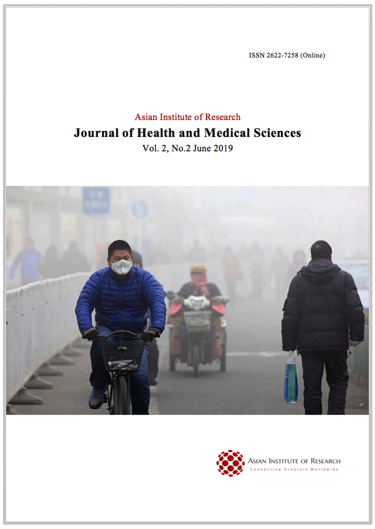

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Weight Changes and Cognitive Functions in Patients with Stroke: Case Report

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Abstract
Objective of the study: Cognition is an important factor for determining the rate of recovery of stoke so finding the factors that might affect cognition is important to improve it and so to improve recovery rate in patients with stroke. Methodology: Fifteen chronic stroke male patients were recruited to this study. The patients age ranged from55 to 65. All patients were assessed for body mass index (BMI) and also for cognitive functions by Montreal Cognitive Assessment (MOCA) scale and rehacom. Results: the study found a Negative strong correlation between MOCA and BMI (R= -.95),Negative moderate correlation between BMI and Attention(R=-.66) ,Weak negative correlation between BMI and memory (R=-.38),Weak positive correlation between MOCA and memory (R=.38),Moderate positive correlation between MOCA and attention (R=.61) and Strong positive correlation between memory and solutions (R=.77).Conclusion: There is a negative correlation between BMI and cognition, so it should consider body weight management in the rehabilitation of stroke patients to improve cognitive functions.

Keywords: Stroke, Cognition, Attention, Memory, BMI, Rehacom, MOCA

Introduction

The brain has to interpret, organize, and store the information. This is the way to do daily activities. A stroke can affect any part of this process, from picking up the information to planning how to respond (Isabel et al.,2019).

Stroke is one of the primary causes of death and disability worldwide. Cognitive impairment frequently occurs after a stroke. This impairment is a significant factor in delayed functional recovery. Post-stroke cognitive impairment is common in the acute stage. Cognition is a predictor factor of long-term recovery.There is the development of new-onset cognitive impairment or a worsening of cognition in up to 50% of those who have survived a stroke in the chronic stage also (Obaid et al.,2018; Mellon et al.,2015). The recovery of cognition depends on the stroke lesion's size and location(Rosaria et al.,2018; Nys et al.,2005). There are also other factors that might affect cognition as age of patients, drugs, psychological state, level of physical impairment, gender, nature of nutrition and weight of patients might also affect cognition (Pushpendra et al.,2015).

Cognition involves many domains as memory, attention, perception, planning (apraxia), making decisions, and social cognition. Studies exploring relationships between obesity and cognitive impairment in the elderly(Ira et al.,2011).Identifying the risk factor of cognition for stroke patients is important because if the doctors could minimize or control it, the recovery of patients with stroke could improve, and the level of impairment could decrease.From this concept, the purpose of this study was to identify if there is a relation between cognition and weight or body mass index(BMI) as no study was done to assess relationships between obesity and cognitive impairment in patients with stroke.

Methodology

Fifteen male patients diagnosed as ischemic chronic stroke were recruited from the Outpatient Clinic of faculty of physical therapy, Cairo University. A written informed consent was signed by the patient before starting the study. The study was conducted from March 2017 to March 2018. All the patients had a primary level of education only. Age of patients ranged from 55 to 65 years old, and All the patients were assessed for weight and length to calculate body mass index (BMI) through the equation :

Formula: weight (kg) / [height (m)]^2

The formula for BMI is weight in kilograms divided by height in meters squared. If height has been measured in centimeters, divide by 100 to convert this to meters.

Or through Formula: 703 x weight (lbs) / [height (in)]^2

When using English measurements, pounds should be divided by inches squared. This should then be multiplied by 703 to convert from lbs/inches2 to kg/m2.

Also, all the patients were assessed for the level of cognition by using MOCA scale and rehacom;

Montreal Cognitive Assessment scale MoCA-A is a 30 points scale that assesses cognitive functions in adults. It is a screening test as it is sensitive to minor impairment in cognitive domains (Zixu et al. ,2018).

Alternating trial making, visuoconstructional skills, naming, memory, attention, serial 7s, sentence repetition, verbal fluency, abstraction, delayed recall, and orientation are sections of MoCA scale. The Arabic version of MOCA-A test was used in this study, and it was validated in Egyptians (Rahman & El Gaafary., 2009).

This scale has two parts: part written by the patient about solving alternating trial making, visuoconstructional skills, and the serial of seven. The remaining sections of the scale were asked orally by the researcher to the patient. Illustration of each section was given to the patient before solving. Each section was scored, then the total score was calculated (Zixu et al. ,2018).

Patients were assessed also using a computer-based software Rehacom. The Rehacom software contains 32 tasks for assessment of Attention & concentration and vigilance, Memory and learning ability, Visuo- motor co-ordination, Reaction time and precision, Visuo- constructive ability and problems Solving and developing strategies. The Rehacom composes regular PC, 1G RAM, DVD drive, 100 GB hard drive with Windows XP SP3, 128 MB RAM direct 3D graghic card, screen at least 19, regular PC Keyboard or Rehacom panel and printer. The software version is (patient enpult (1990-1997)EN/ISO-13485-certified) (Mattioli et al., 2010).

The available modules in Egypt are attention & concentration, figural memory, logical reasoning, and acoustic reactivity. The logical reasoning and acoustic reactivity module were difficult for the education level of our patients, so we used attention &concentration and figural memory modules in this study.

For each module, every task was illustrated for all patients before starting the assessment to be familiar with the procedure of assessment. Patients received no help during the assessment procedure. Time was set at twenty continuous minutes, and if the patient suffered from fatigue (complaint of the patient or repeated errors after correction) at any time during the assessment, the pause was set. An obligatory five minutes rest was obtained between the two parts of the assessment.

For attention and concentration measurement; Level one was selected, then the patient was asked to select a specific picture from a matrix of pictures on the screen. Levels had many tasks if the patient made a wrong answer, another trial was allowed. This increased the time of the levels. Depending on the right answer of the patient and reaction time, the duration of every level was increased or decreased. Values were calculated as the average values of all tasks during the assessment session.

The figural memory module of Rehacom is composed of two phases: acquisition phase and solution phase. Factor words were set at 7 with normal speed. The acquis. Picture- repro. Picture training mode was selected. Pictures were selected as words were available only in the English language, and all patients did not have knowledge of the English language.

During the acquisition phase, a picture or group of pictures was shown to the patient, and the patient was asked to press ok after memorizing them immediately. The duration of this phase was increased or decreased depending on the speed of memorization of figures. The number of pictures depends on the level of difficulty.

During the solution phase, the patient was asked to remember pictures of the previously shown pictures. In this section, a screen of pictures was passing in front of the patient. The screen was passing from right to left. All patients were asked to select only the pictures which were selected in the acquisition phase when passing inside the area marked by 3 red arrows. Data obtained from the figural memory module were acquisition time and solution time.

Data collection and statistical analysis

All variables of BMI and MOCA scores and rehacom variables of attention, acquisition, solution, and memory were collected and correlated together to find which variables of cognition measurement correlated with BMI.

The correlation was done through SPSS package of statistical analysis by Pearson's Correlation Coefficient. Pearson's correlation coefficient (r) is a measure of the strength of the association between the two variables. Pearson's correlation coefficient (r) for continuous (interval level) data ranges from -1 to +1. “0” means there is no relationship between the variables at all, while -1 or 1 means that there is a perfect negative or positive correlation. Values between 0 and 0.3 (0 and −0.3) indicate a weak positive (negative) linear relationship through a shaky linear rule. Values between 0.3 and 0.7 (0.3 and −0.7) indicate a moderate positive (negative) linear relationship through a fuzzy-firm linear rule. Values between 0.7 and 1.0 (−0.7 and −1.0) indicate a strong positive (negative) linear relationship through a firm, linear rule.

Results:

Mean values of age 60.87 ±1.03, mean values of MOCA scores 21.33±.82, mean values of BMI 25.67±1.12, mean values of attention4.13±.52, mean values of memory 3.07±.35, mean values of acquisition 6.2±.55 and mean values of solutions 44.27±2.1.

From the data representing in (table 1); there is a moderate negative correlation between BMI and attention (-.65) (fig.1)and weak negative correlation between BMI and memory (-.37) (fig.2). There is also a strong negative correlation between MOCA scores and BMI (-.95) (fig.3).

There is a moderate positive correlation between MOCA scores and attention (.61) (fig.4) and between MOCA scores and memory (.38) (fig.5) while there is a positive, strong correlation between solution time and acquisition (.76) (fig.6).

Table 1: correlation between BMI and different variables of cognition

	age	*MOCA*	*BMI*	*attention*	*memory*	Acquisition	Solution
age	1						
MOCA	-0.02437	1					
BMI	-0.1181	**-0.95031**	1				
Attention	-0.09612	**0.61219**	**-0.65486**	1			
Memory	0.06873	**0.381835**	**-0.37846**	0.211029	1		
Acquisition	0.147262	-0.0213	0.062409	-0.17635	-0.05578	1	
Solution	-0.1438	0.118862	-0.03324	0.071378	**0.769478**	0.045882	1

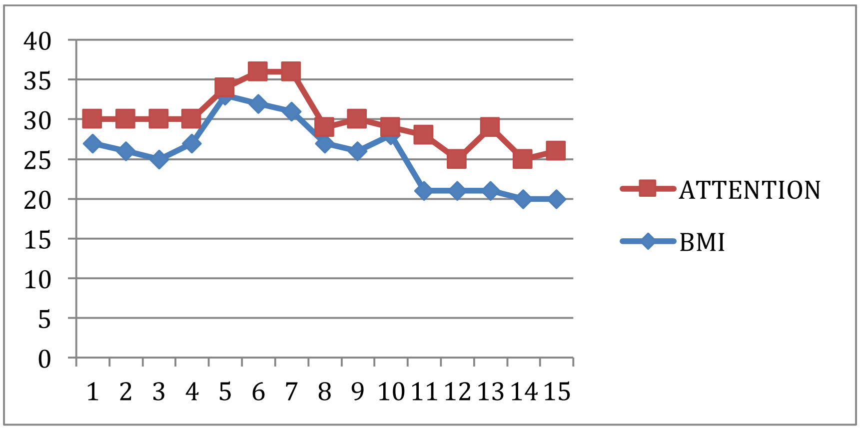

Fig 1: Negative moderate correlation between BMI and Attention.

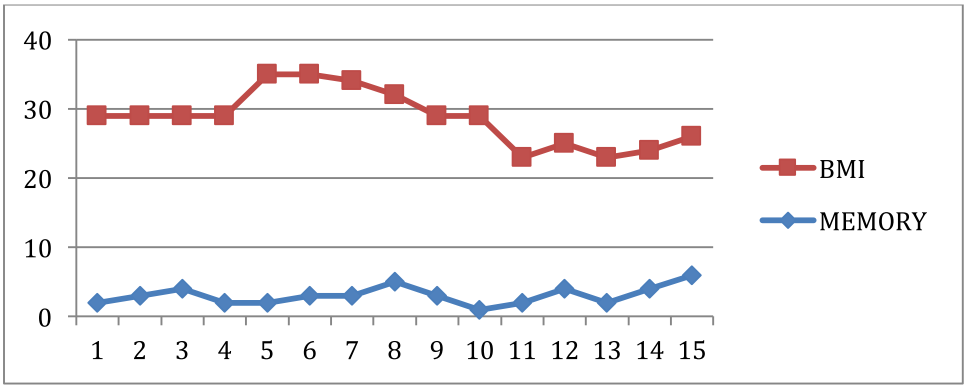

Fig 2: Weak negative correlation between BMI and memory.

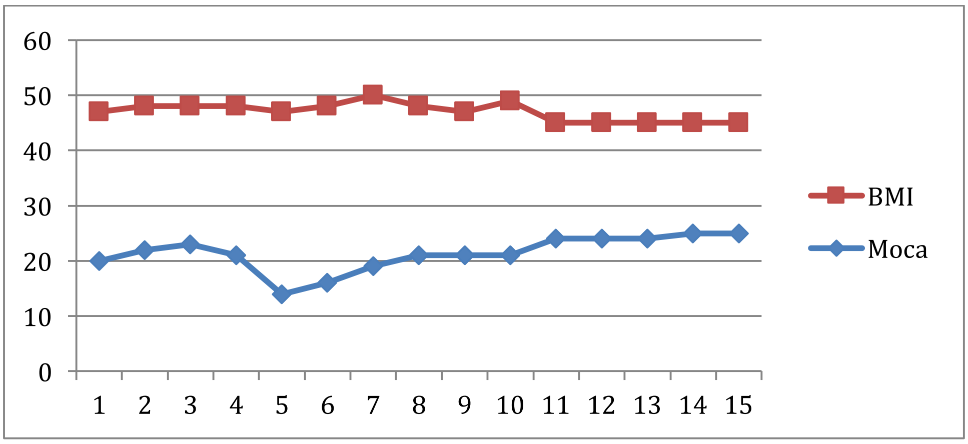

Fig 3: Negative strong correlation between MOCA and BMI.

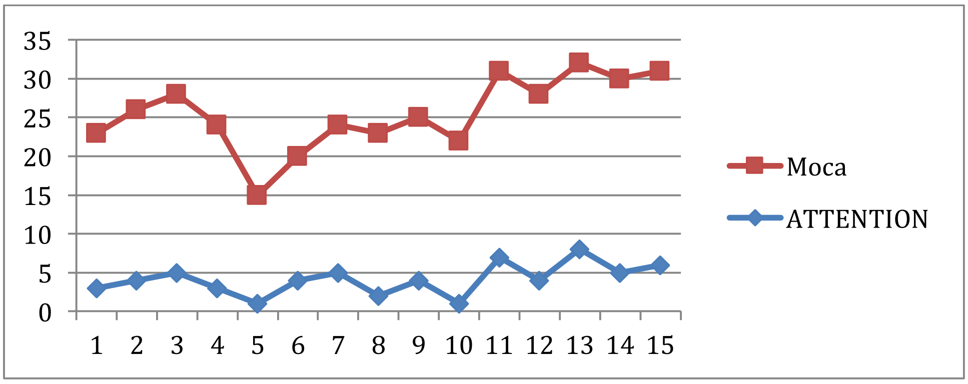

Fig.4: Moderate positive correlation between MOCA and attention.

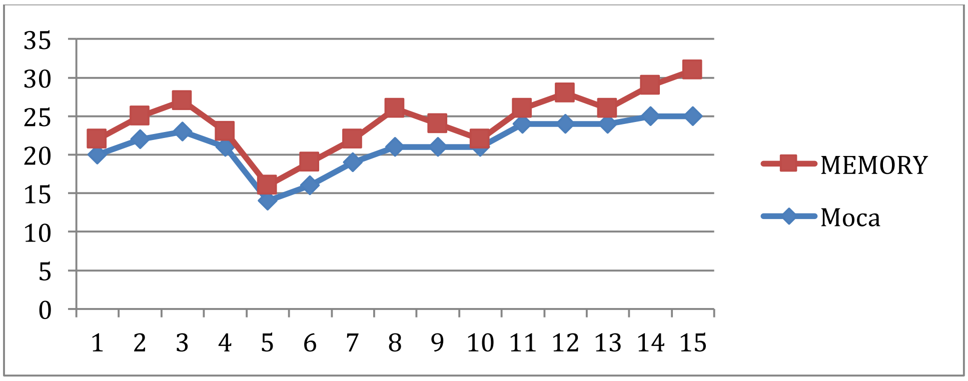

Fig.5: Weak positive correlation between MOCA and memory.

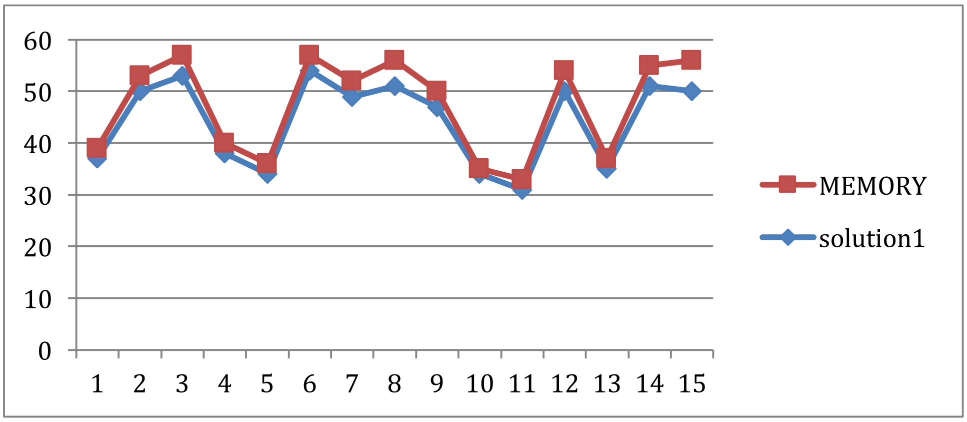

Fig 6: Strong positive correlation between memory and solutions.

Discussion

From the results of our study, there was a negative correlation between BMI and cognition as there was a negative correlation between BMI and MOCA scores and also between it and attention measurement and also between it and memory but for the correlation of memory it was a weak one.

The negative correlation between BMI and cognition might be attributed to overweight and obesity are abnormal or excessive fat accumulation that might impair health. In order to classify overweight or obesity, the body mass index (BMI) is used as an index of weight-for-height in kilograms per square meter (kg/m2). A BMI higher than 25 indicates overweight, whereas a BMI equal to or higher than 30 indicates obesity (Volkow et al.,2009).

There is growing evidence that higher BMI is related to both structural and functional brain differences. BMI was found to relate linearly to reduced prefrontal metabolism in healthy adults with a BMI between 19 and 38 kg/m2.Brain and total gray matter volume are reduced as well as white matter tract integrity (Stanek et al.,2011).

High BMI is associated with chronic low-grade inflammation and with augmented production of pro-inflammatory cytokines.Cytokines released at the periphery of the body are known to enhance the production of brain-produced cytokines. Interestingly, there seems to be a solid there is a link between the effects of inflammation in the brain and the release of dopamine (DA). Overweight and obesity are associated with less responsive DA functioning, less striatal DA-D2/D3 receptor density, and diminished phasic striatal DA signaling. Reductions in baseline prefrontal metabolism were related to decreased memory- and executive performance, often thought to rely on fronto-striatal structures (Frank et al.,2012; Felger et al.,2015).

Memory affection was significantly more common in chronic stroke .an overall prevalence of mild cognitive impairment (MCI) detected based on neuropsychological testing was 14.89% (95% CI: 12.19 to 17.95). Prevalence of the amnestic type was 6.04% (95% CI: 4.40 to 8.1), and that of the multiple domain types was 8.85% (95% CI: 6.81 to 11.32). Adjusted for age, education, and gender, the amnestic type was more common among men and the multiple domain types among women with the advancement of age. Rates differed considerably with educational attainment. Hypertension and diabetes mellitus were the major risk factors for both types of MCI (Pushpendra et al.,2015). And both risk factors are related to obesity so our study confirms that BMI or obesity is correlated to cognition as attention and memory .the higher the BMI the lower the cognitive function of stroke patients so on treatment of stroke patients body weight should be considered as to improve body performance and cognition as cognition not depend only on lesion but also on body weight.

Our study found a correlation between MOCA scores and memory and attention, which were measured by rehacome, which is considered an objective tool to assess cognition functions. The correlation was weak for meamory but moderate for attention, that means that MOCA could be an objective tool to assess attention than a memory.

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