of stress and depressive symptoms: The cognitive control group and flexibility questionnaire. Frontiers in Psychology. 2018;9:2219.

139. Materazzo F, Cathcart S, Pritchard D. Anger, depression, and coping interactions in headache activity and adjustment: a control groupled study. Journal of psychosomatic research. 2000;49(1):69- 75.

140. McPherson S, Hale R, Richardson P, Obholzer A. Stress and coping in accident and emergency senior house officers. Emergency Medicine Journal. 2003;20(3):230-1.