

RELEVANCE OF THE BODY MASS INDEX IN THE COGNITIVE STATUS OF DIABETIC PATIENTS WITH DIFFERENT ALCOHOL-DRINKING PATTERNS

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Abstract - Nowadays the general relevance of alcohol consumption in diabetes is extremely controversial. There are recent reports that alcohol consumption could result in a decreased incidence of diabetes, as well as other studies demonstrating a positive association between alcohol consumption and type 2 diabetes; there are also reports arguing for an inverse association between the two or for no correlation at all. The different results obtained in these studies could be explained by the existence of several confounders that could influence the outcome of the aforementioned studies. In this paper, we studied the possible relevance of BMI as a confounder in the relationship between alcohol consumption in diabetes and cognitive function, by analyzing the correlations between BMI values in diabetic patients with different alcohol drinking patterns and the subdomains from some main psychometric tests, such as MMSE (Mini-Mental State Examination) and MOCA (Montreal Cognitive Assessment). Our results provide evidence for BMI as a possible confounder of the relationship between alcohol consumption in diabetes and cognitive function. We found a significant increase ($p < 0.0001$) in BMI values in patients with diabetes compared to our control group. Most importantly, significant correlations between BMI parameters in alcohol-consuming diabetic patients and most of the subdomains for psychometric testing.

Key words: Diabetes, alcohol, cognitive, body mass index

INTRODUCTION

Considering alcohol usage is such widespread social aspect of modern life, there is an increased awareness regarding the possible effects of alcohol consumption in the progression and complications of diabetes (Baliunas et al., 2009; Carlsson et al., 2003; Conigrave et al., 2001; Wei et al., 2000).

The general relevance of alcohol consumption in diabetes is extremely controversial, considering that there are recent reports describing that moderate alcohol consumption could be associated with a decreased incidence of type 2 diabetes (Zilkens et al.,

2003; Howard et al., 2004), as well as a variety of other studies demonstrating a positive association between drinking alcohol and type 2 diabetes (Heianza et al., 2013; Ajani et al., 2000; Rimm et al., 1995; Perry et al., 1995). In addition, several reports demonstrate an inverse association between the two (Carlsson et al., 2005; Holbrook et al., 1990; Tsumura et al., 1999). Moreover, there are studies stating that there is no association between alcohol consumption and the incidence of diabetes (Wei et al., 2000; Ohlson et al., 1998; Hodge et al., 1993).

Such different findings could have several explanations, as for example the existence of several con-

founders that could significantly influence the final outcome of the aforementioned studies. It appears that sex, as well as the type 2 diabetes definition (e.g. self-report versus objective testing) or the BMI (Body Mass Index) could all be very important confounders or modifiers of the relationship between alcohol consumption and diabetes (Baliunas et al., 2009).

Regarding the BMI, it is thought that a strong inverse association between alcohol drinking and body weight and especially BMI could explain much of the aforementioned apparent protective effect of alcohol in diabetic pathology (Stampfer et al., 2008). These aspects regarding the BMI were never tested in the light of the correlations that might exist between diabetic pathology, alcohol consumption and cognitive function.

Our objective was to investigate the degree of cognitive decline in alcohol-consuming patients with diabetes. Our analysis was initially focused on the relevance of BMI in these correlations, regardless of the drinking habits of the patients. This paper will extensively present the correlations between BMI values in patients and the subdomains from some main psychometric tests, such as the MMSE (Mini-Mental State Examination) and MOCA (The Montreal Cognitive Assessment).

MATERIALS AND METHODS

Patients

This study was conducted according to provisions of the Helsinki Declaration and all the patients signed their consent for participation in this study. It consisted of 80 patients (39 females and 41 males; aged 61.2 years \pm 4.7) with diabetes, and 14 healthy age-matched controls (8 females and 6 males; aged 59.5 years \pm 5.8). Diabetes was diagnosed when fasting glycemia was \geq 126 mg/dl. Patients were recruited from the University Hospital of Psychiatry "Socola", Iași, Romania and they were chronic alcohol abusers, fulfilling DSM diagnostic criteria of alcohol dependence. The healthy control subjects had diabetes excluded by blood samples. The demographic data of

the controls were chosen in order to match the patients with diabetes. Cognitive testing was performed in the morning, between 10-12 a.m. For BMI determination, we divided weight measured in kilograms by height measured in meters squared.

Statistical analysis

Since there were two study groups, the results for BMI were analyzed using Student's t-test (two tailed, unpaired). All results are expressed as mean \pm SEM. $P < 0.05$ were regarded as statistically significant. Pearson's correlation coefficient was used to evaluate the connection between the BMI values versus various subdomains of psychometric tests such as the MMSE and MOCA.

RESULTS

The initial analysis of the results included the BMI values in all patients. We observed a significant increase ($p < 0.0001$) in BMI values in patients with diabetes compared to our control group (Fig. 1).

When we analyzed the connections between BMI values and the results from the MMSE and MOCA tests, we found significant negative correlations for BMI vs. MMSE ($n=95$, $r = -0.783$, $p < 0.0001$) (Fig. 2) and for BMI vs. MOCA ($n=95$, $r = -0.598$, $p < 0.0001$) (Fig. 3).

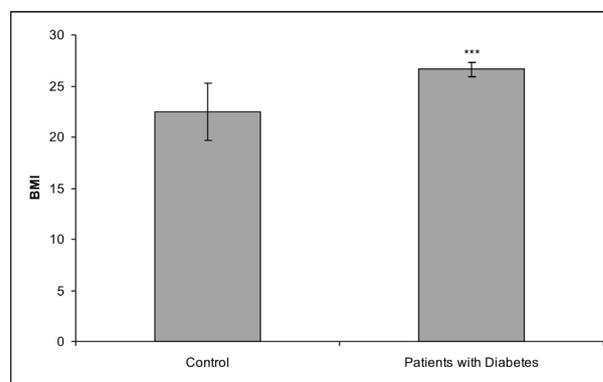


Fig. 1. BMI values in diabetic patients and controls. The values are mean \pm S.E.M. ($n=80$ for cardiovascular patients and $n=14$ per control group). *** $p < 0.0001$.

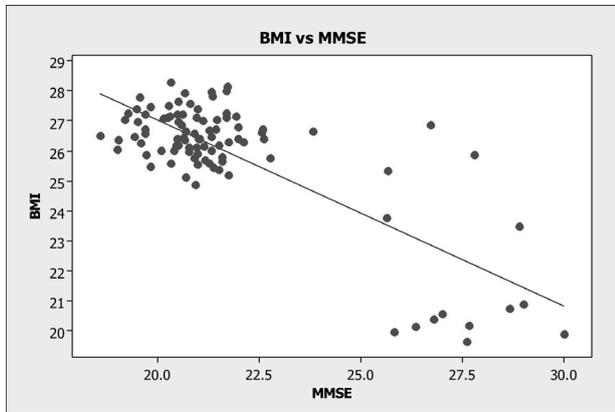


Fig. 2. Correlation between the Body Mass Index (BMI) and Mini-Mental State Examination (MMSE) ($n=95$, $r= -0.783$, $p< 0.0001$).

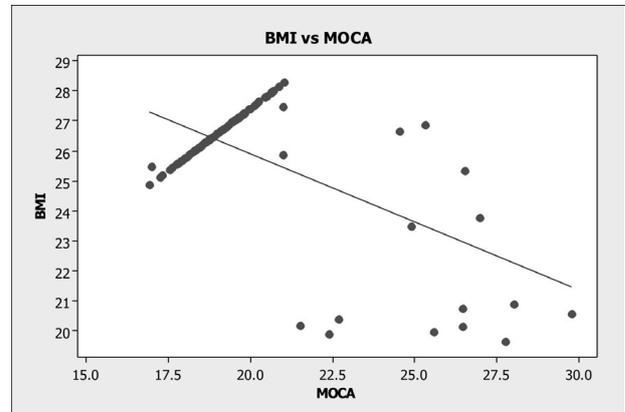


Fig. 3. Correlation between the Body Mass Index (BMI) and The Montreal Cognitive Assessment (MOCA) test ($n=95$, $r= -0.598$, $p< 0.0001$).

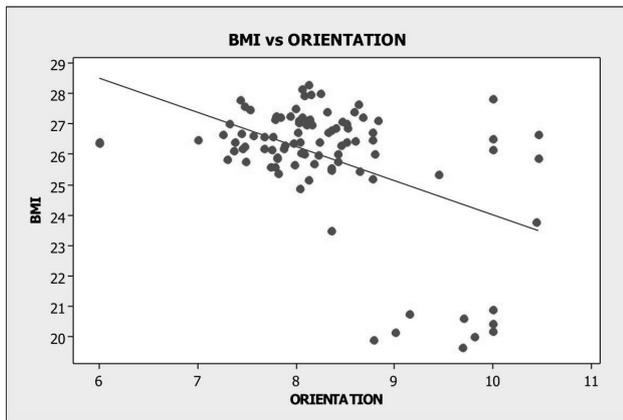
In addition, we found significant negative correlations between the values of BMI and most of the subdomains of both MMSE – BMI vs. orientation ($n=95$, $r= -0.479$, $p< 0.0001$) (Fig. 4A), BMI vs. attention ($n=95$, $r= -0.516$, $p< 0.0001$) (Fig. 4C), BMI vs. recent memory ($n=95$, $r= -0.533$, $p< 0.0001$) (Fig. 4D), and MOCA tests – BMI vs. visuospatial/executive functions ($n=95$, $r= -0.312$, $p= 0.002$) (Fig. 5A), BMI vs. attention ($n=95$, $r= -0.417$, $p< 0.0001$) (Fig. 5C), BMI vs. language ($n=95$, $r= -0.329$, $p= 0.001$) (Fig. 5D), BMI vs. abstractization ($n=95$, $r= -0.313$, $p= 0.002$) (Fig. 5E), BMI vs. long term memory ($n=95$, $r= -0.577$, $p< 0.0001$) (Fig. 5F) and BMI vs. orientation ($n=95$, $r= -0.376$, $p< 0.0001$) (Fig. 5G).

However, in the case of some subdomains from the MMSE test, we could not find any significant correlations, such as in the case of BMI vs. short-term memory ($n=95$, $r= -0.133$, $p= 0.2$) (Fig. 4B), BMI vs. language ($n=95$, $r= -0.086$, $p= 0.405$) (Fig. 4E) and BMI vs. executive functions ($n=95$, $r= -0.046$, $p= 0.659$) (Fig. 4F). In addition, we did not observe any correlations between BMI vs. naming ($n=95$, $r= -0.175$, $p= 0.09$) (Fig. 5B) and BMI values and the level of scholarization, added or not, to the MOCA test: BMI vs. level of scholarization ($n=95$, $r= -0.068$, $p= 0.512$).

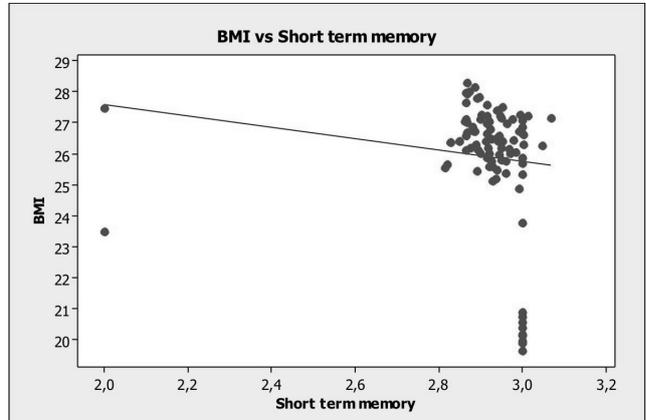
DISCUSSION

Our results provide evidence for the BMI as a possible confounder of the relationship between alcohol consumption in diabetes and cognitive function. However, the present study was performed in diabetic alcohol-consuming patients regardless of their drinking habits. More detailed data regarding how the exact amount of alcohol ingestion influences diabetic pathology and cognitive functions are underway by our research group.

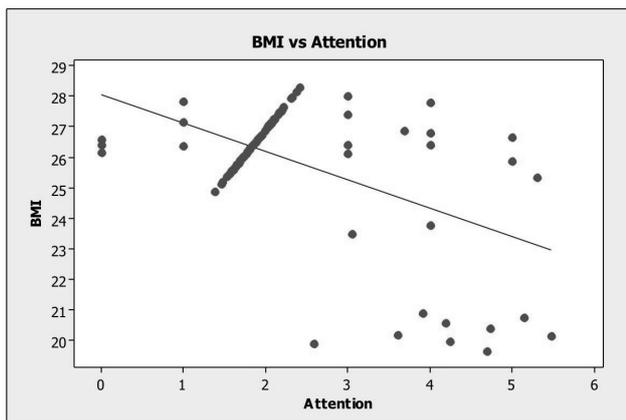
We have shown the possible correlation between BMI values and cognitive deficits as judged by scores of the MMSE and MOCA tests in diabetic patients with drinking habits. Moreover, we have demonstrated significant correlations between BMI values and most of the subdomains from MMSE and MOCA tests. This is particularly important since the association of BMI with cognitive decline showed varying results with higher BMI and weight decline as risk factors for the cognitive impairment. These differences could be attributed to the age of the individuals (Johnson et al., 2006; Kivipelto et al., 2001). Our diabetic patients had an average age of 61.2 years and increased BMI values compared to aged-matched controls.



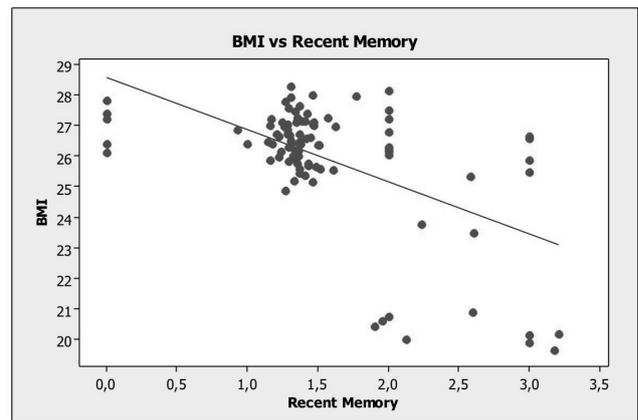
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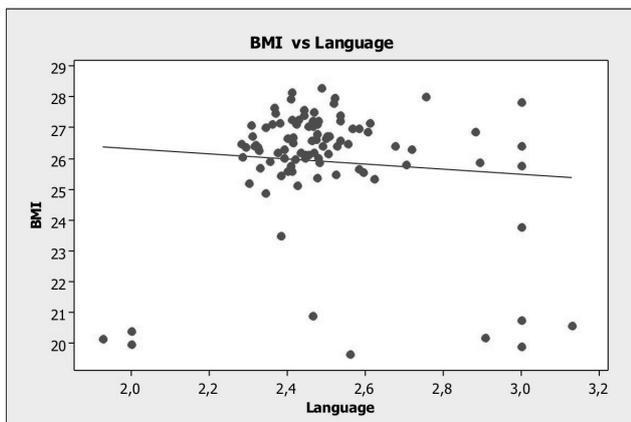
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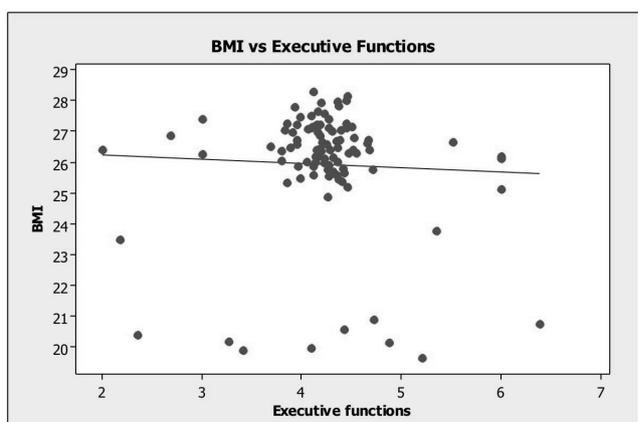
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D



E



F

Fig. 4. Correlations between the Body Mass Index (BMI) and the subdomains of Mini-Mental State Examination (MMSE).

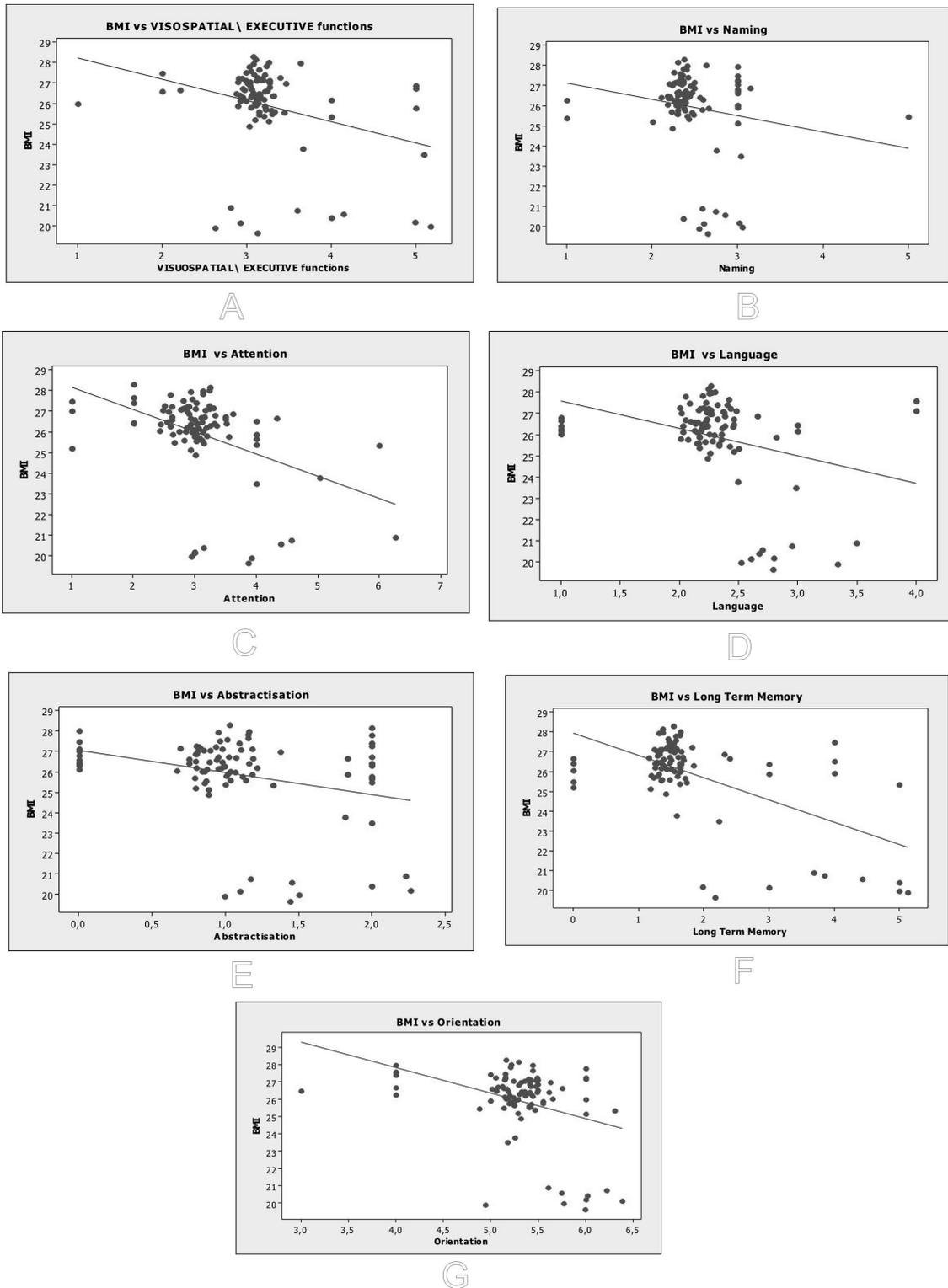


Fig. 5. Correlations between the Body Mass Index (BMI) and the subdomains of The Montreal Cognitive Assessment (MOCA) test.

In addition, there is evidence that a decreased BMI could be associated with anatomo-pathological changes found in the brains of demented people (Luchsinger et al., 2007). Similar reports, as the longitudinal study on cognitive decline of the Cournot group, reported an association of high mid-life BMI and cognitive decline after a subsequent follow-up in 2 223 adults aged 32-62 years at baseline (Cournot et al., 2006). However, in the case of late-life BMI and cognitively impaired patients (older adults), conflicting results of increased risk (Gustafson et al., 2003; Rasay et al., 2006), similar risk (Stewart et al., 2005) or decreased risk (Nourhash'emi et al., 2001; Luchsinger et al., 2007) of high BMI and cognitive impairment were previously reported.

It seems that BMI could be an important factor in the correlations that appear between alcohol consumption, diabetic pathology and cognitive status. However, some recent studies state no differences in relative risk reductions between individuals with low or high BMI, as in a meta-analysis regarding alcohol as a risk factor for type 2 diabetes by Baliunas et al. (2009). These aspects leave this subject open to further discussion and studies, and our group is already working on how the amount on alcohol ingestion and specific drinking habits influence diabetic pathology.

CONCLUSION

The results described herein provide evidence regarding BMI as a possible confounder between alcohol consumption in diabetes and cognitive functioning.

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