

Tatjana Subotić¹, Zorana Filipović,
Katarina Stojčević, Vojislav Jovanović

EGZEKUTIVNE FUNKCIJE KOD OSOBA SA METABOLIČKIM SINDROMOM

Sažetak: Životni stil modernog čoveka doprinosi sve većoj učestalosti metaboličkog sindroma u zemljama razvijenog sveta. Od metaboličkog sindroma boluje 20–25% odraslih, ali procenat ove bolesti je u konstantnom porastu. Godišnje u svetu 3,2 miliona ljudi umre od komplikacija ovog sindroma. Za lečenje je neophodna saradnja lekara različitih specijalnosti, ali je presudna motivacija pacijenata iz ove dijagnostičke kategorije, s obzirom na to da tretman iziskuje značajne promene životnog stila osobe. Hipoteza od koje smo krenuli je da kod ovakvih pacijenata zapravo postoji smanjena mogućnost planiranja, prevođenja plana u produktivnu aktivnost, te efikasnog sprovođenja planiranih aktivnosti, odnosno da kod osoba sa metaboličkim sindromom postoje i elementi disegzekutivnog sindroma. Termin egzekutivne funkcije potiče od engleske reči “executive”, što znači izvršni, i u neuropsihologiji on ima značenje funkcija višeg reda ili nadređenih nad bazičnim neuropsihološkim funkcijama, kao što su pažnja, percepcija, pamćenje, mišljenje i govor. Glavni cilj ovog istraživanja bio je utvrđivanje efikasnosti egzekutivnih funkcija kod osoba sa metaboličkim sindromom. Uzorak je činio 61 ispitanik, oba pola, uzrasta od 20 do 60 godina, podeljenih u dve grupe – osobe sa dijagnozom metaboličkog sindroma i osobe bez ove dijagnoze. Dobijeni rezultati ukazuju da osobe sa metaboličkim sindromom pokazuju znatno lošija postignuća na gotovo svim pokazateljima egzekutivnih funkcija, prikazanih putem odgovarajućih varijabli na primenjenom Viskonsin testu sortiranja karata (Wisconsin Card Sorting Test).

Ključne reči: egzekutivne funkcije, metabolički sindrom, Wisconsin Card Sorting Test (WCST)

Uvod

Pojam i određenje metaboličkog sindroma

Metabolički sindrom je skup poremećaja koji obuhvata abdominalni (centralni) tip gojaznosti, povišen krvni pritisak, povećane trigliceride (masti), smanjen „dobar” HDL holesterol, neosetljivost na insulin. Osobe koje pate od ovog sindroma imaju

¹ Klinika za psihijatrijske bolesti „Dr Laza Lazarević“.

povećan rizik za obolevanje od bolesti srca, krvnih sudova i dijabetesa tip II. Danas se koriste brojne definicije i dijagnostički kriterijumi za dijagnostikovanje metaboličkog sindroma. Možda najčešće korišćeni i citirani su kriterijumi NCEP ATP III (Third Adult Treatment Panel) (1), gde metabolički sindrom postoji ako su prisutna bilo koja tri simptoma od navedenih:

- obim struka preko 102cm kod muškaraca, odnosno veći od 88cm kod žena
- trigliceridi preko 1,7 mmol/l
- HDL (high density lipoprotein, „dobar“ holesterol) manji od 1,04 mmol/l kod muškaraca, odnosno 1,3 mmol/l kod žena
- krvni pritisak preko 130/85 mmHg
- glukoza (šećer) u krvi natašte iznad 5,6 mmol/l.

Metabolički sindrom najčešće je uzrokovan pogrešnim načinom života. Naučnici raspolažu dokazima o naslednim i stečenim uzrocima ovog sindroma. Stečeni uzroci su prekomerna telesna masa, telesna neaktivnost, nedostatak sna, kao i visok procenat ugljenih hidrata u ishrani (više od 60%). Nasledni, genetski uzroci još nisu precizno definisani. Stres se takođe smatra jednim od uzročnika jer remeti hormonsku ravnotežu i povećava sklonost nakupljanju masnog tkiva u predelu stomaka, te s tim povezanih bolesti. Životni stil modernog čoveka doprinosi sve većoj učestalosti metaboličkog sindroma u zemljama razvijenog sveta. Od metaboličkog sindroma boluje 20–25% odraslih (2,3), ali procenat ove bolesti je u konstantnom porastu. Godišnje u svetu 3,2 miliona ljudi umre od komplikacija ovog sindroma (2). Najnovija istraživanja dovode metabolički sindrom u povezanost i sa mentalnim poremećajima depresijom, napetošću i agresivnošću. Istraživanje Raikonena i sar. (4) pokazalo je da su depresivni simptomi, stres, česta i intenzivna osećanja besa i tenzije povezani sa rizikom od razvijanja metaboličkog sindroma. S obzirom na multiple patogene uzroke, lečenje metaboličkog sindroma se istovremeno primenjuje u nekoliko smerova. Neophodno je lečiti svaku od komponenti metaboličkog sindroma upotrebljavajući savremenu optimalnu metodu ili medikament. Za postizanje ovih ciljeva potrebna je saradnja nekoliko lekara i velika motivacija pacijenta. Kao prva linija u borbi protiv metaboličkog sindroma, neophodno je u velikoj meri promeniti životni stil (5, 6), fokusirajući se prevashodno na bihevioralne promene, kao što su prestanak pušenja, pojačana fizička aktivnost, smanjenje telesne težine i uvođenje dijeta. Da bi se postigao optimalni stepen uspešnosti, referentne ustanove neretko kreiraju posebne programe koji uključuju brojne strukturisane i jasno definisane multidisciplinarnе terapijske i rehabilitacione postupke i sadržaje (7, 8), a koji iziskuju visok stepen posvećenosti.

Pojam egzekutivnih funkcija

Termin egzekutivne funkcije potiče od engleske reči “executive”, što znači izvršni, i u neuropsihologiji on ima značenje funkcija višeg reda ili nadređenih nad bazičnim neuropsihološkim funkcijama, kao što su pažnja, percepcija, pamćenje, mišljenje i govor. Izraz „egzekutivne funkcije“ koristi se kao zajednički termin za označavanje svih onih sposobnosti na kojima se zasniva *ka cilju usmereno ponašanje*. Uopšteno, egzekutivne funkcije obuhvataju veći broj kompleksnih sposobnosti, zastupljenih u različitim kognitivnim domenima i modalitetima, a koje se ispoljavaju u svim aspektima ponašanja. Lezakova (9) opisuje četiri komponente egzekutivnih funkcija:

- Volja – proces određivanja ciljeva, želja i potreba i njihovog konceptualnog ostvarivanja. Uključuje sposobnost voljnog, namernog delovanja, tj. ponašanja. Drugim rečima, to je proces formulacija namera u skladu sa subjektivim potrebama i željama i osmišljavanje njihove realizacije u budućnosti.
- Planiranje – definisanje i organizovanje elemenata i redosleda radnji za sprovođenje neke aktivnosti koja vodi postizanju cilja. Planiranje obuhvata sposobnost preciziranja strategije kojom će biti sprovedene namere i postignut cilj, uz uviđanje razlika između želja i realnih okolnosti, anticipiranja kroz razmatranje alternativa i opredeljivanja.
- Svršishodna akcija – prevođenje plana u produktivnu aktivnost koja zahteva od osobe da tu aktivnost započne, održi koliko je to potrebno, promeni ili zaustavi prema okolnostima i cilju.
- Efikasno sprovođenje aktivnosti – sposobnost praćenja, korigovanja i regulisanja aktivnosti u odnosu na njihov tempo, intenzitet i druge kvalitativne aspekte izvođenja. Disfunkcija ove komponente se procenjuje kroz analizu prirode grešaka, sposobnosti uviđanja, reakcije prema greškama i oblika ponašanja koji se koriste za njihovo prevazilaženje.

Disegzekutivni sindrom je danas najpopularniji psihološki konstrukt koji se vezuje za frontalne lezije. Pojam disegzekutivnog sindroma se prvi put pojavljuje u Baddeley-ovom opisu poremećaja kognicije i ponašanja kod pacijenta sa oštećenim egzekutivnim funkcijama (10). U okviru disfunkcije frontalnog režnja opisuju se razne vrste *poremećaja pažnje*: teškoće održavanja i fokusiranja pažnje, neotpornost na interferenciju, poremećaj selektivne pažnje, jednostrano zanemarivanje, poremećaj fiksacije pogleda, poremećaj očnih pokreta, poremećaj budnosti, itd. Pored toga, brojne studije su pokazale da frontalne lezije izazivaju čitav niz *poremećaja mišljenja* (11,12): poremećaj apstraktnog rezonovanja, problemi sortiranja, poremećaj planiranja, poremećaji stvaranja i testiranja hipoteza, sniženje divergentnog mišljenja (osiromašena fluentnost reči, oblika i gestova) i otežano praktično rešavanje problema (teškoće organizovanja ponašanja).

Cilj

Hipoteza od koje smo krenuli je da kod pacijenata sa metaboličkim sindromom zapravo postoji smanjena mogućnost planiranja, prevođenja plana u produktivnu aktivnost, te efikasnog sprovođenja planiranih aktivnosti, odnosno da kod ovih osoba postoje i elementi disegzekutivnog sindroma. U tom kontekstu, glavni cilj ovog istraživanja bio je utvrđivanje efikasnosti egzekutivnih funkcija kod osoba sa metaboličkim sindromom.

Metod

Istraživanje je sprovedeno u periodu od oktobra 2012. do juna 2013. godine u Beogradu, na Institutu za endokrinologiju, dijabetes i bolesti metabolizma KCS. Uzorak istraživanja se sastojao od 61. ispitanika, muškog i ženskog pola, podeljenih u dve grupe (sa i bez metaboličkog sindroma), uzrasta od 20 do 60 godina, koji su prethodnom selekcijom procenjeni kao osobe prosečnih kognitivnih sposobnosti. Osobe sa metaboličkim sindromom, njih 31, predstavljali su ispitanici koji su u postupku dijagnostike sindroma dolazili na Institut za endokrinologiju, dijabetes i bolesti metabolizma KCS. Kontrolnu grupu činilo je 30 osoba bez metaboličkog sindroma, izabranih metodom slučajnog uzorka, po uzrastu, polu i školskoj spremi ujednačenih sa eksperimentalnom grupom (Tabela 1).

Tabela 1. Struktura uzorka prema uzrastu, polu i školskoj spremi ispitanika

	Kategorija ispitanika					
	Sa metaboličkim sindromom			Bez metaboličkog sindroma		
Uzrast (godine)	AS	SD		AS	SD	
	37.06	12.987		37.27	10.379	
Pol	muški	ženski		muški	ženski	
N (%)	10 (16.7%)	21 (34.4%)		11 (18%)	19 (31.1%)	
Školska sprema	srednja	viša	visoka	srednja	viša	visoka
N (%)	17 (27.9%)	6 (9.8%)	8 (13.1%)	15 (24.6%)	6 (9.8%)	9 (14.8%)
Total N (%)	31 (51.7%)			30 (48.3%)		

U istraživanju je korišćen Viskonsin test sortiranja karata (Wisconsin card sorting test – WCST), koji se smatra jednim od najpoznatijih testova za procenu perseverativnosti i apstraktnog rezonovanja. Pored toga, smatra se i dobrim pokazateljem egze-

ktivnih funkcija, usled njegove osetljivosti na disfunkciju frontalnog režnja. WCST test omogućava procenu ispitanikovog planiranja, vizualne organizacije i pretrage, korišćenja povratnih informacija u cilju promene kognitivnog seta, cilju usmerenog ponašanja i modulacije impulsivnog odgovaranja (13). U cilju bržeg i lakšeg zadavanja testa i obrade podataka, koristili smo kompjutersku verziju WCST testa čiji je autor koleginica Nataša Bajić (The Wisconsin Card Sorting Test, Jugoslovenska aplikacija testa, YU-WCST). U odnosu na originalnu verziju testa razlike se sastoje u tome što se u svim slučajevima test zadaje u celini (ne prekida se posle šest kategorija) i što je kompjuter taj koji daje povratnu informaciju o tačnosti sparivanja, a ne ispitivač. Na taj način, bez direktne instrukcije, ispitanik se usmerava da karte klasifikuje prvo po principu boje, zatim forme i, najzad, broja. Princip sparivanja se smenjuje posle svakih deset uspešnih pokušaja.

Dobijeni podaci obrađeni su u programskom paketu SPSS verzija 20, deskriptivnim statističkim metodama i, u cilju utvrđivanja značajnosti dobijenih razlika, korišćen je T test.

Rezultati

Tabela 2. Deskriptivna statistika standardnih WCST skorova za obe grupe

WCST skorovi	Metabolički sindrom	Kontrolna grupa	t	Sig.
Tačni odgovori	79.97	101.80	4.656	0.000
Netačni odgovori	48.03	26.20	-4.656	0.000
Ostvarene kategorije	5.19	8.03	4.453	0.000
PSV odgovori	11.32	1.40	-4.562	0.000
PSV greške	9.81	1.30	-4.648	0.000
NPSV greške	38.23	24.90	-3.941	0.000
Neuspeh u održavanju seta	2.72	0.05	-4.218	0.000
Odg. nivoa konceptualizacije	40.09	59.83	4.846	0.000
Momenat ostvarenja I kat.	15.45	12.30	-1.216	0.229

Poređenje aritmetičkih sredina pokazuje da između osoba sa metaboličkim sindromom i kontrolne grupe postoje statistički značajne razlike na gotovo svim standardnim skorovima WCST testa (Tabela 2). Prosek tačnih odgovora u grupi koju čine ispitanici sa metaboličkim sindromom značajno je manji u odnosu na kontrolnu grupu ($t = 4.656$, $p < 0.001$) i u skladu je sa prosečnim brojem ostvarenih kategorija imajući u vidu da su ove dve mere međusobno visokozavisne. Analizom ove razlike, kao glavni uzročnici izdvajaju se perseverativni odgovori i perseverativne greške. Znatno veće vrednosti

prosečnog broja perseverativnih odgovora ($t = -4.562$, $p < 0.001$) i perseverativnih grešaka ($t = -4.648$, $p < 0.001$) kod osoba sa metaboličkim sindromom u odnosu na kontrolnu grupu ukazuju na ispoljene teškoće prilikom promene mentalnog seta i mentalnu rigidnost. Pored toga, znatno veći skor u okviru neuspeha u održavanju seta kod osoba sa metaboličkim sindromom u odnosu na kontrolnu grupu ($t = -4.218$, $p < 0.001$), ukazuje na teškoće u održavanju optimalnog stepena pažnje i koncentracije. Kako je pronađena značajna razlika i u okviru odgovora nivoa konceptualizacije ($t = 4.846$, $p < 0.001$) može se pretpostaviti da postoji sklonost dužeg trajanja teškoća sa održavanjem pažnje i koncentracije kod osoba sa metaboličkim sindromom u odnosu na kontrolnu grupu, tj. njihovog sporijeg otklanjanja pogrešnog modela izvođenja. Naime, iako se inicijalno ne uočavaju značajne razlike u okviru pažnje i koncentracije prilikom početnog pristupa zadatku, a o čemu govori nepostojanje razlike između grupa na skor momenta ostvarenja prve kategorije ($t = -1.216$, $p = 0.229$), očigledno da do značajnih teškoća dolazi prilikom prvih grešaka, koje se kod osoba sa metaboličkim sindromom znatno teže otklanjaju nego u okviru kontrolne grupe. Dobijeni rezultati su u skladu sa tekućim istraživanjima (14, 15, 16, 17, 18, 19), podržavajući hipotezu da osobe sa metaboličkim sindromom pokazuju slabije postignuće na pokazateljima egzekutivnih funkcija u odnosu na populaciju bez metaboličkog sindroma.

Zaključak

Kao što je već navedeno, za lečenje metaboličkog sindroma neophodna je saradnja lekara različitih specijalnosti, ali je presudna motivacija pacijenata iz ove dijagnostičke kategorije. Jedan od najvažnijih zadataka za osobe koje boluju od metaboličkog sindroma predstavlja značajna promena životnog stila (5, 6), a što je moguće ostvariti samo pojačanim zalaganjem i istrajnošću. Ideja od koje polazimo je da kod ovakvih pacijenata postoji umanjena mogućnost planiranja, prevođenja plana u produktivnu aktivnost i efikasnog sprovođenja planiranih aktivnosti, odnosno da postoje elementi disegzekutivnog sindroma. Višestruke studije su potvrdile da osobe sa metaboličkim sindromom pokazuju teškoće na planu egzekutivnih funkcija (14, 15, 16, 17, 18, 19), što može uticati na dosledno sprovođenje prepisanog tretmana. Sagledavajući rezultate obavljenih studija (16), možemo konstatovati da se i u našem istraživanju pokazalo da osobe sa metaboličkim sindromom pokazuju značajne teškoće na planu pažnje, pri čemu prevashodno izdvajamo modalitet produžene pažnje. Pored toga, uočava se značajno slabija sposobnost osoba sa metaboličkim sindromom, od osoba iz kontrolne grupe, da modifikuju vlastito izvođenje u skladu sa povratnim informacijama, pokazujući teškoće usvajanja novih strategija koje bi bile primerenije za postizanje cilja. U svetlu rastućih saznanja koja potvrđuju teškoće na planu egzekutivnih funkcija kod osoba sa metaboličkim sindromom, dobijeni rezultati ukazuju na potrebu za modifikacijom samog procesa lečenja i planiranja tretmana. Kao praktične preporuke mogu se

izdvojiti intervencije usmerene na postizanje većeg stepena fokusiranosti na tretman, bolje sagledavanje važnih (povratnih) informacija i njihova doslednija i uspešnija implementacija, te jačanje i potkrepljenje novih obrazaca ponašanja usklađenih sa tretmanom, uz izbacivanje prethodno uvreženih i štetnih obrazaca ponašanja.

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Tatjana Subotić¹, Zorana Filipović,
Katarina Stojčević, Vojislav Jovanović

EXECUTIVE FUNCTIONS IN PERSONS WITH METABOLIC SYNDROME

Abstract: Modern man lifestyle contributes to the increasing incidence of metabolic syndrome in the developed world. Prevalence of the metabolic syndrome in adults ranges from 20 to 25%, and it tends to increase. Each year, 3.2 million people around the world die from complications associated with this syndrome. Treatment involves cooperation of medical doctors of various specialties, but the decisive factor is patient motivation, given that the treatment requires significant lifestyle changes. Our hypothesis is that metabolic syndrome patients have reduced ability to plan, convert plan into action and effectively implement planned activities, showing signs of dysexecutive syndrome. The term executive functions comes from the english word “executive”, which also means the controlling, in neuropsychology reserved for high-level abilities that influence more basic abilities such as attention, perception, memory, thinking and speaking. The main objective of this study was to determine characteristics of executive functioning in patients with metabolic syndrome. The sample consisted of 61 subjects of both sexes, aged 20 to 60 years, divided into two groups - those with a diagnosis of metabolic syndrome and those without this diagnosis. The results suggest that people with metabolic syndrome showed significantly poorer performance in almost all indicators of executive functions, represented by Wisconsin Card Sorting Test (Wisconsin Card Sorting Test) variables.

Key words: executive functions, metabolic syndrome, Wisconsin Card Sorting Test (WCST)

Introduction

The concept and definition of the metabolic syndrome

Metabolic syndrome is a cluster of conditions that includes abdominal (central) obesity, increased blood pressure, increased triglycerides (fats), decreased “good”

¹ Clinic for psychiatric disorders „Dr Laza Lazarević“, vojislav_jovanovic@yahoo.com

HDL cholesterol, insulin resistance. People suffering from this syndrome are at increased risk of developing diabetes type II, blood vessel and heart disease. Despite the existence of multiple definitions and diagnostic criteria for the metabolic syndrome, perhaps the most frequently used and cited is the NCEP ATP III definition (Third Adult Treatment Panel) (1). According to the NCEP ATP III definition, metabolic syndrome is present if three or more of the following five criteria are met:

- waist circumference over 102 cm (men) or 88 cm (women)
- fasting triglyceride (TG) level over 1.7 mmol / l
- fasting high-density lipoprotein (HDL) cholesterol level less 1.04 mmol / l (men) or 1.3 mmol / l (women)
- blood pressure over 130/85 mmHg
- fasting blood sugar over 5.6 mmol / l

Metabolic syndrome is usually caused by an unhealthy *lifestyle*. There is scientific evidence that both genetics and lifestyle factors play important roles in the development of metabolic syndrome. Lifestyle factors include overweight, physical inactivity, lack of sleep and very high intakes of carbohydrate (more than 60%). The detailed architecture of *genetic* risk factors has not yet been *precisely defined*. Stress is also considered one of the causes as it disturbs the hormonal balance, increasing abdominal fat. Modern man lifestyle contributes to the increasing incidence of metabolic syndrome in the developed world. Prevalence of the metabolic syndrome in adults ranges from 20 to 25% (2, 3), and it tends to increase. Each year, 3.2 million people around the world die from complications associated with this syndrome (2). *Recent research shows connection between metabolic syndrome and mental disorders such as depression, tension and aggression*. Raikonen et al. (4) showed that depressive symptoms, stress, frequent and intense feelings of anger and tension are associated with the risk for developing the metabolic syndrome. The pathogenesis of the metabolic syndrome is multiple and treatment requires addressing several directions. It is necessary to treat each of the components of the metabolic syndrome using optimal modern method or medication. Treatment involves cooperation of medical doctors of various specialties, but the decisive factor is patient motivation, given that the treatment requires significant lifestyle changes (5, 6), focusing primarily on behavioral changes such as smoking cessation, increased physical activity, weight reduction and diet. To achieve an optimal level of performance, relevant institutions often create special programs that involve a number of structured and clearly defined multidisciplinary therapeutic and rehabilitation contents and procedures (7, 8), which require a high level of commitment.

The concept of executive functions

The term executive functions comes from the English word “executive”, which also means the controlling, in neuropsychology reserved for high-level abilities that

influence more basic abilities such as attention, perception, memory, thinking and speaking. “Executive functions” is an umbrella term for functions that are involved in goal-oriented behavior. In general, executive functions include a number of complex skills represented in different cognitive domains and modalities, which manifest themselves in all aspects of behavior. Lezak (9) proposed a four-component executive function model:

- Volition - the process of determining goals, desires and needs and their conceptual realization. It includes the ability of voluntary, intentional action and behavior. In other words, it is the process of formulation of intention in accordance with one’s needs and desires and their realization in the future.
- Planning - identification and organization of the steps and elements needed to carry out an intention or achieve a goal. Planning includes the ability to refine a strategy which will be used to carry an intention or achieve a goal, realizing the difference between desires and actual circumstances, and anticipation of the future by weighing of options and alternatives.
- Purposive action - transition of a plan into productive activity that requires the actor to initiate and maintain action as long as necessary, switch or stop it according to circumstances or goal
- Effective performance - ability to monitor, self-correct, and regulate the intensity, tempo and other qualitative aspects of delivery. Dysfunction of this component is estimated by analyzing the nature of errors, ability of insight, response to errors and compensatory efforts used to overcome them.

Dysexecutive syndrome is currently the most popular psychological construct related to frontal lesions. The term dysexecutive syndrome first appeared in Baddeley’s description of cognitive and *behavioral* problems in patients with impaired executive functions (10). Various types of attention disorders are described in the context of frontal lobe dysfunction: difficulties in maintaining and focusing attention, vulnerability to interference, disorder of selective attention, unilateral neglect, disorder of visual fixation, disorder of eye movements, impaired vigilance, etc. In addition, numerous studies have shown that frontal lesions cause a range of thinking disorders (11,12): disorder of abstract reasoning, problems of sorting, planning difficulties, disorders of creating and testing a hypothesis, reduction of divergent thinking (fluency, shapes and gestures) and difficulty in practical problem solving (difficulty in organizing behaviors).

Objective

Our hypothesis is that metabolic syndrome patients have reduced ability to plan, convert plan into action and effectively implement planned activities, showing signs of

dysexecutive syndrome. In this context, the main objective of this study was to determine characteristics of executive functioning in patients with metabolic syndrome.

Method

The research was conducted from October 2012 to June 2013 in Belgrade, at the Institute of Endocrinology, Diabetes and Metabolic Diseases KCS. The sample consisted of 61 subjects of both sexes, aged 20 to 60 years, divided into two groups - those with a diagnosis of metabolic syndrome and those without this diagnosis. All of subjects were previously assessed as of average cognitive abilities. Group with metabolic syndrome consisted of 31 individuals who attended the diagnostic procedure in the Institute for Endocrinology, Diabetes and Metabolic Diseases KCS. Control group consisted of 30 people without metabolic syndrome, selected randomly, matched according to age, sex and education with the group with metabolic syndrome (Table 1).

Table 1. Sample structure according to age, sex and education

	Subject categories					
	With metabolic syndrome			Without metabolic syndrome		
Age (years)	AS	SD		AS	SD	
	37.06	12.987		37.27	10.379	
Sex	male	female		male	female	
N (%)	10 (16.7%)	21 (34.4%)		11 (18%)	19 (31.1%)	
Education	secondary school	higher ed.	college	secondary school	higher ed.	college
N (%)	17 (27.9%)	6 (9.8%)	8 (13.1%)	15 (24.6%)	6 (9.8%)	9 (14.8%)
Total						
N (%)	31 (51.7%)			30 (48.3%)		

In this study, we used Wisconsin Card Sorting Test (Wisconsin card sorting test - WCST), which is considered one of the most popular tests for assessment of perseveration and abstract thinking. In addition, it is also a good indicator of executive functions, due to its reported sensitivity to frontal lobe dysfunction. WCST test allows the assessment of the subject's strategic planning, visual organization and search, ability to utilize environmental feedback to shift cognitive sets and to direct behavior toward achieving a goal, as well as to modulate impulsive responding (13). To enable faster and easier test application and data processing, we used a computerized version of the WCST test authored by colleague Natasa Bajic (The Wisconsin Card Sorting

Test, Jugoslovenska Aplikacija Testa, YU-WCST). In comparison with manual administration, computerized version testing is not ended after six correct categories were achieved, but is continued until all cards were sorted, and the feedback is provided by computer not examiner. In this way, without direct instruction, respondent is directed to sort cards by the principle of color, form and finally the number. A *change* in principle follows 10 consecutive correct responses. Data were analyzed using SPSS version 20 software, using descriptive statistical methods and T test.

Results

Table 2. Descriptive statistics for the standard WCST scores for both groups

WCST scores	Metabolic syndrome	Control group	t	Sig.
Correct responses	79.97	101.80	4.656	0.000
Errors	48.03	26.20	-4.656	0.000
Categories Completed	5.19	8.03	4.453	0.000
Perseverative Responses	11.32	1.40	-4.562	0.000
Perseverative Errors	9.81	1.30	-4.648	0.000
Nonperseverative Errors	38.23	24.90	-3.941	0.000
Failure to Maintain Set	2.72	0.05	-4.218	0.000
% Concept Level Responses	40.09	59.83	4.846	0.000
Trials to 1st Category	15.45	12.30	-1.216	0.229

Comparing the means shows statistically significant differences in almost all standard scores of WCST test (Table 2) between persons with metabolic syndrome and the control group. Average of correct responses in metabolic syndrome group was significantly lower than in the control group ($t = 4.656$, $p < 0.001$) which is correspondent with categories completed since these two measures are highly correlated. The main reasons for such difference are preservative responses and perseverative errors. Significantly higher values of average number of perseverative responses ($t = -4.562$, $p < 0.001$) and perseverative errors ($t = -4.648$, $p < 0.001$) in subjects with metabolic syndrome than in the control group indicate difficulty in shifting cognitive set and mental rigidity. Additionally, significantly higher scores in failure to maintain set in people with metabolic syndrome than in the control group ($t = -4.218$, $p < 0.001$) is indicator of difficulties in maintaining the optimal level of attention and concentration. Since the significant difference was found regarding % concept level responses ($t = 4.846$, $p < 0.001$), it can be assumed that there is a tendency of prolon-

ged problems with attention and concentration maintenance in people with metabolic syndrome compared to the control group, i.e. they need more time to change wrong classification criterion. Although there are no significant differences in the context of attention and concentration level during initial steps of the task, which is illustrated with no significant difference between the groups in trials to 1st category scores ($t = -1.216, p = 0.229$), it is obvious that considerable difficulties arise after first errors in subjects with metabolic syndrome. These results are consistent with other studies (14, 15, 16, 17, 18, 19) in suggesting that people with metabolic syndrome show poorer performance in indicators of executive functions compared to the population without metabolic syndrome.

Conclusion

As previously noted, treatment of metabolic syndrome involves cooperation of medical doctors of various specialties, but the decisive factor is patient motivation. One of the most important tasks for people suffering from metabolic syndrome represents significant lifestyle changes (5, 6), which can only be achieved with great effort and perseverance. Our hypothesis is that metabolic syndrome patients have reduced ability to plan, convert plan into action and effectively implement planned activities, showing signs of dysexecutive syndrome. Various studies have confirmed that people with metabolic syndrome have difficulties with executive functioning (14, 15, 16, 17, 18, 19), which is affecting consistent implementation of treatment plan. As in other recent studies (16), our research has shown that people with metabolic syndrome show significant difficulties in the domain of attention, with focus on sustained attention difficulties. Results also suggests that people with metabolic syndrome show significantly lower capacity to adjust actions based on feedback, demonstrating inability to adopt a new strategy that may be more appropriate in achieving a goal. In light of growing evidence that people with metabolic syndrome show difficulties with executive functioning, results indicate the need for treatment modifications and change in treatment planning. Based on research results, *some practical recommendations include* interventions aimed at developing better focus on treatment, better understanding of feedback received and their more consistent and successful implementation, strengthening and reinforcing new patterns of behavior consistent with the treatment, and at the same time discharging previously fixed and harmful behavior patterns.

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