Original Article

Comparing the neuropsychological functions in obese and normal people

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Abstract

Background: Obesity is a chronic heterogeneous disorder causing mental health problems and disorders. This study was aimed at comparing the neuropsychological functions between the obese and normal people.

Methods: This study was a descriptive and causal-comparative study conducted on obese and normal people between January and June of 2020. Participants consisted of 100 people (50 obese and 50 normal people) referred to Arian and Saremi clinics in Mashhad. Purposive sampling method was used and the participants were divided into two groups. The instrument was Wisconsin card sorting test (WCST) and Go / No-Go Task. Data were analyzed using SPSS 21 software and multivariate analysis of covariance.

Results: The results of the WCST showed that there were no significant differences between the obese and normal people in the variables of neuropsychological functions (P>0.05). Likewise, based on the Go / No-Go homework test, no statistically significant difference was found between the two groups in the variables of neuropsychological functions (P>0.05).

Conclusion: The finding showed that there was no difference between neuropsychological functions of the obese and normal people. It can be argued that obesity cannot affect neuropsychological functions.

Keywords: Executive Function; Neuropsychological Tests; Obesity

Cite this article as: Ashkani S, SaadatianV, Rajaei AR. Comparing the neuropsychological functions in obese and normal people. SDH. 2020;e34. DOI: http://dx.doi.org/10.22037/sdh.v6i1.34260

Introduction

Obesity is a health challenges in the world. According to the World Health Organization (WHO) in 2016, 13% of adults were obese and 39% were overweight (1). Obesity is the mainly related to nutrition and refers to the conditions characterized by extreme accumulation of fat in the body. It is also associated with an increased risk of physical and mental disorders (2, 3).

The prevalence of obesity has increased in many parts of the world over the last three decades (4). Obesity has been introduced as the second driving factor accelerating death and is related to the health level of every society (5, 6). In addition, it has become a serious health problem with significant economic costs worldwide; expenditure such as lost productivity and foregone economic growth as a result of lost work days, lower productivity at work, mortality and permanent disability (7, 8). Therefore, examining its related factors can be important as it seems to affect neuropsychological functions, which are considered to be higher functions of the nervous system (9).

Executive functions are general terms referring to mental processes related to cognitive and emotional controls and are necessary to maintain purposeful behaviors

(10). In fact, they are a set of cognitive processes that manage purposeful behaviors (11). These functions include starting tasks and following up, organizing, memory, strengthening attention, planning, controlling behaviors and emotions, time management and problem-solving ability (12). Executive functions can affect brain's ability for planning, organizing, coordination, complicated sequences, and purposeful behaviors such as beneficial activities in daily life (13). Conceptualization, mental flexibility and behavioral inhibition are the three main executive functions (14). It is possible that people with poor executive functions are overweight and obese because many dimensions of neuropsychological functions, such as impulse, self-review, and goal-oriented behavior are directly related to the ability to maintain energy balance (15). Obese individuals usually have cognitive problems in the executive function (16).

Many previous studies revealed that obesity can affect neuropsychological functions (17-19). However, Zhongquan et al. showed that there was no association between executive function and obesity (20). The contradictory findings of previous studies and the fact that, no study has compared neuropsychological functions between obese and normal individuals so far led the researchers to determine whether there is a difference between the neuropsychological functions of obese and normal people.

Methods

It was a descriptive and causal-comparative study conducted on 100 obese and normal between January and June of 2020. The statistical population were 50 obese people who were selected by purposive sampling and 50 people with normal weight who were selected by matching method based on variables such as age and level of education. Inclusion criteria were the age of 20 to 45 years, having a diploma, and body mass index (BMI) above 30 for obese people. Exclusion criteria also were lack of completing tests, providing incomplete information and lack of cooperation in implementation of the study.

In this study, the necessary permission was obtained from the university and presented to the Arian and Saremi clinics, both of which agreed to cooperate. Among 200 applicants, the people who met the research conditions were selected and then the necessary explanations were given about the tests. Each test took approximately 20 minutes, with only 5 to 8 people taking the test each day. A suitable location was chosen for the tests to minimize disturbing factors. Finally, after explaining and justifying people, the Wisconsin card sorting computer test (WCST) and Go/No-go task was performed.

Wisconsin card sorting computer test

The initial version of the WCST was developed by Grant et al. (20, 21). This test assesses the abstraction and change ability of cognitive strategies in response to changing environmental feedbacks and then requires planning, organized search, and the ability to use environmental feedback to change cognitive set-shifting (22). It is considered as one of the most sensitive tests related to the dorsolateral prefrontal cortex (DLPFC) (23). Performance in this test has been emphasized as a measure of frontal lobe injury. Three main characteristics are subject performance, number of categories obtained, number of perseverative errors, and total error. In this test, a subject is presented with a set of 64 cards on which there are one to four symbols in the form of triangle, star, plus and circle in four colors of red, green, yellow and blue. Four cards include a red triangle, two green stars, three plus yellow and four circles as the main cards. The subject task is to place the other cards under the main cards according to the principle that governs the four main cards. The desired pattern for the four main cards is color, shape and number, which are repeated again. After each answer, the subject receives correct or incorrect

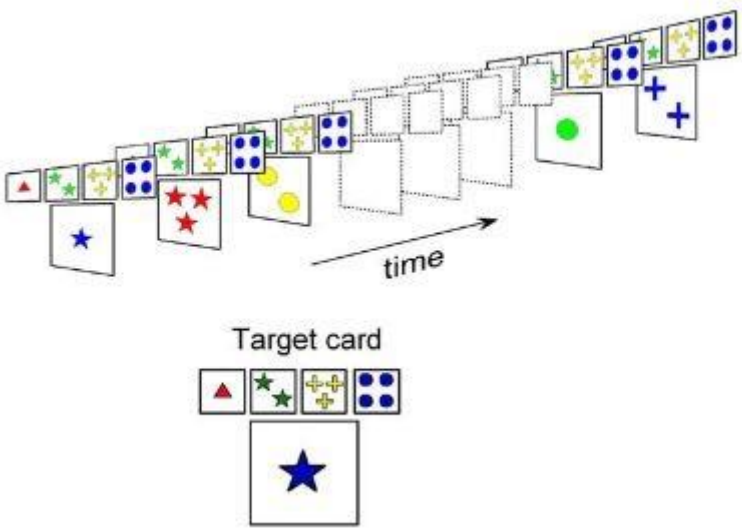

Figure 1. Schematic of the Wisconsin card sorting test

feedback. When each person gave a sufficient number of consecutive answers, the desired response pattern changes. The reliability of this test in the Iranian population using the retest method was 0.85 (24).

Go/No-go task

This test was designed by Huffman in 1984; it is widely used to measure behavioral inhibition and includes two categories of stimuli (25). This task is installed as software on the computer and the subject sits in front of the computer screen and performs a selective reaction task. Here, there are two attempts to Go and No-Go, and subjects should respond to one group of stimuli (Go) and refrain from responding to another group (No-Go). Since the number of go stimuli is usually greater, the person is more willing to respond (26). Two types of Go/No-Go positions are randomly assigned to the task. Failure to inhibit proper response or committing error means performing a motor response in the Go stimulus and the subject is non-objective when presenting the stimulus. In the present study, the Go/No-Go software of Sina Institute of cognitive sciences was used. From this test, three separate scores are obtained including the percentage of commission error, omission error, and reaction time. Ghadiri et al., reported the validity of the test to be 0.87 (27).

Data analysis

Data were analyzed using SPSS software version 21. Quantitative variables were stated as mean ± standard deviation and multivariate analysis of variance and analysis of covariance were used to test the research hypotheses. Significance level was considered $P < 0.05$.

Results

The mean of the studied variables between the obese and normal groups is shown in Table 1. According to the results of analysis of covariance between the two groups in the WCST, no significant difference was found between the two groups of obese and normal ($P > 0.05$). The results of multivariate analysis of variance between the two groups in the Go / No-Go task are presented in Table 2. The results showed that there was no significant difference between the obese and normal groups ($P > 0.05$). This means that the rate of committing error, omission, inhibition and reaction time were the same in both groups.

Table 1. The results of studied variables in Wisconsin card sorting test and comparison between the two groups

Dependent variable	Group	Mean ± SD	df	Mean Square	F	P-value
Number of categories	obese	5.92±0.27	1	7.84	11.784	0.110
	normal	5.36±1.12				
Perseverative error	obese	1.44±1.13	1	16	3.428	0.167
	normal	2.24±2.84				
Total error	obese	192.92±69.51	1	9761.44	1.742	0.190
	normal	212.68±202.80				

Table 2. The results of multivariate analysis of variance in the Go / No-Go task

Variable	Group	Mean ± SD	df	Mean Square	F	P-value
commission error	obese	6.10 ± 3.727	1	187.690	6.64	0.110
	normal	8.84 ± 6.529	1	5580.09	197.47	0.115
Omission error	obese	3.22 ± 6.720	1	141.61	2.56	0.113
	normal	5.60 ± 8.804	1	1944.810	35.20	0.230
Inhibition	obese	25.56 ± 9.013	1	655.360	9.31	0.139
	normal	30.68 ± 7.723	1	79037.44	1122.55	0.240
Reaction time	obese	472.04 ± 72.96	1	32472.04	2.37	0.127
	normal	508.08 ± 148.63	1	24015880.36	1752.17	0.133

Discussions

This study aimed at comparing the neuropsychological functions in obese and normal people. The results of WCST showed that there was no significant difference between the two groups of obese and normal people in the variables of neuropsychological functions. Moreover, according to the results of the go/no-go task test, no significant difference was found between the variables of neuropsychological functions of the two groups. The results of the present study confirmed the findings of Du et al. study (19), while were not consistent with the results of Favier, Mamrot and Hanc, and as well as Lisa et al. (16-18). Explaining the findings of the present study, it can be argued that the neuropsychological functions are higher functions of the nervous system including a set of cognitive abilities such as the planning ability, set shifting and problem-solving, cognitive flexibility and rule acquisition ability (28). It can appear in different people according to their capacities, type of test and type of obesity. In this study, three functions of conceptualization, mental flexibility and behavioral inhibition were studied. Since the neuropsychological functions involve all the complex cognitive processes that are necessary to perform new tasks (29), they must be examined from a variety of perspectives. In fact, neuropsychological functions are responsible for reviewing and

regulating cognitive processes during complex cognitive tasks (30).

In this study, no significant difference was observed between the two groups of obese and normal people in the neuropsychological functions; perhaps the reasons can be the type of tool and the statistical population. The ability to accurately assess the neuropsychological functions in laboratory settings may be influenced by factors such as the structure and organization created by the specialist, the features and skills of the specialist, and how measurement tools are developed and implemented (31). It is believed that individuals use neuropsychological functions when performing new and complex tasks in order to **s**hape new programs and also monitor and control their effectiveness (22). With this regard neuropsychological functions are less involved in simple and normal tasks. Accordingly, new and complex tests involving a set of information should be used to assess neuropsychological functions.

The limitations of the study were included research tools as computer and statistical population that should be considered in generalizing the results. It is recommended that therapists use other tools to compare neuropsychological functions. In addition, populations such as overweight, underweight and obese should be studied.

Conclusion

The finding of the study showed that neuropsychological functions are not affected by obesity, so it can't be said that obese people who have problems with neuropsychological functions are simply obese. Based on the present study, weakness in neuropsychological functions should be sought in factors other than obesity.

Conflict of Interest: The authors declare that there is no conflict of interest regarding the publication of this article.

The authors would like to thank all those who helped in this research.

Authors' contribution: Study conception and design: Ashkani S; Saadatian V; data collection: Ashkani S; analysis and interpretation of results: SaadatianV, & Rajaei A.R; draft manuscript preparation: Ashkani S, Saadatian V, & Rajaei A.R. All authors reviewed the results and approved the final version of the manuscript.

***Funding*:** This study did not receive any funding.

Informed consent: All participants entered the study after informed written contest.

Acknowledgements: This study is taken from the dissertation with the ethics code No. IR.IAU.TJ.REC.1399.011 approved by the Islamic Azad University of Torbat-e Jam. The authors would like to thank all those who helped in this research.

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